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ISOTOPE SEPARATION AND ISOTOPE EXCHANGE

A Bibliography with Abstracts

G. M. Begun

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CHEMISTRY DIVISION

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FOREWORD

The simple building blocks of the nineteenth century scientist, the ninety-two chemical elements have been multiplied today to well over thirteen hundred different nuclides of which some three hundred and thirty occur in nature while the remaining number are artifically radioactive. We know now that isotopes are not identical, even chemically, and that their nuclear properties may be vastly different. To the nuclear scientist these nuclides are all different materials which behave differently in nuclear devices. One isotope may serve for a reactor core or container while another form of the same element may not be satisfactory at all. For this reason, scientists of the present and future must obtain substantial samples of relatively pure nuclides for experimentation and testing. In some cases, it will be necessary to produce considerable quantities of specific isotopes for nuclear purposes.

The rapid development of nuclear science has been paralleled by the growth of a new chemistry--Isotope Chemistry. Isotope chemistry should not be confused with tracer chemistry in which isotopes are used only as tracers and isotope effects generally ignored. Isotope chemistry deals with the equilibrium and nonequilibrium

ISOTOPE SEPARATION AND ISOTOPE EXCHANGE

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ABSTRACT

The unclassified literature from 1907 through 1957 has been searched for isotopic exchange and isotopic separation reactions involving U and the lighter elements of the periodic chart through atomic number 30. From 1953-1957, all elements were included. Numerous references to isotope properties, isotopic ratios, and kinetic isotope effects were included. This is a complete revision of TID-3036 (Revised) issued June 4, 1954.

INTRODUCTION

This is a complete revision of TID-3036 (Revised) issued June 4, 1954. Additional references have been added, and some deleted as not applicable. The number of references, most with brief abstracts, has been increased from 1414 to 2500

The material contained in this bibliography has been taken largely from Chemical Abstracts and Nuclear Science Abstracts from 1907 through 1957. An attempt has been made to cover the open literature and the available non-classified report literature. The abstracts were searched under the general headings of isotope separation and isotope exchange, and specifically for U and all the lighter elements of the periodic chart through Zn. From 1953-1957 material on all elements has been included. Many earlier references to other elements are noted, although coverage is not complete. Numerous references to kinetic isotope effects are included, as well as references concerned with natural variations in isotope abundance and with isotopic properties such as vapor pressure.

The references are arranged in chronological order according to their Chemical Abstract (C.A.) or Nuclear Science Abstract (NSA) listing with the C.A. references preceding the NSA references for each year. Several reports are abstracted in Abstracts of Declassified Documents (ADD), the journal which preceded Nuclear Science Abstracts, and several reports for which no abstracts could be found have been inserted in their approximate chronological order.

Three indexes follow the list of references; author, subject, and report number. The report number index also includes information on report availability when possible. Special attention should be given reference number 2494 (Proceedings of the 1957 International Symposium on Isotope Separation at Amsterdam). Titles and authors of the papers included are listed in the abstract, but these have not been indexed individually.

Acknowledgment - Special thanks are due the following persons without whose help this bibliography could not have been assembled: Robert E. Allen who co-authored the previous editions; John Drury who furnished motivation and encouragement; the members of the Chemical Separation of Isotopes Group of the Chemistry Division at Oak Ridge National Laboratory who so eagerly sought out errors in the previous edition and in the proofs of this manuscript.

REFERENCES

1

THE RADIO-ELEMENTS AND THE PERIODIC LAW. Fredrick Soddy. Chem. News 107, 97-9(1912). C.A. 7, 1442_7.

Isotopes of the same element produced in the natural disintegration series are stated to be chemically non-separable.

2

THE POSITION OF THE RADIO-ELEMENTS IN THE PERIODIC TABLE. K. Fajans. Physik. Z. 14, 136-42(1913). Radium 10, 61-5(1913). C.A. 7, 1669_1.

Isotopes are postulated to be so similar as to be inseparable chemically or by fractional crystallization.

3

RADIUM D AND THE FINAL PRODUCT OF THE RADIUM DISINTEGRATION SERIES. R. Whytlaw-Gray. Nature 91, 659-60(1913). C.A. 7, 3570_8.

Isotopes of Pb were found to have identical chemical properties.

4

THE QUESTION OF ISOTOPIC ELEMENTS. G. von Hevesy and F. Paneth. Physik. Z. 15, 797-805(1914). C.A. 9, 175_8.

Electrolytically, isotopic elements (Pb) were found to be equivalent.

5

THE PHYSICAL PROPERTIES OF ISOTOPES. F. A. Lindemann. Nature 95, 7-8(1915). C.A. 9, 1148_6.

It is suggested that isotopic elements may differ in vapor pressure and melting points. The concept is applied to isotopes of Pb.

6

THE QUESTION OF THE ISOTOPIC ELEMENTS. K. Fajans. Physik. Z. 15, 935-40(1914). C.A. 9, 1149_3.

The question of chemical identity of isotopes is discussed for the case of Pb.

7

THE QUESTION OF ISOTOPIC ELEMENTS. REPLY TO K. FAJANS. G. von Hevesy and F. Paneth. Physik. Z. 16, 45-51(1915). C.A. 9, 2485_4.

New data are given to support the contention that isotopic elements of Pb are identical electrochemically.

8

GALVANIC CELLS WITH LEAD ISOTOPES. G. von Hevesy and F. Paneth. Monatsh. 36, 795-803(1915). C.A. 10, 148_7.

Isotopes of Pb are shown to be electrochemically interchangeable.

9

THE QUESTION OF ISOTOPIC ELEMENTS. II. REJOINDER TO THE REPLY OF G. von HEVESY AND F. PANETH. K. Fajans. Physik. Z. 17, 1-4(1916). C.A. 10, 1005_6.

The question of interchangeability of isotopic elements is further discussed.

10

THE QUESTION OF ISOTOPIC ELEMENTS. III. REPLY TO THE FOREGOING PAPER OF K. FAJANS. G. von Hevesy and F. Paneth. Physik. Z. 17, 4-6(1916). C.A. 10, 1005_8.

Brief summary of points previously discussed.

11

THE ISOTOPES. Harry Schmidt. Umschau 19, 385-8(1915). C.A. 10, 1132_3.

A review of the work of Soddy, Fleck, Fajans, etc., on the theory of isotopes.

12

THE CHEMICAL REACTIONS OF THE RADIOELEMENTS. Fritz Paneth. Jahrb. Radioakt. Elektronik 11, 451-70(1914). C.A. 10, 1470_5.

A review of the theory of isotopes and its experimental data.

13

ATTEMPT TO SEPARATE THE ISOTOPIC FORMS OF LEAD BY FRACTIONAL CRYSTALLIZATION OF THE NITRATE. T. W. Richards and N. F. Hall. J. Am. Chem. Soc. 39, 531-41(1917). C.A. 11, 1361_1.

The difference in atomic weight after a total of 1006 crystallizations was slightly greater than the experimental error.

14

SEPARATION OF ISOTOPES: A COMMENT ON THE PAPER OF T. W. RICHARDS AND N. F. HALL. Fredrick Soddy. J. Am. Chem. Soc. 39, 1614-15(1917). C.A. 11, 2639_1.

The chemical non-separability of isotopes is asserted. The method referred to is fractional crystallization.

15

IS THE SEPARATION OF ISOTOPES POSSIBLE? R. T. A. Mees. Chem. Weekblad 14, 622-6(1917). C.A. 11, 2752_4.

The conclusion is reached that with the possible exception of the work of Richards and Hall (C.A. 11, 1361) no evidence has been brought forward that separation is possible.

16

ATTEMPTED SEPARATION OF ISOTOPIC ELEMENTS BY MEANS OF FRACTIONAL DIFFUSION. H. Lachs, M. Nadratowska and L. Wertenstein. Compt. rend. soc. sci. Warsaw 9, 670-2(1917); Chem. Zentr. I, 416(1918); J. Chem. Soc. 114, II, 213. C.A. 12, 2482_9.

An attempt to separate the isotopes U_1 and U_2 by the fractional diffusion of a solution of uranyl nitrate showed that any difference in diffusion coefficients must be less than 1.5%.

17

THE POSSIBILITY OF SEPARATING ISOTOPES. F. A. Lindemann and F. W. Aston. Phil. Mag. 37, 523-35(1919). C.A. 13, 1669_1.

The theoretical possibility of separating isotopes is treated mathematically for distillation, diffusion, density methods, and electric separation by the positive ray method. Results on Ne were negative by fractional distillation and diffusion.

18

THE POSSIBILITY OF SEPARATING ISOTOPES. S. Chap-

man. Phil. Mag. 38, 182-7(1919). C.A. 13, 2633_3.

A thermal diffusion method for separating Ne isotopes is proposed.

18a

NOTE ON THE VAPOR PRESSURE AND AFFINITY OF ISOTOPES. F. A. Lindemann. Phil. Mag. 38, 173-81 (1919). C.A. 13, 2636_2.

Lindemann concludes that although isotopes cannot be identical chemically there is only a second-order difference if "zero point" energy is assumed.

19

THE SEPARATION OF ISOTOPES. Alexander Fleck. Nature 104, 565(1920). C.A. 14, 1255_6.

A method of separation of Ra isotopes by fractional precipitation is suggested.

20

THE SEPARATION OF THE ELEMENT CHLORINE INTO CHLORINE AND META-CHLORINE. W. D. Harkins. Science 51, 289-91(1920). C.A. 14, 1480.

An account of preliminary experiments to effect the separation by means of diffusion. The experiments were carried out with HCl and about 19,000 l. of the gas have been diffused. Preliminary analyses indicate that the density of the fraction which remains in the diffusion tubes is increasing at about the rate predicted by the Rayleigh theory of diffusion, if the atomic weight of Cl is taken as 35 and that of meta-Cl as 37.

21

AN ATTEMPT TO DETERMINE IF COMMON LEAD COULD BE SEPARATED INTO ISOTOPES BY CENTRIFUGING IN THE LIQUID STATE. J. Joly and J. H. J. Poole. Phil. Mag. 39, 372-5(1920). C.A. 14, 1927_1.

The results were negative.

22

THE SEPARATION OF ISOTOPES. T. R. Merton and H. Hartley. Nature 105, 104-5(1920). C.A. 14, 1927_4.

A method is suggested for separating the isotopes of Cl which have atomic weights of 35 and 37. The method depends on the assumption that in the absorption spectrum of Cl there is a difference between the wave lengths of absorption lines due to molecules containing different isotopes. Light passed through Cl_2 would be used in the photochemical reaction of H_2 with Cl_2.

23

THE SEPARATION OF THE ISOTOPES OF CHLORINE. D. L. Chapman. Nature 105, 487-8(1920). C.A. 14, 3015_9.

It is considered possible to separate the isotopes of chlorine in the gaseous state in a reaction where the number of atoms of Cl in the reacting compound is unequal to the number in the resulting compound.

24

CONCENTRATION OF THE LIGHTER ISOTOPE OF IODINE. Emil Kohlweiler. Z. physik. Chem. 95, 95-125(1920). C.A. 14, 3188_9.

Fractional diffusion of I vapor at 220° has been employed to concentrate the lighter isotope of this element. The theory of fractional diffusion is discussed.

25

THE SEPARATION OF THE ISOTOPES OF MERCURY. J. N. Brönsted and G. Hevesy. Nature 106, 144(1920). C.A. 14, 3573_2.

A partial separation of the isotopes of mercury was brought about by evaporating Hg at low pressure and condensing the evaporated atoms on a cooled surface.

26

THE POSSIBILITY OF SEPARATING MERCURY INTO ITS ISOTOPIC FORMS BY CENTRIFUGING. J. H. J. Poole. Phil. Mag. 41, 818-22(1921). C.A. 15, 2776_8.

A mathematical treatment which concludes separation would be very small.

27

THE SEPARATION OF THE ISOTOPES OF CHLORINE. J. N. Brönsted and G. Hevesy. Nature 107, 619(1921). C.A. 16, 17_3.

When about half of a strong solution of HCl cooled down to about −50° was evaporated in a high vacuum, the mixture of water and HCl being condensed on a surface cooled with liquid air, the condensed part of the HCl was found richer, and the remaining part poorer, as regards the lighter constituent of Cl than the ordinary HCl.

28

THE SEPARATION OF CHLORINE INTO ISOTOPES. W. D. Harkins. Nature 108, 209(1921). C.A. 16, 196_8.

Twenty grams of NaCl containing Cl 0.0375 units higher in atomic weight, and 80 grams containing Cl 0.034 units higher were prepared by gaseous diffusion of HCl.

29

THE SEPARATION OF THE ELEMENTS CHLORINE AND MERCURY INTO ISOTOPES. Wm. D. Harkins. Science 54, 359-60(1921). C.A. 16, 196_8.

Cl has been separated by gaseous diffusion of HCl gas. Hg was separated by slow distillation at low pressures.

30

THE SEPARATION OF MERCURY INTO ISOTOPES. Wm. D. Harkins and R. S. Mulliken. Nature 108, 146(1921). C.A. 16, 197_2.

Hg was separated by slow distillation at low pressures.

31

ISOTOPES. J. J. Thomson. Proc. Roy. Soc. (London) 99A, 87-104(1921). C.A. 16, 197_4.

An ordinary chemical reaction should separate isotopes.

32

THE SEPARATION OF THE ELEMENT CHLORINE INTO ISOTOPES. W. D. Harkins and A. Hayes. J. Am. Chem. Soc. 43, 1803-25 (1921). C.A. 16, 679_1.

This paper presents in detail the data, already briefly announced in several notes on the heavy fraction from the diffusion of HCl gas at atmospheric pressure. The increase in atomic weight of Cl amounted to 1 part in 645. The diffusion apparatus, including the porous clay diffusion tubes, are shown, and the process is described in detail.

33

SEPARATION OF THE ISOTOPES OF MERCURY. J. N. Brönsted and G. von Hevesy. Z. physik. Chem. 99, 189-206(1921). C.A. 16, 1180_8.

Hg was separated by a vaporization or distillation method and by an effusion method.

34

THE SEPARATION OF ISOTOPES. THEORY AND RESOLUTION OF ISOTOPIC MIXTURES BY DIFFUSION AND SIMILAR PROCESSES. EXPERIMENTAL SEPARATION OF MERCURY BY EVAPORATION IN A VACUUM. R. S. Mulliken and Wm. D. Harkins. J. Am. Chem. Soc. 44, 37-65(1922). C.A. 16, 1359_4

A study of the theory of the separation of isotopes by various types of diffusion or by non-equilibrium evaporation. Hg was separated by non-equilibrium evaporation.

35

AN ATTEMPT TO SEPARATE THE ISOTOPES OF CHLORINE. E. J. Bowen, T. R. Merton, H. Hartley, and A. O. Ponder. Phil. Mag. 43, 430-6(1922). C.A. 16, 2067_8.

A photochemical method was used in which white light was filtered through a long column of Cl gas and then passed into an equivalent mixture of Cl and H.

36

THE SEPARATION OF ISOTOPES BY THERMAL AND PRESSURE DIFFUSION. R. S. Mulliken. J. Am. Chem. Soc. 44, 1033-51(1922). C.A. 16, 2255_2.

Simple equations are developed giving the change in composition of any mixture of isotopes when subjected to thermal diffusion or centrifuging. A method of "evaporative centrifuging" is proposed.

37

AN ATTEMPT TO SEPARATE THE ISOTOPES OF CHLORINE. E. B. Ludlam. Proc. Cambridge Phil. Soc. 21, II, 45-51(1922). C.A. 16, 3029_6.

HCl at a pressure of a few cm. of Hg was allowed to pass over water or NH_4OH. The density of a small fraction left uncombined was within experimental error.

38

THE SEPARATION OF ISOTOPES. G. von Hevesy. Oesterr. Chem. Ztg. 25, 80-2(1922). C.A. 16, 3253_3.

A brief discussion of isotopes in the radioactive series and the method of detecting isotopes by positive rays is followed by a description of the partial separation of Hg into isotopes by the methods of diffusion and of ideal distillation.

39

STABILITY OF ATOMIC NUCLEI, THE SEPARATION OF ISOTOPES, AND THE WHOLE-NUMBER RULE. Wm. D. Harkins. J. Frank. Inst. 194, 165-211, 329-56(1922). C.A. 16, 3432_2.

A review.

40

STABILITY OF ATOM NUCLEI, THE SEPARATION OF ISOTOPES, AND THE WHOLE NUMBER RULE. William D. Harkins. J. Frank. Inst. 194, 521-35(1922). C.A. 16, 4125_4.

A review.

41

CHEMICAL METHOD OF SEPARATING THE ISOTOPES OF LEAD. Thomas Dillon, Rosalind Clarke, and Victor M. Hinchy. Sci. Proc. Roy. Dublin Soc. 17, 53-7(1922). C.A. 16, 4125_5.

It is concluded from atomic weight determinations that the different isotopes of Pb are not identical in their behavior towards Grignard reagent.

42

THE SEPARATION OF ISOTOPES BY DISTILLATION AND ANALOGOUS PROCESSES. R. S. Mulliken. J. Am. Chem. Soc. 44, 2387-90(1922). C.A. 17, 21_4.

The efficiency of the separation of isotopes by non-equilibrium distillation has been studied.

43

SEPARATION OF THE ISOTOPES OF ZINC. A. C. Egerton. Nature 110, 773 (1922). C.A. 17, 674_3.

Some separation was effected by quantity distillation in high vacuum.

44

ATTEMPTS TO SEPARATE THE ISOTOPES OF CHLORINE BY ADSORPTION IN CHARCOAL. Jitsusaburo Sameshima, Kazuo Aihara, and Toshiaki Shirai. J. Chem. Soc. Japan 43, 761-6(1922). C.A. 17, 923_4.

In fractional desorption of HCl from bamboo charcoal no effect greater than experimental error was found.

45

STABILITY OF ATOM NUCLEI, THE SEPARATION OF ISOTOPES, AND THE WHOLE NUMBER RULE. W. D. Harkins. J. Franklin Inst. 194, 645-81, 783-814(1922); 195, 67-106(1923). C.A. 17, 1374_5.

A review.

46

EXPERIMENTS ON SEPARATING ELEMENTS AND ISOTOPES BY DIFFUSION. Ernst Murmann. Oesterr. Chem.-Ztg. 26, 14-15(1923). C.A. 17, 1375_2.

Attempts to separate U, Cl, and Li salts into isotopes by diffusion were unsuccessful.

47

SEPARATION OF THE ISOTOPES OF MERCURY. W. D. Harkins and S. L. Madorsky. J. Am. Chem. Soc. 45, 591-601(1923). Nature 111, 148(1923). C.A. 17, 1582_4.

Hg was separated by vacuum distillation in a relatively large apparatus.

48

STABILITY OF ATOM NUCLEI, THE SEPARATION OF ISOTOPES, AND THE WHOLE NUMBER RULE. William D. Harkins. J. Franklin Inst. 195, 553-73(1923). C.A. 17, 1919_3.

A review.

49

THE SEPARATION OF ISOTOPES. APPLICATION OF SYSTEMATIC FRACTIONATION TO MERCURY IN A HIGH-SPEED EVAPORATION-DIFFUSION APPARATUS. R. S. Mulliken. J. Am. Chem. Soc. 45, 1592-1604(1923). C.A. 17, 2818_6.

Hg is separated by diffusion of the vapor through a filter-paper at low pressure.

50

ATTEMPT TO SEPARATE THE ISOTOPES OF CHLORINE BY THE METHOD OF FRACTIONAL ADSORPTION. Jitsusaburo Sameshima, Kazuo Aihara and Toshiaki Shirai. Sci. Repts. Tohoku Imp. Univ. 12, 149-54(1923). C.A. 17, 2990_5.

Attempts to separate HCl by fractional desorption were unsuccessful.

51

SEPARATION OF THE ISOTOPES OF ZINC. A. C. Egerton and W. B. Lee. Proc. Roy. Soc. (London) 103A, 499-515 (1923). C.A. 17, 3279_5.

A partial separation of the isotopes of Zn, amounting to about 1 part in 1800 of density, was obtained by a short series of distillations of molten Zn at very low pressure.

52

THE RESULT OF AN ATTEMPT TO SEPARATE LEAD INTO ISOTOPES. ATOMIC WEIGHT OF LEAD. O. Hönigschmid and M. Steinheil. Ber. 56B, 1831-7(1923). C.A. 18, 197_2.

A series of irreversible distillations of $PbCl_2$ showed no isotopic separation.

53

THE DISCOVERY AND SEPARATION OF THE ISOTOPES OF CHLORINE AND THE WHOLE NUMBER RULE. W. D. Harkins and T. H. Liggett. J. Phys. Chem. 28, 74-82(1924). C.A. 18, 1080.

The atomic weight of Cl in residual samples from the diffusion of HCl through clay pipe stems has been very accurately determined by precipitation of AgCl. Determinations on cuts of 20,400, and 8000 showed a steady increase corresponding to a uniform efficiency of separation of about 50%; the maximum increase was 0.044 unit of atomic weight.

54

THE SEPARATION OF ISOTOPES. J. Kendall and E. D. Crittenden. Proc. Nat. Acad. Sci. 9, 75-8(1923). C.A. 18, 1427_8.

An apparatus is proposed for the separation of Li and Cl isotopes by electromigration of the ions. Electrolysis is also proposed.

55

THE SEPARATION OF ISOTOPES. J. Kendall. Phys. Rev. 21, 389-90(1923). C.A. 18, 2282_9.

Three methods of isotope separations are proposed. They are ionic migration, electrolysis, and fractional crystallization.

56

THE POSSIBILITY OF SEPARATING THE ISOTOPES OF CHLORINE BY FRACTIONAL DIFFUSION OF SOLUTIONS OF SODIUM CHLORIDE. B. L. Vanzetti. Gazz. chim. ital. 54, 89-94(1924). C.A. 18, 2283_1.

Five kg. NaCl in solution was dialyzed through animal membranes until 5g. remained. No effect was found.

57

THE SEPARATION OF ISOTOPES BY THE IONIC MIGRATION METHOD. J. Kendall and J. F. White. Proc. Nat. Acad. Sci. 10, 458-61(1924). C.A. 19, 600_7.

Aqueous NaCl is being tested in a electromigration apparatus. No results are reported.

58

A REDETERMINATION OF THE ATOMIC WEIGHT OF BROMINE. THE INSEPARABILITY OF THE ISOTOPES BY FRACTIONAL CRYSTALLIZATION. P. L. Robinson and H. V. A. Briscoe. J. Chem. Soc. 127, 138-50(1925). C.A. 19, 1512_4.

Repeated fractional crystallization of NH_4Br showed no concentration of Br isotopes.

59

AN ATTEMPTED ELECTROLYTIC SEPARATION OF THE ISOTOPES OF CHLORINE AND MAGNESIUM. J. E. G. Pilley. Phil. Mag. 49, 889-99(1925). C.A. 19, 2448_6.

An attempt to separate isotopes of chlorine and magnesium by electromigration of the ions gave negative results.

60

THE SEPARATION OF CHLORINE INTO ISOTOPES (ISOTOPIC ELEMENTS) AND THE WHOLE-NUMBER RULE FOR ATOMIC WEIGHTS. W. D. Harkins. Proc. Natl. Acad. Sci. 11, 624-8(1925). C.A. 20, 8_8.

A review of the work of separating Cl into isotopes. Samples with atomic weights 0.055 units higher and 0.04 units lower than ordinary Cl have been obtained.

61

THE SEPARATION OF THE ELEMENT CHLORINE INTO ISOTOPES. THE LIGHT FRACTION. W. D. Harkins and F. A. Jenkins. J. Am. Chem. Soc. 48, 58-69(1926). C.A. 20, 1755_5.

By a systematic series of diffusions of HCl through porous pipe-stems, Cl of atomic weight 0.039 lower than ordinary Cl has been obtained.

62

ATTEMPTS TO FRACTIONATE MIXED ISOTOPES OF LEAD AND THE ATOMIC WEIGHT OF THIS METAL. T. W. Richards, H. S. King, and L. P. Hall. J. Am. Chem. Soc. 48, 1530-43(1926). C.A. 20, 2783_6.

Neither fractionation by irreversible volatilization nor the Grignard process showed any separation of the Pb isotopes.

63

MOBILITY OF IONS IN SOLUTION WITH PARTICULAR REFERENCE TO THE SEPARATION OF ISOTOPES. E. R. Jette. Phil. Mag. (7) 3, 258-69(1927). C.A. 21, 1214_2.

A critical review of the mobilities of ions from the point of view of the kinetic theory and hydrodynamics. Conclusion: It is impossible to effect a separation of isotopes by their difference in mobilities.

64

THE EMISSION OF POSITIVE RAYS. APPLICATION TO THE SEPARATION OF ISOTOPES. Max Morand. Ann. phys. 7, 103-83(1927). C.A. 21, 2222.

A comprehensive discussion of the phenomenon of positive-ion emission. From experiment a satisfactory technique is developed for obtaining an intense, homogeneous and properly directed beam of positive rays. Such emission is then used to obtain a separation of the isotopes of Li in larger quantities than has hitherto been possible.

65

SEPARATION BY THE IONIC MIGRATION METHOD. James Kendall. Science 67, 163-7(1928). C.A. 22, 1271_9.

An informal summary and discussion of separations based on differences in electrolytic ion velocities is presented. Applications of the method to the separation of isotopes are discussed.

66

SOME EXPERIMENTS ON THE SEPARATION OF THE ISOTOPES OF Cl BY CHEMICAL METHODS. T. Nishimura and T. Toyama. Bull. Inst. Phys. Chem. Research, (Tokyo) 7, 98-108(1928). C.A. 22, 3348_1.

Efforts to separate the isotopic forms of Cl were made by taking advantage of the solution of HCl in aqueous $FeCl_3$ solutions and also by forming solid salts of Mg oxychloride and carnalite. No success was obtained.

67

SOME EXPERIMENTS ATTEMPTING TO SEPARATE THE ISOTOPES OF MAGNESIUM BY CHEMICAL METHODS. Tsunekichi Nishimura, Takemaro Yamamoto, and Masae Arai. Bull. Inst. Phys. Chem. Research (Tokyo) 7, 237-56 (1928); Abstracts 1, 19-22. C.A. 22, 3348_2.

The separation of the Mg isotopes was tried with several compounds. Results were inconclusive.

68

AN ATTEMPT PARTIALLY TO SEPARATE THE ISOTOPES OF CADMIUM. Arthur A. Sunier. Abstracts of Theses, Univ. of Chicago, Science Series 4, 173-7 (1925-6). C.A. 22, 3826_8.

No difference in atomic weight was found for 2 extreme fractions of Cd produced by 13 successive evaporations in vacuum, in each of which the amount was decreased by 1/2.

69

THE SEPARATION OF THE ELEMENT CHLORINE INTO ISOTOPES (ISOTOPIC ELEMENTS): LIGHT FRACTION. F. A. Jenkins. Abstracts of Theses, Univ. Chicago, Science Series 4, 93-8(1925-26). C.A. 22, 3827_1.

By a systematic fractionation of HCl gas, consisting of diffusions against air at atomic pressure through porous pipe-stems, 28 g of HCl is obtained in which the Cl has an atomic weight 35.418, as found from the ratio Ag/AgCl. Atomic weight changes for intermediate fractions are determined from the densities of HCl solutions, and afford a comparison of the efficiencies of 2 forms of diffusion apparatus.

70

SEPARATION OF ISOTOPES OF POTASSIUM. G. von Hevesy and M. Lögstrup. Z. anorg. allgem. Chem. 171, 1-13 (1928). C.A. 22, 4356_6.

By subjecting K to the process of ideal distillation, a residue was obtained having atomic weight 39.109 corresponding to an increase of 4.8% in the proportion of the isotope K^{41}.

71

THE SEPARATION OF ISOTOPES AND A FURTHER SEPARATION OF MERCURY BY EVAPORATIVE DIFFUSION. W. D. Harkins and B. Mortimer. Phil. Mag. 6, (7) 601-31(1928). C.A. 23, 329_1.

A comprehensive survey of the separation of isotopes actually achieved has been made, and the possibilities of any larger separations have been discussed. The difference of atomic weight between samples of Hg as obtained in this work is 0.189 unit, the largest difference in atomic weight yet achieved by artificial means. The theory of isotopic resolution by evaporation and diffusion is briefly reviewed.

72

THE FIRST SEPARATION OF CHLORINE ISOTOPES. W. D. Harkins and C. E. Broecker. Z. Physik 50, 537-47 (1928). C.A. 23, 329_4.

This constitutes a comprehensive review of Harkins' work on the separation of chlorine isotopes, a research initiated in 1916-17. The essential method is a gaseous diffusion separation using HCl gas diffusing through porous porcelain pipe stems.

73

RESEARCHES ON THE EXISTENCE OF VAPOR PRESSURE DIFFERENCES OF ISOTOPES BY FRACTIONAL DISTILLATION. I. DISTILLATION STUDIES ON CCl_4. H. G. Grimm. Z. Physik. Chem. 181-99(1929). C.A. 24, 1792_2.

Calculations from experiment indicate that the boiling points of 2 kinds of CCl_4 differing in molecular weights by 2 cannot differ more than 0.001°.

74

RESEARCHES ON THE EXISTENCE OF VAPOR PRESSURE DIFFERENCES OF ISOTOPES BY FRACTIONAL DISTILLATION. II. STUDIES IN FRACTIONATION OF CHLORINE DISTILLED ON A TECHNICAL SCALE AT THE SULFURIC ACID, DYE AND SODA FACTORY, LUDWIGSHAFTEN. H. G. Grimm and L. Braun. Z. Physik Chem., 200-06(1929). C.A. 24, 1792_3.

The first and last samples of an extensive fractional distillation of liquid Cl were examined for difference in density of a saturated NH_4Cl solution produced from 2 samples. The difference in atomic weights of the 2 fractions must have been less than 0.002%.

75

POSSIBILITY OF SEPARATING NEON INTO ITS ISOTOPIC COMPONENTS BY DISTILLATION. W. H. Keesom and H. van Dijk. Proc. Acad. Sci. Amsterdam 34, 42-50(1931). C.A. 25, 3561_4.

By means of distillation at −248.4° Ne was separated into two components differing in density by 0.4%.

76

THE POSSIBILITY OF SEPARATING NEON ISOTOPES BY DISTILLATION. H. van Dijk. Physica 11, 203-7 (1931). C.A. 26, 28_2.

Neon was distilled in a 19 plate distillation column at a temperature of 24.7° absolute. Ne^{20} was found to have a higher vapor pressure than Ne^{22}.

77

RARE EARTHS. James Kendall. Proc. Roy. Phil. Soc. Glasgow 59, 1-11(1931). C.A. 26, 3448_5.

The ionic-migration method was applied to an attempted separation of rare earths and their isotopes.

78

THE HYDROGEN ISOTOPE OF MASS 2 AND ITS CONCENTRATION. Harold C. Urey, F. G. Brickwedde, and George M. Murphy. Phys. Rev. 40, 1-15(1932). C.A. 26, 4242_9.

The isotope was concentrated in 3 samples of gas by evaporating large quantities of liquid H_2 and collecting gas which evaporated from the last 2 or 3 cc. Spectrographic analysis of these samples gave new lines which agree with those calculated for an H^2 isotope.

79

THE HYDROGEN ISOTOPE OF MASS 2. H. Kallmann and W. Lasareff. Naturwissenschaften 20, 472 (1932). C.A. 26, 4749_8.

The H^2 isotope was found in a sample of distilled H_2.

80

SEPARATION OF GASEOUS ISOTOPE MIXTURES. G. Hertz. Naturwissenschaften 20, 493-4(1932). C.A. 26, 4749_9.

An apparatus is described consisting of 24 units each having 2 clay diffusion tubes and a mercury pump, to separate isotope mixtures by the diffusion method. The apparatus was first used to separate Ne isotopes.

81

CONCENTRATION OF THE H^2 ISOTOPE OF HYDROGEN BY THE FRACTIONAL ELECTROLYSIS OF WATER. E. W. Washburn and Harold C. Urey. Proc. Natl. Acad. Sci. 18, 496-8(1932). C.A. 26, 5003_8.

The possibility of a fractionation owing to a possible small difference in the normal electrode potentials of the 2 isotopes and in the diffusion of the 2 species of ions through a cathode film is examined.

82

A PROCEDURE FOR THE SEPARATION OF GASEOUS MIXTURES OF ISOTOPES AND THE APPLICATION TO THE ISOTOPES OF NEON. G. Hertz. Z. Physik 79, 108-21 (1932). Z. Physik 79, 700 (1932). C.A. 27, 1818_3.

Spectroscopically pure Ne isotopes are obtainable by the difference of the velocity of diffusion through porous walls.

83

ISOTOPES OF HYDROGEN. G. N. Lewis. J. Am. Chem. Soc. 55, 1297-8(1933). C.A. 27, 2092_4.

Water containing approximately 30% heavy water was obtained by electrolysis.

84

PHOTOCHEMICAL SEPARATION OF ISOTOPES. W. Kuhn and H. Martin. Naturwissenschaften 20, 772(1932). C.A. 27, 2621_3.

On irradiation of $COCl_2$ by ultra violet light (2816.179Å) from an Al arc, the Cl_2 liberated shows a slight excess of Cl^{35}.

85

CONCENTRATION OF THE HEAVY HYDROGEN ISOTOPE. J. L. Newell and J. B. Ficklen. J. Am. Chem. Soc. 55, 2167(1933). C.A. 27, 2876_8.

The densities of H_2O from Cr-plating solutions indicated the presence of about 0.6% H_2O containing the heavier H isotope.

86

THE SEPARATION OF HYDROGEN ISOTOPES BY FRACTIONAL DESORPTION. H. S. Taylor, A. J. Gould, and W. Bleakney. Phys. Rev. 43, 496-7(1933). C.A. 27, 2876_7.

A one-stage fractional desorption of H_2 from active charcoal at liquid air temperature yielded a sample enriched threefold in HD.

87

AN ATTEMPT TO SEPARATE ISOTOPES BY REVERSIBLE FRACTIONAL DISTILLATION. H. J. Henriques and R. E. Cornish. J. Phys. Chem. 37, 397-8(1933). C.A. 27, 3137_8.

In a liquid-vapor equilibrium type fractionating column the necessary height and distillation time eliminate this as a method of isotope separation. Boiling points of isotopic modifications of methylene chloride differ by 0.005° or less.

88

ZERO-POINT ENERGY AND THE SEPARATION OF ISOTOPES. H. Eyring. Proc. Natl. Acad. Sci. U.S. 19, 78-81(1933). C.A. 27, 3137_9.

The theory of the separation of H isotopes by the electrolysis of H_2O is discussed.

89

FRACTIONATION OF ISOTOPES BY ELECTROLYSIS. James Kendall. J. Am. Chem. Soc. 55, 2612-13(1933). C.A. 27, 3394_3.

A small fractionation of Hg by electrolysis of an acid solution of $HgNO_3$ was obtained. With Li no fractionation was obtained.

90

SEPARATION OF THE ISOTOPIC FORMS OF WATER BY FRACTIONAL DISTILLATION. G. N. Lewis and R. E. Cornish. J. Am. Chem. Soc. 55, 2616-17(1933). C.A. 27, 3394_5.

With a 20 ft fractionating column appreciable changes in the density of H_2O are secured by separation of the isotopes of H and O.

91

CONCENTRATION OF THE H^2 ISOTOPE. G. N. Lewis and R. T. MacDonald. J. Chem. Phys. 1, 341-4(1933). C.A. 27, 3664_4.

Twenty liters of H_2O from an old electrolytic cell was electrolized until the volume was reduced to 0.5 cc. The concentration of D in the product was 65.7%.

92

THEORETICAL CONSIDERATIONS CONCERNING THE SEPARATION OF ISOTOPES. H. Eyring and A. Sherman. J. Chem. Phys. 1, 345-9(1933). C.A. 27, 3664_4.

Isotopic enrichment is calculated at 20, 90, and 273°K for H_2, O_2, N_2, Cl_2, H_2O, C-H, and a large number of metal-H bonds by the diffusion processes.

93

THE ISOTOPIC FRACTIONATION OF WATER BY DISTILLATION AND BY ADSORPTION. E. W. Washburn and Edgar R. Smith. J. Chem. Phys. 1, 426(1933). C.A. 27, 3865_4.

Ten liters of H_2O, specific gravity 1.000053, was distilled at atmospheric pressure through a 35 ft column. H_2O saturated activated carbon showed a slight increase in the specific gravity of the H_2O.

94

EXPERIMENTS TO SEPARATE ISOTOPES BY G. HERTZ'S METHOD. H. Harmsen. Z. Physik. 82, 589-609(1933). C.A. 27, 4164_4.

A separation of the Ne isotopes 20 and 22 is achieved such that each of the fractions contain no more than 1% of the other isotope.

95

THE ELECTROLYTIC ISOLATION OF THE HEAVIER HYDROGEN ISOTOPE BY G. N. LEWIS. M. Polanyi. Naturwissenschaften 21, 316-17(1933). C.A. 27, 4730_4.

96

SIMPLE TYPE OF ISOTOPIC REACTION. G. N. Lewis. J. Am. Chem. Soc. 55, 3502-3(1933). C.A. 27, 4730_6.

Water was reduced in density after repeated saturation with and removal of NH_3. Likewise bubbling SO_2 through water caused a density decrease in the H_2O. The reactions $HDO + NH_3 \rightleftharpoons H_2O + NH_2D$ and $H_2O^{18} + SO_2 \rightleftharpoons H_2O^{16} + SO^{16}O^{18}$ are the equilibria involved.

97

INCREASE OF CONCENTRATION OF H^1H^2 BY FRACTIONAL EVAPORATION AND RECTIFICATION. W. H. Keesom, H. van Dijk, and J. Haantjes. Proc. Acad. Sci. Amsterdam, 36, 248-52(1933). C.A. 27, 5002_8.

Forty liters of liquid H_2 were reduced to 2 liters of gas by evaporation at 14-15°K. The residue contained 3% by volume of HD.

98

DIFFUSION TECHNIQUE FOR THE SEPARATION OF THE ISOTOPES OF HYDROGEN. R. M. Langer. Phys. Rev. 38, 1047-8 (1931). C.A. 27, 5006_7.

99

MASS SPECTRA AND ISOTOPES. F. W. Aston. Longmans, Green, & Co., New York (1933). C.A. 27, 5250.

100

APPARATUS FOR THE SEPARATION OF ISOHYDROGEN (DEUTERIUM) OXIDE BY ELECTROLYSIS. W. D. Harkins and C. Doede. J. Am. Chem. Soc. 55, 4330-1(1933). C.A. 27, 5636_5.

Two concentric Ni tubes are used for electrodes and vessel.

101

EXCHANGE REACTIONS OF PROTIUM AND DEUTERIUM. R. H. Crist and G. A. Dalin. J. Chem. Phys. 1, 677(1933). C.A. 27, 5636_6.

H_2 equilibrated for several days at 800° with H_2O showed higher deuterium content.

102

SEPARATION OF THE ISOTOPES OF HYDROGEN. C. H. Collie. Nature 132, 568-9(1933). C.A. 28, 36_6.

103

THE EXCHANGE OF HYDROGEN BETWEEN WATER AND HYDROGEN COMPOUNDS DISSOLVED IN IT. K. F. Bonhoeffer and G. W. Brown. Z. physik. Chem. 23, 171-4(1933). C.A. 28, 406_8.

H_2O containing 1 part in 800 of D was prepared by electrolysis of 150 l. of H_2O from concentrated electrolytic cells with H_2SO_4 as the electrolytic and Pb electrodes. NH_3, NH_4Cl and cane sugar were dissolved in this water and by density determinations it was shown that D exchanges with H contained in the compounds.

104

THE CONCENTRATION OF DEUTERIUM BY ELECTROLYSIS. D. H. Rank. J. Chem. Phys. 1, 750-1(1933). C.A. 28, 406_9.

The concentration of D by electrolysis is discussed and it is shown that the separation factor depends upon the temperature at which the electrolysis takes place.

105

THEORETICAL AND PRACTICAL STUDIES OF ATOMIC AND MOLECULAR FORMS OF THE HYDROGEN ISOTOPES. H. S. Taylor and H. Eyring. Proc. Am. Phil. Soc. 72, 255-64(1933). C.A. 28, 706_9.

The electrolytic separation of H isotopes is discussed. It is shown that a compound with light H will enolize about 7 times and ketonize about 12 times as fast as the heavy species at ordinary temperatures.

106

HEAVY WATER. K. F. Bonhoeffer. Angew. Chem. 46, 776-9(1933). C.A. 28, 967_2.

The summary of the methods of separating the isotopes of hydrogen and of the properties of heavy water.

107

TECHNIQUE FOR THE ELECTROLYTIC PRODUCTION OF D_2O. Hugh S. Taylor, H. Eyring, and A. A. Frost. J. Chem. Phys. 1, 823-4 (1933). C.A. 28, 967_3.

Six hundred and ten gallons of electrolyte from commercial electrolytic cells yielded 420 cc. of D_2O, 99% pure.

108

ELECTROLYTIC SEPARATION OF HYDROGEN ISOTOPES AND THE MECHANISM OF THE CATHODE PROCESS. B. Topley and H. Eyring. J. Am. Chem. Soc. 55, 5058-9(1933). C.A. 28, 967_4.

Electrolysis of H_2O containing ~7% D at 26° with Pt anode and various metals as cathodes gives the separation factor (α) in KOH. The mechanism of the cathode process is discussed.

109

SEPARATION OF HYDROGEN ISOTOPES BY DIFFUSION THROUGH PALLADIUM. L. Harris, W. Jost, and R. W. B. Pearse. Proc. Natl. Acad. Sci. U. S. 19, 991-4(1933). C.A. 28, 1265_5.

It is concluded that the diffusion is an atomic process and there is an activation factor favorable to the lighter isotope.

110

HEAVY HYDROGEN IN CONTACT WITH NORMAL WATER. M. L. Oliphant. Nature 132, 675(1933). C.A. 28, 1265_6.

It is thought that exchange between D_2 gas and liquid water occurred after six weeks in contact.

111

THE ISOTOPIC FRACTIONATION OF WATER. E. W. Washburn, Edgar R. Smith, and M. Frandsen. J. Chem. Phys. 1, 288(1933). C.A. 28, 1265_7.

When H_2O is subjected to electrolysis an isotopic fractionation occurs, the evolved O being richer in O^{16} isotope, and the evolved H being richer in the H^1 isotope than the water from which they were evolved.

112

FREEZING POINTS OF MIXTURES OF H_2O AND H_2^2O. V. K. La Mer, W. C. Eichelberger, and H. C. Urey. J. Am. Chem. Soc. 56, 248-9(1934). C.A. 28, 1587_5.

The freezing point is a linear function of the density to 20% D_2O, but a deviation outside the experimental error is perceptible at 40%.

113

FRACTIONATION OF THE HYDROGEN ISOTOPES BY THE ADDITION OF SODIUM TO WATER. C. O. Davis and Herrick L. Johnston. J. Am. Chem. Soc. 56, 492-3(1934). C.A. 28, 1599_1.

Reaction of Na with water gave a separation coefficient of 2.5 using a Rayleigh type formula.

114

POSSIBILITY OF INTERCHANGE BETWEEN DEUTERIUM GAS AND HYDROGEN IN COMPOUNDS. A. J. Gould and W. Bleakney. J. Am. Chem. Soc. 56, 247-8(1934). C.A. 28, 1599_3.

If preferential solubility, diffusion, and the presence of metallic surfaces are avoided D_2 will not exchange with H_2O.

115

REACTION RATES OF THE HYDROGEN ISOTOPES. M. Polányi. Nature 133, 26-7(1934). C.A. 28, 1915_5.

H^1 does not always react faster than H^2. Quantum mechanical leakage of energy through the barriers favors H^1, but the zero-point energy effect at times suffices to reverse the relation.

116

THE EQUILIBRIUM AMONG THE THREE HYDROGENS. D. Rittenberg, W. Bleakney, and H. C. Urey. J. Chem. Phys. 2, 48-9(1934). C.A. 28, 1922_4.

The equilibrium constants for the reaction $H_2 + D_2 \rightleftarrows 2H\ D$ were measured with the mass spectrometer and agree with theory.

117

EXPERIMENTS ON HEAVY HYDROGEN. A. Farkas and L. Farkas. Nature 132, 894(1933). C.A. 28, 1922_7.

The gas diffusing from a thin Pd tube at 150° has a higher H^1:H^2 ratio than the original gas. At higher temperatures the diffusing gas becomes heavier.

118

SEPARATION AND PROPERTIES OF THE ISOTOPES OF HYDROGEN. Harold C. Urey. Science 78, 566-71(1933). C.A. 28, 1922_8.

H_2O containing various percentages of D_2O were prepared by electrolysis of KOH solutions in cells consisting of glass vessels with Ni tubing electrodes, cooled by H_2O to 20° and operated at 25 amp. The thermodynamic, physical, kinetic and physiological properties of protium and deuterium oxides are discussed and tabulated.

119

ELECTROLYTIC CONCENTRATION OF DEUTERIUM. R. P. Bell and J. H. Wolfenden. Nature 133, 25-6(1934). C.A. 28, 1922_9.

120

A CATALYZED REACTION OF HYDROGEN WITH WATER. J. Horiuchi and M. Polányi. Nature 132, 819(1933). C.A. 28, 2254_8.

The exchange of atoms between 1.1N H_2SO_4 solution and heavy H_2 in contact with it was catalyzed by Pt black, so that the deuterium content of the H_2 fell to 0.66% of its original value in 1 hour at room temperature. Without Pt no exchange occurred. The suggested explanation is that the exchange of atoms between H and water is due to the ionization of H corresponding to the electromotive process of the H electrode.

121

CONCENTRATION OF THE HEAVY HYDROGEN ISOTOPE BY ELECTROLYSIS. H. Erlenmeyer and H. Gärtner. Helv. Chim. Acta 17, 30-1(1934). C.A. 28, 2264_5.

Electrolysis of 8 liters of 0.1N H_2SO_4 solutions on Pb electrodes to a final volume of 13 cc. yielded 12 cc. of water weighing 5.6 mg more than the control sample of ordinary water.

122

THE DIFFUSION OF HYDROGEN THROUGH METALS: FRACTIONATING THE HYDROGEN ISOTOPES. C. G. Fink, H. C. Urey, and D. B. Lake. J. Chem. Phys. 2, 105-6(1934). C.A. 28, 2264_7.

In an electrolysis bath with Pd electrode some fractionation of H^2 took place in diffusion through the Pd.

123

MANUFACTURE OF PURE HEAVY HYDROGEN ISOTOPE BY DIFFUSION. G. Hertz. Naturwissenschaften 21, 884-5(1933). C.A. 28, 2264_8.

The process applied to Ne gave Ne^{22} spectroscopically free from Ne^{20} as well as almost pure H^2 from H_2O.

124

ISOTOPIC FRACTIONATION OF HYDROGEN. Hershel Hunt. J. Chem. Phys. 2, 106(1934). C.A. 28, 2264_9.

H_2O, containing 1 part H^2 to 200 parts H^1, was electrolyzed and the H evolved passed over CuO in such a way that half the gas recombined to form H_2O at 200° and the rest reacted at 600°. The H_2O collected at 600° had a greater mass than that collected at 200°.

125

CHEMICAL SEPARATION OF DEUTERIUM FROM HYDROGEN. A. Farkas and L. Farkas. Nature 133, 139(1934). C.A. 28, 2265_1.

Deuterium and H^1 having energies of activation small enough to render them sensitive to the difference in zero-point energies will react at different rates. The rates of production of D and H^1 for Zn, Al, Ca, and Na reacting with water or acid stand in the ratio of 4, 2, 1.5, and 1.2 respectively.

126

THE ISOTOPIC FRACTIONATION OF WATER BY PHYSIOLOGICAL PROCESSES. Edward W. Washburn and Edgar R. Smith. Science 79, 188-9(1934). C.A. 28, 2379_1.

Sap H_2O and water from combined H taken from branches and leaves of a willow tree showed increased D content.

127

THE MANUFACTURE OF DEUTERIUM AND ITS COMPOUNDS. Wells A. Webb. Ind. Eng. Chem. News Ed. 12, 63(1934). C.A. 28, 2608_2.

128

EXCHANGE OF HEAVY HYDROGEN ATOMS BETWEEN WATER AND ORGANIC COMPOUNDS. K. F. Bonhoeffer and R. Klar. Naturwissenschaften 22, 45(1934). C.A. 28, 2609_2.

Between water and dissolved sugar only the OH hydrogen is exchangeable. CH_3 hydrogen is not exchangeable in NaOAc. Keto-enol H is exchangeable against water hydrogen if small amounts of Na are present.

129

EXCHANGE OF HEAVY HYDROGEN ATOMS BETWEEN WATER AND MOLECULAR HYDROGEN. K. F. Bonhoeffer and K. W. Rummel. Naturwissenschaften 22, 45(1934). C.A. 28, 2609_3.

Efforts were made to catalyze the reaction between D_2O and H_2 by Pt sponge. Equilibrium was reached under pressure in a few days.

130

ISOTOPIC FRACTIONATION OF WATER BY DISTILLATION. N. F. Hall and T. O. Jones. J. Am. Chem. Soc. 56, 749-50(1934). C.A. 28, 2989_3.

H_2O containing about 3% D on distillation gave 3 fractions with sp.gr. 1.003365, 1.003444, and 1.003546; at 10 mm. the 1st fifth of the distillate contained 32% less D and the last fifth contained about 25% more.

131

ELECTROLYTIC CONCENTRATION OF THE HEAVY HYDROGEN ISOTOPES. B. Topley and H. Eyring. Nature 133, 292(1934). C.A. 28, 2989_4.

Electrolysis of H_2O with various metals as electrodes gave values for the electrolytic separation factor ranging between 7.9 and 2.8. The metals studied were; smooth Pt, Pb, Fe, Cu, Ag, Ni, W, Pt black, liquid Ga, and Hg.

132

CHEMICAL SEPARATION OF THE ISOTOPES OF HYDROGEN. E. D. Hughes, C. K. Ingold, and C. L. Wilson. Nature 133, 291-2(1934). C.A. 28, 2989_5.

The ratio, α, for the specific rates of discharge of H and D when metals are dissolved in H_2O is not characteristic of the metal but depends in some unknown way on experimental conditions. Various metals were studied as well as compounds forming volatile hydrides with H_2O.

133

PREPARATION OF HEAVY HYDROGEN. P. Harteck. Proc. Phys. Soc. (London) 46, 277-80(1934). C.A. 28, 2989_7.

The preparation of D by electrolysis of an alkaline solution with Ni electrodes is described.

134

NATURAL SEPARATION OF THE ISOTOPES OF HYDROGEN. Malcolm Dole. J. Am. Chem. Soc. 56, 999(1934). C.A. 28, 2989_8.

The combustion of kerosene gave H_2O with a density of 7 ppm greater than ordinary H_2O. Thiophene-free C_6H_6 from the destructive distillation of coal gave a product with density 8 ppm greater and H_2O from honey showed an increase of 4 ppm over ordinary H_2O.

135

THE RELATIVE REACTIVITIES OF THE HYDROGEN ISOTOPES WITH CHLORINE. G. K. Rollefson. J. Chem. Phys. 2, 144-5(1934). C.A. 28, 2989_8.

In the reaction $CO + H_2 + 2Cl_2 \rightarrow COCl_2 + 2HCl$, D reacted more slowly than H.

136

EXCHANGE REACTIONS OF HYDROGEN ATOMS. N. F. Hall, E. Bowden, and T. O. Jones. J. Am. Chem. Soc. 56, 750(1934). C.A. 28, 2989_9.

2% heavy water did not exchange H with KH_2PO_2 or BzONa. $C_2H_4(OH)_2$ exchanged $1/3$ of its H immediately. AcOK and H_2 gas exchanged slowly.

137

DISINTEGRATION OF THE SEPARATED ISOTOPES OF LITHIUM BY PROTONS AND BY HEAVY HYDROGEN. M. L. Oliphant, E. S. Shire, and B. M. Crowther. Nature 133, 377(1934). C.A. 28, 2990_6.

The isotopes of Li were separated by electromagnetic means in the nearly pure state in amounts of 1 γ.

138

ISOTOPES OF HYDROGEN AND THEIR SEPARATION. A REVIEW. S. Veil. Rev. Sci. 72, 174-7(1934). C.A. 28, 3298_9.

A review of their discovery.

139

THEORY OF THE ELECTROLYTIC SEPARATION OF ISOTOPES. R. P. Bell. J. Chem. Phys. 2, 164-6(1934). C.A. 28, 3656_9.

Gurney's treatment of overvoltage is applied to the relative rates of discharge of two isotopes. This method favors separation of the light elements.

140

ENRICHMENT OF THE HEAVY HYDROGEN ISOTOPE. W. Uhlmann. Naturwissenschaften 22, 119-20(1934). C.A. 28, 3657_1.

Water from an old storage battery showed some density increase.

141

AN EXAMINATION OF WATER FROM VARIOUS NATURAL SOURCES FOR VARIATIONS IN ISOTOPIC COMPOSITION. Edward W. Washburn and Edgar R. Smith. Bur. Standards J. Research 12, 305-11(1934). C.A. 28, 3657_2.

The density of water from various sources was measured by a differential pyconometer method for determining differences in density to 1 in 10^6. Purified samples from several sources were found to be denser than normal water by a few ppm.

142

EXPERIMENTS ON HEAVY HYDROGEN. I. A. Farkas and L. Farkas. Proc. Roy. Soc. (London) A144, 467-80(1934). C.A. 28, 3657_3.

The equilibrium $D_2 + H_2 = 2HD$ was studied on a hot Ni wire.

143

ISOTOPE ENRICHMENT IN TECHNICAL OXYGEN FRACTIONS. R. Klar and A. Krauss. Naturwissenschaften 22, 119(1934). C.A. 28, 3657_5.

Linde O_2 evaporated to a small volume and burned with H_2 showed an enrichment in O^{18} content from the normal value 1:600 to 1:510 for $O^{18}O^{16}$. The vapor pressure of $O^{16}O^{18}$ near its boiling point is estimated to be 5% lower than that of $O^{16}O^{16}$. The O_2 remaining in the H_2 (2% O_2, 1% A) during fractionation of air was separated and burned with H_2. This sample was lowered in O^{18} content to 1:635.

144

GENERAL CONSIDERATION ON THE THEORY OF THE SEPARATION OF H^1 AND H^2 BY ELECTROLYSIS OF WATER. R. H. Fowler. Proc. Roy. Soc. (London) A144, 452-66(1934). C.A. 28, 3668_1.

A mathematical treatment is given of the separation of protium from deuterium by electrolysis of H_2O.

145

SEPARATION OF THE HYDROGEN ISOTOPES BY ELECTROLYSIS. I. B. Topley and H. Eyring. J. Chem. Phys. 2, 217-30(1934). C.A. 28, 4306_1.

The equilibrium constants of the reactions $H_2O + 2H^2 = H_2^2O + 2H$ and $H_2O + H_2^2O = 2HH^2O$ are calculated and from these an expression is obtained for the electrolytic separation coefficient. The vapor pressures of liquids containing isotopic molecules are discussed theoretically.

146

THE SEPARATION OF THE ISOTOPES OF HYDROGEN BY THE CHEMICAL DECOMPOSITION OF WATER AND SOME REMARKS ON THE MECHANISMS UNDERLYING THE REDUCTION ACTION OF DISSOLVING METALS. E. D. Hughes, C. K. Ingold, and C. L. Wilson. J. Chem. Soc. 493-8(1934). C.A. 28, 4306_3.

The action of pure elements, impure elements, metallic couples, Na amalgams and CaH_2, CaC_2, and Al_4C_3 on a media containing D_2O and acid or alkali were studied by burning

the H_2 evolved and determining, by density measurements, the percentage of H^2 atoms in the water formed.

147

THE MUTUAL EXCHANGE OF THE HYDROGEN ATOMS BETWEEN WATER AND ACETONE. Karl Schwartz and Herbert Steiner. Z. physik. Chem. B25, 153-6(1934). Translated by Margaret Van Ness. (AEC-tr-1701). C.A. 28, 4306_6.

The H atoms in Me_2CO do not exchange with H^2 atoms in heavy water after standing for 48 hours or boiling for 12 hours. When mixed with 0.6M NaOH prepared from heavy water complete exchange of all 6 H atoms takes place in 18 hours.

148

A SLIGHT DIFFERENCE IN THE ISOTOPIC COMPOSITION OF OXYGEN MADE BY THE FRACTIONATION OF LIQUID AIR AND OXYGEN OF ORDINARY AIR. Edgar R. Smith. J. Chem. Phys. 2, 298(1934). C.A. 28, 4306_9.

O_2 prepared from liquid air contains approximately 2 parts in 10^5 more atoms of O^{18} than ordinary O_2.

149

ISOTOPIC EXCHANGE BETWEEN D_2O AND C_2H_2. L. H. Reyerson and Samuel Yuster. J. Am. Chem. Soc. 56, 1426-7(1934). C.A. 28, 4373_2.

Isotopic exchange occurs between C_2H_2 and solutions of D_2O containing an alkali. If the exchange occurs in neutral and acid solutions the rate must be extremely slow.

150

THE ISOTOPIC FRACTIONATION OF WATER BY PHYSIOLOGICAL PROCESSES-AN ADDITION. Edgar R. Smith. Science 79, 454-5(1934). C.A. 28, 4442_1.

Results of a previous paper (C.A. 28, 2379_1) are somewhat charged by the discovery that commercial O_2 is slightly enriched over atmospheric O_2 in O^{18}.

151

ATTEMPTS TO INCREASE THE HEAVY HYDROGEN ISOTOPE IN WATER. A. Güntherschulze and F. Keller. Z. Elektrochem. 40, 182-3(1934). C.A. 28, 4660_4.

No effects were found in electrolytic baths, storage battery or on electrolysis of water.

152

METHOD FOR OBTAINING DEUTERIUM OXIDE FROM WATER BY ELECTROLYSIS. K. Schwartz, L. Küchler, and H. Steiner. Z. Elektrochem. 40, 298-9(1934). C.A. 28, 4977_7.

A simple and cheap apparatus is described with three cuts.

153

ENZYME CATALYSIS OF THE IONIZATION OF HYDROGEN. B. Cavanagh, J. Horiuchi, and M. Polányi. Nature 133, 797(1934). C.A. 28, 5085_6.

Several strains of E. coli and Aerobacter aerogenes have brought about the exchange of H^2 for H in H_2O. With the latter organisms at 37°K, the first-order velocity constant = 0.0065 for 5 × 10 in. total organisms including 2.5 × 10 in. living organisms.

154

BINDING AND INTERCHANGE OF WATER MOLECULES IN A SALT HYDRATE. A. W. C. Menzies and F. T. Miles. J. Am. Chem. Soc. 56, 1647-8(1934). C.A. 28, 5328_2.

$CuSO_4 . H_2O + D_2O$ vapor took up over 4 moles of D_2O. Upon dehydration at 75° complete exchange was found.

155

CONTINUOUS-FLOW METHODS OF CONCENTRATING DEUTERIUM. L. C. Anderson, J. O. Halford, and J. R. Bates. J. Chem. Phys. 2, 342-4(1934). C.A. 28, 5328_3.

Two types of electrolytic cell for concentrating heavy water are described.

156

PRODUCTION OF LARGE QUANTITIES OF HEAVY WATER. Leif Tronstad. Nature 133, 872(1934). C.A. 28, 5328_3.

Production of large quantities of D_2O in Norway is discussed.

157

INTERRELATIONS OF HYDROGEN AND DEUTERIUM MOLECULES. A. J. Gould, W. Bleakney, and H. S. Taylor. J. Chem. Phys. 2, 362-73(1934). C.A. 28, 5328_4.

Diffusion of H_2 through Pd and desorption from charcoal at liquid air temperatures give approximately the theoretical separation of H and D. The reaction $H_2 + D_2 = 2$ HD was studied from −190 to 270° with various solid catalysts.

158

EXCHANGE REACTION OF HYDROGEN AND DEUTERIUM OXIDE. R. H. Crist and G. A. Dalin. J. Chem. Phys. 2, 442-3(1934). C.A. 28, 5328_8.

The rate of exchange between H_2 and D_2O was studied at 500, 526 and 530° and the equilibrium constants calculated and compared with theory.

159

MERCURY-PHOTOSENSITIZED DECOMPOSITION OF THE DEUTEROAMMONIAS. J. C. Jungers and H. S. Taylor. J. Chem. Phys. 2, 373-80(1934). C.A. 28, 5337_4.

Vapor pressure data for ND_3 more than 99% pure are given for 202.3−238.6°K.

160

EXCHANGE REACTION BETWEEN DEUTERIUM AND WATER VAPOR ON SURFACES. H. S. Taylor and H. Diamond. J. Am. Chem. Soc. 56, 1821-2(1934). C.A. 28, 5745_2.

D_2 exchanged with H_2O on oxide catalysts at elevated temperatures.

161

INCREASE OF THE PERCENTAGE OF DEUTERIUM IN WATER DURING VERY SLOW EVAPORATION. T. Tucholski. Nature 134, 29(1934). C.A. 28, 5754_4.

Twenty-five liters of distilled H_2O evaporated during a three year period to 600cc showed 1.65% D_2O content. It was concluded that D_2O would be found in mountain caves rather than in the surfaces of seas.

162

HIGH INTENSITY MASS SPECTROMETER. W. R. Smythe, L. H. Rumbaugh, and S. S. West. Phys. Rev. 45, 724-7(1934). C.A. 28, 6057_7.

A mass spectrometer with a new type magnetic lens permits collection of K^{39} at the rate of 1 mg in 7 hrs. Several 10^{-6} g. samples of Li^6 and Li^7 have also been collected.

163

THE NATURAL SEPARATION OF THE ISOTOPES OF HYDROGEN. I. THE CONCENTRATION OF DEUTERIUM IN BENZENE, KEROSENE, AND HONEY. Malcolm Dole. J. Chem. Phys. 2, 337-41(1934). C.A. 28, 6061_4.

Water obtained in the combustion of C_6H_6, kerosene, and honey was slightly greater in density than ordinary water.

164

CONCENTRATION OF HEAVY WATER BY SPONTANEOUS EVAPORATION. E. D. Hughes, C. K. Ingold, and C. L. Wilson. Nature 134, 142(1934). C.A. 28, 6367_6.

The experiment reported by Tucholski (C.A. 28, 5754_4) is criticized.

165

THE VAPOR PRESSURES AND DERIVED THERMAL PROPERTIES OF HYDROGEN AND DEUTERIUM. R. B. Scott, F. G. Brickwedde, H. C. Urey, and M. H. Wahl. J. Chem. Phys. 2, 454-64(1934). C.A. 28, 6605_7.

The vapor-pressure equations of liquid and solid, normal H_2^2 were determined from 13.9 to 20.4°K. The triple and boiling points of H_2^2 are 18.58° and 23.5°K respectively. The zero-point energies and vibrational energy changes are calculated.

166

THE EQUILIBRIUM $H_2O + HD = HOD + H_2$ AND ITS ROLE IN THE SEPARATION OF THE HYDROGEN ISOTOPES. A. Farkas and L. Farkas. J. Chem. Phys. 2, 468-9(1934). C.A. 28, 6626_7.

The separation of H_2 and D_2 is reviewed and discussed.

167

NEW METHODS FOR SEPARATING HEAVY WATER FROM ORDINARY WATER. G. Bruni and M. Strada. Atti accad. Lincei, 19, 453-8(1934). C.A. 28, 6627_1.

After 9 steps of fractional crystallization (1/5 to 1/4 of the liquid being frozen and melted for the next step) starting with 4000 liters of water, a product was obtained containing 0.414% D_2O.

168

EXCHANGE REACTION OF HYDROGEN AND DEUTERIUM OXIDE. R. H. Crist and G. A. Dalin. J. Chem. Phys. 2, 548(1934). C.A. 28, 6627_3.

Corrections on a previous article (C.A. 28, 5328_5).

169

ELECTROLYTIC ENRICHMENT OF THE HEAVY HYDROGEN ISOTOPE IN WATER. L. Tronstad and J. Brun. Z. Elektrochem. 40, 556-8(1934). C.A. 28, 6626_9.

The inefficiency of Pb electrodes and acid solution in the concentration of D_2 by electrolysis was found to be partially due to the formation of slime on the surface of the electrodes.

170

CATALYTIC REPLACEMENT OF PROTIUM BY DEUTERIUM IN BENZENE. J. Horiuchi, G. Ogden, and M. Polányi. Trans. Faraday Soc. 30, 663-5(1934). C.A. 28, 6627_4.

D replaces H in the benzene nucleus in the presence of Pt or Ni catalyst at ordinary temperatures.

171

CONCENTRATION OF DEUTERIUM BY ELECTROLYSIS OF SULFURIC ACID SOLUTION. T. Titani, K. Kurano, and M. Harada. Bull. Chem. Soc. Japan 9, 269-71(1934). C.A. 28, 6639_9.

Electrolysis of 10% H_2SO_4 with Pb electrodes in 3 runs with ratios of initial to final volume of 64 – 50,000 gives the separation coefficient $\alpha = 2.2$ to 2.7 after allowance for spray and evaporation losses.

172

CONCENTRATION OF DEUTERIUM BY ELECTROLYSIS OF NEUTRAL SALT SOLUTIONS. I. T. Titani, K. Okabe, and M. Harada. Bull. Chem. Soc. Japan 9, 272-3(1934). C.A. 28, 6640.

Electrolysis of 0.25M Na_2SO_4 with a Ni cathode and Pb anode gives $\alpha = 2.3$. The use of neutral salts appears advantageous.

173

DECOMPOSITION OF SODIUM FORMATE BY E. COLI IN THE PRESENCE OF HEAVY WATER. A. Farkas, L. Farkas, and J. Yudkin. Proc. Roy. Soc. (London) B115, 373-9(1934). C.A. 28, 6737_1.

E. coli catalyzes the exchange equilibrium between H_2 and H_2O.

174

EFFECT OF FRACTIONAL CRYSTALLIZATION ON THE ISOTOPIC COMPOSITION OF WATER. E. S. Gilfillan. J. Am. Chem. Soc. 56, 2201(1934). C.A. 28, 7087_3.

In the crystallization of distilled H_2O by freezing half the amount taken, the average effect on the density per crystallization is 0.10 ppm. The effect was also determined for 6% NaCl solutions and found to be 0.5 ± 0.3 ppm.

175

EXCHANGE OF HYDROGEN ATOMS IN ORGANIC COMPOUNDS WITH THE HYDROGEN ATOMS OF WATER. R. Klar. Z. physik. Chem. B26, 335-42(1934). C.A. 28, 7123_8.

Organic compounds and water containing D_2O were mixed. No exchange was found with NaOAc or C_6H_6. AcH exchanges slowly. HCHO, Me_2CO and acetylacetone exchanged completely. D concentrates in the water.

176

CATALYTIC INTERCHANGE OF HYDROGEN BETWEEN WATER AND ETHYLENE AND BETWEEN WATER AND BENZENE. J. Horiuchi and M Polányi. Nature 134, 377-8(1934). C.A. 28, 7132_5.

In the presence of Ni catalyst, H is rapidly exchanged between H_2O and C_2H_4, and H_2O and C_6H_6. The distribution coefficient of H^2 between H_2O and C_2H_4 is 1.7 at 80°; between H_2O and C_6H_6 it is 1.05 at 200°.

177

THE SEPARATION OF ISOTOPES. PREPARATION OF PURE HEAVY HYDROGEN BY DIFFUSION. H. Harmsen, G. Hertz, and W. Schütze. Z. Physik 90, 703-11(1934). C.A. 28, 7151_4.

Deuterium was obtained in a spectroscopically pure condition by the Hertz diffusion method.

178

METHODS OF THE ENRICHMENT OF HYDROGEN BY THE HEAVY ISOTOPE. S. E. Frish and V. I. Chernyaev. Compt. rend. acad. sci. U.R.S.S. 3, 247-8(1934). C.A. 28, 7151_5.

A description is given of an electrolytic cell for the isotopic fractionation of H with a cooling arrangement and an arrangement to condense the water vapor in the evolved gas. When 10cc residue from 2-1 sample was condensed to 0.5cc, sample gave a 3% D_2 content.

179

HEAVY HYDROGEN, OR DEUTERIUM, AND HEAVY WATER. A. Boutaric. Génie civil. 104, 444-6(1934). C.A. 28, 7151_8.

A review.

180

EXPERIMENTS ON HEAVY WATER. H. Erlenmeyer and H. Gartner. Nature 134, 327(1934). C.A. 28, 7151_9.

By crystallizing Na_2SO_4 in H_2O containing 4 to 5% D_2O, about equal quantities of H_2O and D_2O compose the H_2O of crystallization. Ether dissolves in the two waters in about equal quantities. KH_2PO_2 does not exchange its normal H atoms for D atoms in the solution of 4 to 5% D_2O. $Co(NH_3)_6(NO_3)_3$ exchanges all 18 H atoms for D in this solution.

181

HEAVY WATER AND WATER OF CRYSTALLIZATION. J. N. Friend. Nature 134, 463(1934). C.A. 28, 7151_9.

D_2O cannot be concentrated by fractional crystallization with Na_2SO_4.

182

AN ATTEMPT TO FRACTIONATE THE VARIETIES OF HYDROGEN BY DIFFUSION THROUGH PALLADIUM. V. Lombard and C. Eichner. J. chim. phys. 31, 396-406(1934). C.A. 28, 7152_2.

To obtain comparable values for diffusion it is necessary to use a rapid stream of H against the Pd foil.

183

POSSIBILITY OF SEPARATING HEAVY WATER BY FRACTIONAL FREEZING. G. Bruni. J. Am. Chem. Soc. 56, 2013-14(1934). C.A. 28, 7152_4.

The previously reported separation of D_2O from H_2O by fractional crystallization (C.A. 28, 6627_1) has been shown to be incorrect.

184

SEPARATION OF THE ISOTOPES OF LITHIUM AND SOME NUCLEAR TRANSFORMATIONS OBSERVED WITH THEM. M. L. Oliphant, E. S. Shire, and B. M. Crowther. Proc.

Roy. Soc. (London) A146, 922-9(1934). C.A. 29, 40_9.

The isotopes of Li were separated electromagnetically in the nearly pure states in amounts of 1 γ.

185

ISOTOPIC EQUILIBRIUM IN THE HYDROGEN-HYDROGEN OXIDE SYSTEM. R. H. Crist and G. A. Dalin. J. Chem. Phys. 2, 735-8(1934). C.A. 29, 41_3.

The distribution of D_2 between H and water vapor was determined at 800°K; the experimental and calculated results agreed.

186

EXPERIMENTS ON HEAVY HYDROGEN III. ELECTROLYTIC SEPARATION OF THE HYDROGEN ISOTOPES. A. Farkas and L. Farkas. Proc. Roy. Soc. (London) A146, 623-9(1934). C.A. 29, 41_4.

The electrolytic separation of D seems to be due to attainment of the equilibrium $H_2O + HD \rightleftharpoons HOD + H_2$, the equilibrium constant was found to be about 3.8 at room temperature.

187

EXPERIMENTS ON HEAVY HYDROGEN. IV. HYDROGENATION AND EXCHANGE REACTION OF ETHYLENE WITH HEAVY HYDROGEN. A. Farkas, L. Farkas, and E. K. Rideal. Proc. Roy. Soc. (London) A146, 630-9(1934). C.A. 29, 41_5.

The reaction $C_2H_4 + HD \rightleftharpoons C_2H_3D + H_2$ has been studied on active Ni catalysts at various temperatures.

188

THE POSSIBILITY OF SEPARATING D_2O FROM WATER BY FRACTIONAL CRYSTALLIZATION. G. Bruni. Atti. accad. Lincei, 20, 73-5(1934). C.A. 29, 404_4.

It was found that there was no appreciable concentration of D_2O in H_2O after 9 fractional recrystallizations. Conclusions were that the lattice are determined mainly by the size of the O atom. The curves for the liquid and solid almost coincide, making fractional separation impracticable.

189

THE EQUILIBRIUM CONSTANT OF THE REACTION $HDO + H_2 \rightleftharpoons H_2O + HD$. T. Förster. Z. physik. Chem. B27, 1-5(1934). C.A. 29, 666_6.

The constant is calculated from spectroscopic data and compared with experimental values.

190

THE HEAVY HYDROGEN ISOTOPE. L. Farkas. Naturwissenschaften 22, 614-23; 640-6; 658-62(1934). C.A. 29, 677_2.

An exhaustive review of the properties and uses of heavy hydrogen with 173 references is presented.

191

A METHOD OF SEPARATING ISOTOPE MIXTURES BY DIFFUSION THROUGH STREAMING MERCURY VAPOR. G. Hertz. Z. Physik 91, 810-15(1934). C.A. 29, 677_4.

A diffusion pump is described which preferentially pumps faster-diffusing components of a gas mixture. Twelve such pumps in series alter the isotope abundance ratio in Ne by a factor of 10 in 45 min. The working pressure is 1-2 mm. of Hg.

192

DISTRIBUTION OF H_2O AND D_2O IN DIFFERENT SYSTEMS. H. B. Erlenmeyer and H. Gärtner. Helv. Chim. Acta 17, 970-3(1934). C.A. 29, 976_6.

No exchange was found between KH_2PO_4 and D_2O. A concentration of D_2O was obtained by partial extraction of water with ether. This was explained as a non-equilibrium process.

193

THE EQUILIBRIUM $H_2O + HD \rightleftharpoons HDO + H_2$. L. Farkas and A. Farkas. Trans. Faraday Soc. 30, 1071-9(1934). C.A. 29, 985_2.

The constant was determined over the temperature range 3 to 450°. The constant in the gaseous state is 2.67 at 20° and varies with temperature according to the formula $K = (750/2.3RT) - 0.1335$.

194

THE FREEZING POINT OF MIXTURES OF H_2O AND D_2O. THE LATENT HEAT OF FUSION OF D_2O. V. K. La Mer and W. N. Baker. J. Am. Chem. Soc, 56, 2641-3(1934). C.A. 29, 990_4.

Freezing points were determined from 1.29 – 99.38% D_2O. The composition of the liquid and solid phases was determined and agreed closely with the calculations of Seltz (C.A. 28, 1593_1). Separation of D_2O by fractional crystallization does not seem practical.

195

APPLICATION OF WAVE MECHANICS TO REACTIONS INVOLVING HYDROGEN AND DIPLOGEN (DEUTERIUM). R. A. Smith. Proc. Cambridge Phil. Soc. 30, 508-13(1934). C.A. 29, 993_6.

The activation energy for the reaction between D_2 and H_2O in the gas phase is calculated as 50 kcal. It is concluded that OH^- and OH_3^+ are not important in affecting the rate of exchange on collision in the liquid phase at ordinary temperatures.

196

A LABORATORY SET-UP FOR THE ELECTROLYTIC FRACTIONATION OF HYDROGEN ISOTOPES. II. H. Erlenmeyer and H. Gärtner. Helv. Chim. Acta 17, 1226-31(1934). C.A. 29, 999_4.

The construction and operation of a battery of cells with Pb electrodes is described for concentration to about 3% D_2O from 8.1 l. of commercial electrolyte.

197

DIRECT INTRODUCTION OF DEUTERIUM INTO BENZENE WITHOUT HETEROGENEOUS CATALYSIS. C. K. Ingold, C. G. Raisin, and C. L. Wilson. Nature 134, 734(1934). C.A. 29, 1072_9.

C_6H_6 shaken with 90% sulfuric acid containing D, exchanged H for the D in the acid at room temperature.

198

SEPARATION OF NEON INTO ITS ISOTOPIC COMPONENTS BY MEANS OF RECTIFICATION. W. H. Keesom, H. van Dijk, and J. Haantjes. Proc. Acad. Sci. Amsterdam 37, 615(1934); Physica 1, 1109-14(1934). C.A. 29, 1321_5.

Neon was separated in rectification columns. An efficiency of 50% was obtained.

199

FRACTIONATION OF THE ISOTOPES OF HYDROGEN AND OF OXYGEN IN A COMMERCIAL ELECTROLYZER. E. W. Washburn, Edgar R. Smith, and F. A. Smith. J. Research Natl. Bur. Standards 13, 599-608(1934). C.A. 29, 1708_9.

Upon electrolysis of ordinary water, the change in density at the start is caused as much by the fractionation of O as of H. A steady state is reached indicating an electrolytic fractionation factor for deuterium of 2.4.

200

EXCHANGE REACTIONS OF DEUTERIUM AND METHANE UNDER THE INFLUENCE OF EXCITED MERCURY. H. S. Taylor, K. Morikawa, and W. S. Benedict. J. Am. Chem. Soc. 57, 383(1935). C.A. 29, 1712_9.

CH_4-D_2 mixtures in the presence of Hg vapor and illuminated by resonance radiation show considerable interaction at all temperatures from 40 to 300°.

201

THE ELECTROLYTIC PRODUCTION OF HEAVY WATER. Y. Hori. J. Electrochem. Assoc. Japan 2, 290-7(1934). C.A. 29, 1720_9.

Various processes for the electrolytic production of D_2O are discussed.

202

CONCENTRATING HEAVY WATER. A. I. Brodskiĭ, V. A. Aleksandrovich, M. M. Slutskaya, and M. K. Shelud'ko. Compt. rend. acad. sci. U.R.S.S. 3, 615-17(1934). C.A. 29, 2077_5.

Six electrolyses starting with 33 liters of water yielded 0.2 cc of 95% heavy water.

203

SEPARATION OF NONRADIOACTIVE ISOTOPES. V. I. Chernyaev. Uspekhi Fiz. Nauk. 14, 685-720(1934). C.A. 29, 2077_9.

A review of various methods used on several isotopes.

204

EXCHANGE REACTIONS OF HYDROGEN ON METALLIC CATALYSTS. J. Horiuchi and M. Polányi. Trans. Faraday Soc. 30, 1164-72(1934). C.A. 29, 2431_8.

The exchange of hydrogen as measured by the distribution of deuterium between H_2O and C_2H_4, and H_2O and C_6H_6 on Pt black and Ni catalysts does not occur appreciably at room temperature, but proceeds slowly at 80° and more rapidly at 200°.

205

THE HYDROGEN ISOTOPE OF ATOMIC WEIGHT TWO. Harold C. Urey and G. K. Teal. Rev. Mod. Phys. 7, 34-94(1935). C.A. 29, 2442_6.

A comprehensive review of research on deuterium containing 287 references on subjects including, methods of separation, analysis, physical properties of deuterium and its compounds, chemical kinetics, nuclear spins and moments, ortho-para conversion and the spectra of deuterium and its compounds.

206

THEORETICAL AND EXPERIMENTAL STUDIES ON THE METHOD OF OBTAINING HEAVY WATER. B. Kamienski. Roczniki Chem. 14, 401-5(1934). C.A. 29, 2442_7.

Experimental work on electrolysis to produce heavy water is presented along with discussion.

207

CONCENTRATION OF DEUTERIUM BY THE ELECTROLYSIS OF WATER. I. Y. Ota. Mem. Faculty Sci. Agr. Taihoku 10, 71-9(1934). C.A. 29, 2442_7.

The efficiency of various methods of concentrating D electrolytically has been investigated.

208

ALUMINUM CHLORIDE AS A CATALYST OF HYDROGEN INTERCHANGE. J. Kenner, M. Polányi, and P. Szego. Nature 135, 267-8(1935). C.A. 29, 2443_1.

If C_6H_6 and HCl containing 13.4% DCl are brought together in contact with $AlCl_3$ at 25° and 50° over 90% of the D passes into the C_6H_6.

209

ORTHOHYDROGEN, PARAHYDROGEN AND HEAVY HYDROGEN. A. Farkas. 229p. The Macmillan Co., New York (1935). C.A. 29, 2454_1.

Book.

210

OVERPOTENTIAL OF THE HYDROGEN ISOTOPES. F. P. Bowden and H. F. Kenyon. Nature 135, 105(1935). C.A. 29, 2457_7.

The effect of overvoltage on the separation of the isotopes is discussed; the efficiency of separation decreases with rising temperature.

211

DIFFUSION OF GASES THROUGH METALS. T. Franzine. Nature 135, 308(1935). C.A. 29, 2802_5.

Experimental evidence shows that Pd adsorbs D from a mixture of H and D.

212

ADSORPTION OF LIGHT AND HEAVY HYDROGEN BY NICKEL. R. Klar. Naturwissenschaften 22, 822(1934). C.A. 29, 2810_7.

Pace and Taylor found equal adsorption of H and D on technical catalyzers between 110 and 184°. Klar found marked difference between 0 and 100°, increasing to about 100° then decreasing until about 200° and then again increases.

213

THE ISOTOPIC FRACTIONATION OF WATER BY DISTILLATION. M. Harada and T. Titani. Bull. Chem. Soc. Japan 10, 39-40(1935). C.A. 29, 2841_6.

The separation of H_2O by distillation in a stream of CO_2 – free air through a Hempal glass column, yields after 3 fractionations and purifications, a distillate of density 2.5 ppm less than normal H_2O.

214

NOTE ON A PAPER BY BELL AND WOLFENDEN ON ELECTROLYTIC SEPARATION OF DIPLOGEN (DEUTERIUM). W. W. Sawyer. Proc. Cambridge Phil. Soc. 31, 116-18(1935). C.A. 29, 2841_8.

The assumption made in the theory of Bell and Wolfenden (C.A. 28, 1922_9) of the concentration of D by electrolysis that γ is independent of the mass of the isotope is confirmed by a more accurate calculation.

215

THE ISOTOPIC FRACTIONATION OF WATER DUE TO EVAPORATION AND DISTILLATION. T. Titani and M. Harada. Bull. Chem. Soc. Japan 10, 41-2(1935). C.A. 29, 2841_6.

Water from evaporated sea water and from the combustion of molasses gave a higher density than ordinary water.

216

THE PREPARATION OF DEUTERIUM-FREE WATER. DEUTERIUM CONTENT OF ORDINARY WATER AND THE ATOMIC WEIGHT OF HYDROGEN. ELECTROLYTIC SEPARATION OF OXYGEN ISOTOPES. Herrick L. Johnston. J. Am. Chem. Soc. 57, 484-6(1935). C.A. 29, 2841_9.

Water with less than 1 D atom in 1,000,000 H atoms was prepared by fractional electrolysis of water. Attempts to prepare O^{17} or O^{18} by electrolysis appear unfeasible.

217

ISOTOPIC EXCHANGE EQUILIBRIA. Harold C. Urey and Lotti J. Greiff. J. Am. Chem. Soc. 57, 321-7(1935). C.A. 29, 2842_2.

By the use of spectroscopic data equilibrium constants are calculated for several exchange reactions involving the isotopes of Cl, S, O, N, C, Br, and Li. A number of reactions are discussed with respect to their probable usefulness in effecting the separation of isotopes.

218

FRACTIONATION OF THE OXYGEN ISOTOPES IN AN EXCHANGE REACTION. L. A. Webster, M. H. Wahl, and Harold C. Urey. J. Chem Phys. 3, 129(1935). C.A. 29, 2842_3.

The reaction $2H_2O^{18} + CO_2^{16} = 2H_2O^{16} + CO_2^{18}$ has at 0° an equilibrium constant of 1.097 and a fractionation factor of 1.047, the O^{18} being concentrated in the CO_2. The fractionation factor was experimentally confirmed by passing CO_2 through D_2O free H_2O, and by comparing densities of the original H_2O and that produced in the reaction $CO_2 + 3H_2 \rightarrow CH_4 + H_2O$.

219

CATALYTIC EXCHANGE OF DEUTERIUM AND METHANE. K. Morikawa, W. S. Benedict, and H. S. Taylor. J. Am. Chem. Soc. 57, 592-3(1935). C.A. 29, 2842_4.

A study has been made of the exchange, at reduced Ni catalyst-surfaces, between D_2 and CH_4. Exchange took place at 184–305°. At the upper temperature equilibrium was reached within 20 hours.

220

QUANTUM MECHANICAL EFFECTS IN REACTIONS INVOLVING HYDROGEN. R. P. Bell. Proc. Roy. Soc. (London) A148, 241-50(1935). C.A. 29, 2842_7.

Expressions are deduced for the permeability of a parabolic potential barrier to a stream of particles with Maxwellian energy distribution, and figures are given illustrating these expressions for barriers of various dimensions.

221

CONCENTRATION OF TRITIUM. P. W. Selwood, H. S. Taylor, W. W. Lozier, and W. Bleakney. J. Am. Chem. Soc. 57, 780(1935). C.A. 29, 3596_1.

T can be produced by further electrolysis of D_2O.

222

ALLEGED ISOTOPIC INTERCHANGE BETWEEN WATER AND ACETYLENE. R. P. Bell. J. Am. Chem. Soc. 57, 778-9(1935). C.A. 29, 3596_2.

Bell could not confirm the results of Reyerson and Yuster (C.A. 28, 4373_2).

223

ISOTOPIC INTERCHANGE BETWEEN ACETYLENE AND HEAVY WATER. L. H. Reyerson. J. Am. Chem. Soc. 57, 789-90(1935). C.A. 29, 3596_2.

Reply to Bell (C.A. 29, 3596_2) and affirmation of previous results (C.A. 28, 4373_2).

224

A LABORATORY SET-UP FOR THE ELECTROLYTIC FRACTIONATION OF HYDROGEN ISOTOPES. III. H. Erlenmeyer and Hans Gärtner. Helv. Chim. Acta. 18, 419-26(1935). C.A. 29, 3596_3.

The apparatus for electrolysis and for regeneration of water from the resulting detonating-gas mixture is described and illustrated.

225

PLANT FOR THE PRODUCTION OF HEAVY WATER. W. G. Brown and A. F. Daggett. J. Chem. Phys. 3, 216-18(1935). C.A. 29, 3608_9.

An electrolytic plant for the production of D_2O is described. The fractionation factor of 8.6 (uncorrected for evaporation) is the highest yet reported.

226

EXCHANGE BETWEEN AMMONIA AND DEUTERIUM ON CATALYTIC IRON SURFACES. H. S. Taylor and J. C. Jungers. J. Am. Chem. Soc. 57, 660-1(1935). C.A. 29, 3893_4.

The exchange reactions of dry D_2 and dry NH_3 in the presence of $Fe\text{-}K_2O\text{-}Al_2O_3$ catalyst at room temperature was studied. In one month all the ammonias were present.

227

ELECTROLYTIC CONCENTRATION OF OXYGEN ISOTOPES. P. W. Selwood, Hugh S. Taylor, J. A. Hipple, Jr., and B. Walker. J. Am. Chem. Soc. 57, 642-4(1935). C.A. 29, 3909_9.

The electrolysis of water yielded only a small increase in O^{18} concentration in the liquid. Ratio of specific rates of discharge of O^{16}/O^{18} is 1.01.

228

HYDROGEN CATALYSIS ON NICKEL. I. COMPARISON OF THE RATE OF CONVERSION OF PARAHYDROGEN WITH THE REACTION RATE $H_2 + D_2 = 2HD$ ON NICKEL SURFACES. Edgar Fajans. Z. physik. Chem. B28, 239-51(1935). C.A. 29, 4251_9.

The para-H conversion and the reaction $H_2 + D_2 = 2HD$ on nickel surfaces were studied and compared. It is concluded that the mechanism is the same for each.

229

THE MUTUAL INTERCHANGEABILITY OF THE HYDROGEN ATOMS OF THE COORDINATION ZONE OF A COMPLEX SALT, AND OF WATER. O. Bankowski. Monatsh. 65, 262-6(1935). C.A. 29, 4282_7.

$[Co(NH_3)_4(H_2O)_2]Cl_3$, $[Co(NH_3)_4(CO_3)]Cl$, and $[Cu(NH_3)_4]SO_4H_2O$ dissolved in D_2O showed rapid H exchange. In a very concentrated solution only the H atoms of a single coordinatively bonded group can interchange.

230

A CASCADE ELECTROLYTIC PROCESS FOR SEPARATING THE HYDROGEN ISOTOPES. Harold C. Urey and M. H. Wahl. Phys. Rev. 43, 566(1933). C.A. 29, 4664_8.

231

DISTILLATION AND RECTIFICATION OF DILUTE SOLUTIONS OF VOLATILE COMPOUNDS. I. THEORETICAL STUDY AND APPLICATION TO THE CASE OF HEAVY WATER. P. Jaulmes. Chimie & industrie 33, 1045-52(1935). C.A. 29, 4975_5.

A mathematical treatment of the subject, showing that it is impossible to effect complete separation of two substances if the apparatus used is too simple or if an insufficient amount of heat is used.

232

EXCHANGE REACTIONS BETWEEN HEAVY HYDROGEN AND HYDROGEN ADSORBED IN SOLIDS. A. Farkas and L. Farkas. Trans. Faraday Soc. 31, 821-4(1935). C.A. 29, 4990_9.

Quartz vessels, Pt wires, etc, even after through outgassing at high temperatures contain H which is shown by exchange with D_2.

233

LABORATORY APPARATUS FOR THE ELECTROLYTIC CONCENTRATION OF THE ISOTOPE 2 OF HYDROGEN. G. Champetier. Bull. soc. chim. France (5) 2, 162-7(1935). C.A. 29, 5025_8.

234

REACTION OF AMINES WITH HEAVY WATER. Paul Goldfinger and Wladimir Lasareff. Compt. rend. 200, 1671-3(1935). C.A. 29, 5069_9.

Mono- and dimethylamine hydrochlorides dissolved in 5% D_2O undergo a rapid exchange of H for D. The former acquires 2D, the latter 1D.

235

INVESTIGATION OF THE CONCENTRATION OF D_2O IN NATURAL ICE. E. Baroni and A. Fink. Monatsh. 65, 386-90(1935). C.A. 29, 5343_7.

Some samples of ice from caverns and glacial ice showed 0.004 to 0.019% D_2O above normal.

236

AN ATTEMPTED CONCENTRATION OF THE HEAVY NITROGEN ISOTOPE. M. H. Wahl, J. F. Huffman, and J. A. Hipple, Jr. J. Chem. Phys. 3, 434-5(1935). C.A. 29, 5708_3.

The ratio of the vapor pressures of $N^{14}H_3$ and $N^{15}H_3$ is greater than 1.0052. The distillation of liquid NH_3 may be a means of obtaining increased concentrations of $N^{15}H_3$.

237

VAPOR PRESSURES OF THE ISOTOPIC FORMS OF WATER. M. H. Wahl and Harold C. Urey. J. Chem. Phys. 3, 411-14(1935). C.A. 29, 5711_9.

238

CATALYTIC EXCHANGE REACTION BETWEEN DEUTERIUM AND WATER. Hugh S. Taylor and H. Diamond. J. Am. Chem. Soc. 57, 1256-9(1935). C.A. 29, 6130_2.

A rapid exchange reaction has been observed at high temperatures between D_2 and H_2O retained by the catalytic materials chromic oxide, zinc oxide, zinc chromite, alumina, and platinized asbestos.

239

ELECTROLYTIC SEPARATION OF THE HYDROGEN ISOTOPES. O. Halpern and Ph. Gross. J. Chem. Phys. 3, 452-6(1935). C.A. 29, 6482_8.

240

QUANTITATIVE ISOTOPIC EXCHANGE REACTIONS IN THE CARBOHYDRATE GROUP. W. H. Hamill and W. Freudenberg. J. Am. Chem. Soc. 57, 1427-30(1935). C.A. 29, 6575_6.

Various carbohydrates were shown to exchange hydroxyls completely with D_2O.

241

ENZYME CATALYSIS OF THE EXCHANGE OF DEUTERIUM WITH WATER. G. H. Bottomley, B. Cavanagh, and M. Polányi. Nature 136, 103-4(1935). C.A. 29, 6611_8.

A suspension of Lactobacillus acidophilus catalyzed the exchange between H_2 and D_2O. The catalytic power of the organisms was not related to their viability.

242

EXCHANGE REACTIONS OF HYDROGEN WITH DEUTERIUM. I. EXCHANGE IN CARBOXYL GROUPS OF SUCCINIC ACID AND IN HYDROXYL GROUPS OF HYDROQUINONE. A. I. Brodskiĭ and C. Scarre. Acta Physicochim. U.R.S.S. 2, 603-10(1935). C.A. 29, 6821_3.

Exchange takes place at 70° in 2-4 hours between D_2O and the carboxyl group of succinic acid or the hydroxyl group of hydroquinone.

243

EXCHANGE REACTIONS OF HYDROGEN WITH DEUTERIUM. II. EXCHANGE IN SULFURIC ACID AND SODIUM HYDROXIDE. Zh. M. Shershever, A. I. Brodskiĭ, and M. M. Slutskaya. Acta Physicochim. U.R.S.S. 2, 611-14(1935). C.A. 29, 6821_5.

NaOH and H_2SO_4 exchange H atoms with D_2O.

244

PRODUCTION OF LIGHT WATER, AND THE DETERMINATION OF THE DEUTERIUM CONCENTRATION IN NORMAL WATER. N. Morita and T. Titani. Bull. Chem. Soc. Japan 10, 257-8(1935). C.A. 29, 6835_4.

245

EXCHANGE REACTIONS WITH DEUTERIUM ATOMS. K. H. Geib and E. W. R. Steacie. Z. physik Chem. B29, 215-24(1935). Trans. Roy. Soc. Can. (3) 29, III, 91-103 (1935). C.A. 29, 7141_7.

Exchange reactions were studied in a wood discharge tube between D atoms and H_2O, NH_3, C_2H_2, and CH_4.

246

THE DIFFUSION OF HYDROGEN AND DEUTERIUM IN PALLADIUM. I. W. Jost and A. Widmann. Z. physik. Chem. B29, 247-55(1935). C.A. 29, 7163_9.

The rate of absorption of H and D in a Pd sphere was measured between 192° and 302.5°; at 302.5° the rate for D is $^1/_{1.35}$ slower than for H.

247

NEW METHOD OF SEPARATION OF HEAVY WATER. G. Bruni. IX Congr. intern. quim. pura aplicada 2, 526-28(1934). C.A. 29, 7180_2.

Fractional crystallization of H_2O is suggested.

248

FRACTIONATION OF THE ISOTOPES OF OXYGEN IN A COMMERCIAL ELECTROLYZER (A CORRECTION). Edgar R. Smith and M. Wojciechowski. J. Research Natl. Bur. Standards 15, 187-8(1935). C.A. 29, 7180_4.

249

EXCHANGE REACTION BETWEEN ACETONE AND WATER-d. KINETICS AND EQUILIBRIUM. J. O. Halford, L. C. Anderson, J. R. Bates, and R. D. Swisher. J. Am. Chem. Soc. 57, 1663-5(1935). C.A. 29, 7768_5.

250

CONCENTRATION OF THE HEAVIER ISOTOPES OF OXYGEN IN COMMERCIAL ELECTROLYTIC CELLS. W. H. Hall and Herrick L. Johnston. J. Am. Chem. Soc. 57, 1515-17(1935). C.A. 29, 7827_6.

251

THE BEHAVIOR OF METAL-AMMONIA COMPOUNDS IN WATER CONTAINING D_2O. H. Erlenmeyer and H. Lobeck. Helv. Chim. Acta. 18, 1213-15(1935). C.A. 29, 7850_9.

$Cu(NH_3)_4SO_4.H_2O$ was dissolved in water containing D_2O and the solution distilled at 20° in vacuo. Apparently all the H's exchanged and additional fractionation resulted from the distillation.

252

PRELIMINARY STUDY OF THE FRACTIONATION OF ISOTOPIC ISOMERS BY DISTILLATION. D. F. Stedman. Can. J. Research 13B, 114-21(1935). C.A. 30, 337_7.

Slight separations of some isotopic isomers were achieved by equilibrium rectification. With Cl the total separation amounted to 0.048 at. wt. units; 28.6% of the O^{18} was also removed from the natural O by fractionation of water, and in a short run with liquid O the normal concentration was raised from 0.2 to 0.25%. The boiling point of CH_3D appears to be 0.5° lower than that of CH_4.

253

RATES OF REACTION OF SODIUM ATOMS WITH HYDROGEN AND DEUTERIUM CHLORIDES. C. E. H. Bawn and A. G. Evans. Trans. Faraday Soc. 31, 1392-1400(1935). C.A. 30, 363_9.

The rates of these reactions were studied by the diffusion flame method. The reactions $Na + DCl \rightarrow NaCl + D$ is the slower. The activation energies differ by 300 calories.

254

ELECTROLYTIC PREPARATION OF HEAVY WATER. THE RELATION BETWEEN ELECTRIC CURRENT DENSITY AND THE ISOTOPIC SEPARATION COEFFICIENT. J. Electrochem. Soc. Japan 3, 127(1935). C.A. 30, 388_1.

It was concluded that if certain conditions were maintained the separation coefficient could be kept constant.

255

THE ELECTROLYTIC SEPARATION FACTOR OF THE HYDROGEN ISOTOPES UNDER VARIOUS EXPERIMENTAL CONDITIONS. A. Eucken, and K. Bratzler. Z. physik. Chem. A174, 273-90(1935). C.A. 30, 916_6.

In order conveniently to make a large number of determinations of the conditions affecting the electrolytic separation factor of H isotopes, the D content of the evolved H was determined by measuring the thermal conductivity.

256

EXPERIMENTS ON ELECTRICAL SEPARATION OF THE ISOTOPES OF LITHIUM. A. Eucken and K. Bratzler. Z. physik. Chem. A174, 269-72(1935). C.A. 30, 916_9.

Li was deposited on Hg from Li_2SO_4 solution. After repeated electrolysis the atomic weight changed only within the experimental error so that only an extremely small change in the isotopic component can be present, the upper limit being 1.07%.

257

THE MELTING CURVE OF MIXTURES OF HEAVY AND ORDINARY WATER: THE SOLUBILITY EQUILIBRIUM IN

THE SYSTEM. M. Deželic. Z. anorg. allgem Chem. 225, 173-4(1935). C.A. 30, 941_9.

Thermal analysis of the system D_2O-H_2O indicates a continuous series of solid solutions. The graph is a straight line, indicating the impossibility of separating heavy water from ordinary water by fractional freezing.

258

EXCHANGE OF HEAVY HYDROGEN ATOMS BETWEEN HYDROGEN AND AMMONIA. K. Wirtz. Naturwissenschaften 23, 721-2(1935). C.A. 30, 945_5.

The constant $K = [NH_2D][H_2]/[NH_3][HD] = 1.9$ at 300°. The exchange was catalyzed by a Pt wire at 300°.

259

ISOTOPIC SHIFT OF WATER BY DISTILLATION. J. Horiuchi and G. Okamoto. Bull. Chem. Soc. Japan 10, 503-5(1935). C.A. 30, 1277_8.

Samples of D_2O were distilled at constant low temperatures. The D_2 content of this first distillate was detected by a micropycnometer. The results are discussed thermodynamically and a few calculations are made.

260

EQUILIBRIUM STUDIES ON THE EXCHANGE REACTION BETWEEN ACETYLENE AND HEAVY WATER. L. H. Reyerson and Bruce Gillespie. J. Am. Chem. Soc. 57, 2250-1(1935). C.A. 30, 1288_5.

The equilibrium between C_2H_2 and aqueous solutions containing 9.77 and 18.97% D_2O was studied at 0°, 25°, and 100°. Average values of K_x for the reaction $C_2H_2 + D_2O = C_2D_2 + H_2O$ were found to be 0.365, 0.45 and 0.51 at 0°, 25° and 100°, respectively.

261

THE ELECTROLYTIC PREPARATION OF DEUTERIUM FROM HEAVY WATER. F. Norling. Physik. Z. 36, 711-13(1935). C.A. 30, 1309_8.

A v-shaped electrolytic cell is used with 3 electrodes.

262

EFFICIENCY OF SEPARATION OF HYDROGEN AND DEUTERIUM BY ELECTROLYSIS. T. H. Oddie. Proc. Phys. Soc. (London) 47, 1060-7(1935). C.A. 30, 1309_9.

After correcting for losses due to evaporation and spraying, the efficiency (α) is shown to increase with increasing current density. α is independent of pH and of the nature of the electrodes.

263

EXCHANGE EQUILIBRIA BETWEEN DEUTERIUM AND AMMONIA. K. Wirtz. Z. physik. Chem. B30, 289-97(1935). C.A. 30, 1639_2.

Equilibrium between NH_3 and D_2 was studied in vessels containing a Pt filament kept at 300°. The gas pressure was 40-50 mm and equilibrium was reached in 1-1.5 hours. The distribution coefficient (D/H in exchange partners)/(D/H in hydrogen) is about 1.5. Three of the equilibrium constants were calculated from spectroscopic data and used to evaluate the fourth.

264

EXCHANGE REACTIONS WITH DEUTERIUM. I. DEUTERIUM AND HYDROGEN CHLORIDE. P. C. Cross and P. A. Leighton. J. Chem. Phys. 4, 28-30(1936). C.A. 30, 1639_5.

The results on the equilibria $H_2 + 2DCl = D_2 + 2HCl$ and $H_2 + DCl = HD + HCl$ agree with theoretical values.

265

ELECTROLYTIC SEPARATION OF THE OXYGEN ISOTOPES. G. Ogden. Nature 136, 912(1935). C.A. 30, 1653_8.

The electrolytic separation coefficient for the isotopes of O is found theoretically to lie between 0.86 and 1, depending on the width and height of the energy barrier, if account is taken of the possibility of "tunneling" of the barrier of the $O^{16}H$ or $O^{18}H$ complex. This separation coefficient apparently depends upon the nature of the electrode and of the electrolyte.

266

HEAVY WATER AND HYDROGEN. A. E. Knowles. British Patent 435, 450, Sept. 23, 1935. C.A. 30, 1671_2.

In the electrolysis of water for the concentration of D_2O, the water vapor carried off by the gases is condensed before washing of the gases and is used as feed to an electrolytic cell in the next stage of concentration. The washed hydrogen is brought into intimate contact with the feed water in a coke tower. The hydrogen from the later stages of concentration is liquefied and the "heavy" and "light" gases are separated by fractional distillation.

267

ISOTOPIC EXCHANGE REACTIONS OF ORGANIC COMPOUNDS. I. THE INTERMOLECULAR NATURE OF THREE-CARBON TAUTOMERISM. D. J. G. Ives and H. N. Rydon. J. Chem. Soc. 1735-42(1935). C.A. 30, 1739_2.

One H atom of propene apparently undergoes exchange with D_2O in NaOH solution.

268

SEPARATION BY RECTIFICATION OF NEON INTO ITS ISOTOPIC COMPONENTS. W. H. Keesom and J. Haantjes. Proc. Acad. Sci. Amsterdam 38, 809; Physica 2, 981-5 (1935). C.A. 30, 2058_6.

An apparatus containing 85 pans each carrying about 1 cc of liquid with a pressure at the top of the column close to the tripple point was used. In 14 rectifications taking 4 days each, 7 fractions of various densities were collected.

269

ISOTOPIC EXCHANGE BETWEEN WATER AND SEVERAL ORGANIC COMPOUNDS. M. Harada and T. Titani. Bull. Chem. Soc. Japan 10, 554-7(1935). C.A. 30, 2082_7.

The equilibrium constant K of the reaction $RH_n + HDO = RH_{n-1}D + H_2O$ and the distribution coefficient k of the D atom were determined after shaking the substance with 1-2% heavy water. No exchange was found with $CHCl_3$, Et_2O and BzH. Values of K, and k are given for $PhNH_2$, PhOH, Pyrrole, BzOH, and $PhCH_2OH$.

270

HEAVY WATER AND DEUTERIUM. Georg Pfleiderer. German Patent 623,336, Dec. 18, 1935. C.A. 30, 2119_4.

In concentrating D_2O or D by electrolyzing water containing an added electrolyte until its volume is 0.01% or less than its original volume, the concentration of the added electrolyte is kept substantially constant by removing a part thereof by electrolysis. Specific processes in which KOH is the added electrolyte are described in detail.

271

THE ABUNDANCE RATIO OF THE ISOTOPES OF POTASSIUM IN MINERAL AND PLANT SOURCES. A. Keith Brewer. J. Am. Chem. Soc. 58, 365-70 (1936). C.A. 30, 2435_3.

Ashes from plants give variations in the K^{39}/K^{41} ratio as great as 15%.

272

SELECTIVE ADSORPTION OF HEAVY WATER. A. King, F. W. James, C. G. Lawson, and H. V. A. Briscoe. J. Chem. Soc. 1545-9(1935). C.A. 30, 2451_6.

Heavy water is selectively adsorbed when passed as steam over charcoal or silica gel at 100°.

273

EQUILIBRIA OF THE REACTIONS BETWEEN ACETYLENE AND HEAVY WATER AT 25°. L. H. Reyerson and Bruce

Gillespie. J. Am. Chem. Soc. 58, 282-4(1936). C.A. 30, 2469_5.

The equilibrium constants for the reactions between H_2O, HDO, D_2O, C_2H_2, C_2HD and C_2D_2 were determined at 25°.

274

INVESTIGATION OF THE CONCENTRATION OF D_2O IN NATURAL ICE. II. E. Baroni and A. Fink. Monatsh. 67, 131-6(1935). C.A. 30, 2483_8.

Twenty-one samples of glacial ice showed both increases and decreases in density over normal H_2O.

275

INVESTIGATION OF THE CONCENTRATION OF D_2O IN NATURAL ICE. III. E. Baroni and A. Fink. Monatsh. 67, 193-5(1936). C.A. 30, 2483_9.

Snow shows normal deuterium content. Frost shows 15-50% increase over normal due to fractional crystallization.

276

ELECTROLYTIC PRODUCTION OF HEAVY WATER. RELATION BETWEEN CURRENT DENSITY AND ISOTOPE SEPARATION COEFFICIENT. T. Noguchi. J. Electrochem. Assoc. Japan 3, 305-10(1935). C.A. 30, 2498_6.

It was noted that the separation coefficient was not greatly affected by the current density.

277

EXCHANGE EXPERIMENTS WITH ORGANIC COMPOUNDS AND HEAVY WATER. F. K. Münzberg and W. Oberst. Z. physik. Chem. B31, 18-22(1935). C.A. 30, 2549_9.

No exchange was obtained between D_2O and HCO_2Na in neutral solution but in 0.1N NaOH some exchange occurred at 100°. HCO_2H exchanges the H from the OH group. Malonic acid exchanges all 4 H atoms, succinic acid exchanges 2 H atoms, and CH_2ClCO_2H exchanges only the carboxyl H atom.

278

RATE OF REACTION OF DEUTERIUM WITH HYDROGEN CHLORIDE. P. Cross and H. Steiner. J. Chem. Phys. 4, 165-9(1936). C.A. 30, 2830_6.

The reaction $D_2 + HCl = HD + DCl$ was investigated at 765-843°K. The constant of the homogeneous bimolecular reaction: $K_c = 6.27 \times 10^{13} \times T^{0.5} \times e^{-26,200}$ $mole^{-1}\ cm^{-3}\ sec^{-1}$.

279

REACTIONS INVOLVING HYDROGEN MOLECULES AND ATOMS. J. Hirschfelder, H. Eyring, and B. Topley. J. Chem. Phys. 4, 170-7(1936). C.A. 30, 2830_8.

The absolute rates of all the reactions involving H and D are calculated theoretically at 300°, 600°, 900°, and 1000°. The results are comparable with experimental values.

280

THE CATALYTIC INTERACTION OF AMMONIA WITH DEUTERIUM. A. Farkas. Trans. Faraday Soc. 32, 416-27(1936). C.A. 30, 2836_7.

The exchange of H atoms between D_2 and NH_3 on an Fe catalyst was studied at pressures of 30–400 mm. and temperatures at 160-230°.

281

THE THERMAL INTERACTION OF DEUTERIUM AND AMMONIA. A. Farkas. J. Chem. Soc. 26-36(1936). C.A. 30, 2836_9.

The kinetics of the exchange reaction between NH_3 and D_2 in the gas phase at 680–780° and at pressures of 10–400 mm. were investigated. Mechanisms are discussed. The relative rates of exchange reactions of D_2 with H_2, CH_4, NH_3, and H_2O at 1000°K were found to be 100; 20; 3; 1 respectively.

282

THE ELECTROLYTIC PREPARATION OF DEUTERIUM AND THE SEPARATION COEFFICIENT α. M. P. Applebey and G. Ogden. J. Chem. Soc. 163-8(1936). C.A. 30, 2851_7.

The apparatus used is described. The separation coefficient was found to vary with the initial atom % D. The theory of the separation factor is discussed.

283

HEAVY WATER. A. E. Knowles. French Patent, 789,822. Nov. 7, 1935. C.A. 30, 2860_2.

D is concentrated by electrolysis. Hydrogen from the later stages is liquefied and separated by fractional distillation.

284

THE EQUILIBRIUM OF THE LIGHT AND HEAVY ISOTOPES OF HYDROGEN WITH CRYSTALLINE CUPROUS CHLORIDE. A. F. Kapustinskiĭ. J. Am. Chem. Soc. 58, 460-3(1936). C.A. 30, 3301_7.

Calculated equilibrium constants for the reaction $H_2 + 2DCl = D_2 + 2HCl$ are 0.6 at 417° and 0.5 at 385°.

285

THE ELECTROLYTIC SEPARATION OF DEUTERIUM. A. J. Edwards, H. F. Walton, R. P. Bell, and J. H. Wolfenden. J. Chem Soc. 286-7(1936). C.A. 30, 3332_6.

Experiments were performed to determine whether the minimization of, and correction for, evaporation loss, as well as a general standardization of conditions of electrolysis, would be of value in explaining the lack of reproducibility in the results of various investigations on the separation of H isotopes. A table of electrolytic separation coefficients obtained when Ni, Cu, arc C, Fe, Ni, coated with sulfide, Fe coated with sulfide, and pure C were used as electrodes is included.

286

THE NATURE OF OVERVOLTAGE AND THE ELECTROLYTIC SEPARATION OF HYDROGEN ISOTOPES. J. Horiuchi and G. Okamoto. Sci. Papers Inst. Phys. Chem. Research Tokyo 28, 231-42(1936). C.A. 30, 3332_7.

Overvoltage and separation factors were determined with various electrodes in the electrolysis of water. The separation factors ranged from 3.0 to 6.8.

287

DIFFERENCE BETWEEN HEAVY OXYGEN CONTENTS OF ORDINARY WATER AND AIR. ELECTROLYTIC SEPARATION OF THE OXYGEN ISOTOPES. N. Morita. J. Chem. Soc. Japan 57, 176-9(1936). C.A. 30, 3687_8.

The oxygen of air contains more heavy O than the O of water. The separation coefficient of O isotopes is 1.01 ± 0.01 when NaOH is electrolyzed with Ni as an electrode.

288

EQUILIBRIUM CONSTANTS FOR THE EXCHANGE REACTIONS: $HCl + HD = DCl + H_2$ AND $HBr + HD = DBr + H_2$. K. Wirtz. Z. physik. Chem. B31, 309-18(1936). C.A. 30, 3703.

The constants were determined for HCl and HBr between 300° and 650°K with a Pt catalyst. The distribution coefficient D/H (Halide)/D/H (hydrogen) is approximately unity in both cases. The equilibrium constants agree with theory.

289

THE EXCHANGE REACTIONS BETWEEN HEAVY WATER AND HYDROGEN COMPOUNDS. II. E. Ogawa. J. Chem. Soc. Japan 57, 104-11(1936). C.A. 30, 3703_3.

Corrections and additions to the previous work (C.A. 30, 2473_1).

290

SMALL CHEMICAL SEPARATION OF THE CHLORINE ISOTOPES. R. S. Bradley. Nature 137, 403-4(1936). C.A. 30, 3715_5.

A small increase in the density of CCl_4 after some of it was decomposed by Na is reported.

291

THE VELOCITY OF THE EXCHANGE REACTION OF HYDROGEN ATOMS BETWEEN SUGAR AND WATER.

M. Harada and T. Titani. Bull. Chem. Soc. Japan 11, 55-6(1936). C.A. 30, 4076_7.

The H-D exchange was complete within one minute under the conditions of the reaction.

292

ENRICHMENT OF NITROGEN IN THE ISOTOPE N^{15}. D.E. Wooldridge and F. A. Jenkins. Phys. Rev. 49, 704(1936). C.A. 30, 4397_7.

In an apparatus for the separation of gaseous isotopes by diffusion, using N_2, N^{15} was enriched from $^1/_{350}$ to 3%.

293

COMPARATIVE DIFFUSION SPEEDS OF HYDROGEN AND DEUTERIUM THROUGH HOT PLATINUM. R. Jouan. J. phys radium 7, 101-6(1936). C.A. 30, 4737_8.

At 450-950° diffusion of D_2 is $^3/_4$ that of H_2.

294

THE REACTION OF FORMALDEHYDE WITH HYDROGEN PEROXIDE IN HEAVY WATER. PROOF OF THE LACK OF EXCHANGE OF THE HYDROGEN ATOMS IN FORMALDEHYDE. K. Wirtz and K. F. Bonhoeffer. Z. physik. Chem. B32, 108-12(1936). C.A. 30, 4815_2.

CH_2O has no exchangeable H atoms.

295

EXCHANGE REACTIONS BETWEEN HEAVY WATER AND HYDROGEN COMPOUNDS. E. Ogawa. Bull chem. Soc. Japan 11, 310-20(1936). C.A. 30, 5080_8.

Reactions between HDO and water soluble H compounds were studied. H compounds such as $C_6H_{12}O_6$, NH_4Cl, $CO(NH_2)_2$, NH_2CH_2COOH, $H_2NOH.HCl$ were studied.

296

THE SEPARATION OF GAS MIXTURES BY DIFFUSION IN STREAMING MERCURY VAPOR. H. Barwich. Z. Physik 100, 166-91(1936). C.A. 30, 5086_5.

An experimental and theoretical investigation was made of the Hertz method of separating isotopes by diffusion through a chain of Hg vapor pumps. Calculations are made for the time taken to produce a given separation for a fixed number of pumps. The calculations are applied to the attempted separation of H_2O^{18} and H_2O^{16}.

297

THERMAL DIFFUSION IN DEUTERIUM MIXTURES. K. E. Grew and B. E. Atkins. Proc. Phys. Soc. (London) 48, 415-20(1936). C.A. 30, 5091_4.

The thermal diffusion effects were studied in mixtures of H_2-N_2 and of D_2-N_2 over a temperature range of −190° + 100°.

298

CONCENTRATING THE HYDROGEN ISOTOPE, D, BY ELECTROLYSIS OF WATER. II. PRODUCTION OF HEAVY WATER AND APPARATUS. Y. Ota. Mem. Faculty Sci. Agr. Taihoku 15, 165-70(1935). C.A. 30, 5131_4.

Various methods of concentrating D electrolytically have been investigated.

299

EFFECT OF ELECTROLYTE ON THE CONCENTRATION OF HEAVY WATER. A. I. Brodskiĭ and N. P. Skrinnikova. Acta Physicochim. U.R.S.S. 2, 809-10(1935). C.A. 30, 5485_6.

The separation factors determined by electrolyzing 100cc. of 0.2N salt solution in 0.1% D_2O between Pt electrodes and measuring the concentration of D_2O in the residual liquid, increase from 5.6 for KOH through H_2SO_4, KCl, NaCl, and K_2CO_3 to 10.6 for Li_2SO_4.

300

HEAVY HYDROGEN, THE ISOTOPE OF HYDROGEN AND HEAVY WATER. G. Champetier. Bull. soc. encour. ind. natl. 135, 237-49(1936). C.A. 30, 5496_1.

A review.

301

CONCENTRATING HEAVY WATER. A. E. Knowles. U. S. Patent 2,044,704. June 16, 1936. C.A. 30, 5511_6.

Water is electrolytically decomposed in successive stages and vapor condensate fed to the next stage.

302

THE ISOTOPIC EXCHANGE REACTIONS BETWEEN CARBOHYDRATES AND HEAVY WATER. M. Harada. J. Chem. Soc. Japan 57, 391-400(1936). C.A. 30, 5860_7.

Exchange took place within a few seconds.

303

THE ENRICHMENT OF HEAVY-WATER ISOTOPES IN ORDINARY WATER THROUGH FRACTIONAL CRYSTALLIZATION. E. H. Riesenfeld and T. L. Chang. Ber. deut. chem. Ges. 69B, 1302-5(1936). C.A. 30, 5862_9.

No enrichment of HDO or H_2O^{18} was found.

304

MECHANISM OF THE CATALYTIC EXCHANGE REACTION BETWEEN DEUTERIUM AND WATER. A. Farkas. Trans. Faraday Soc. 32, 922-32(1936). C.A. 30, 5864_9.

The velocity of the catalytic exchange reaction HD + H_2O → HDO + HH taking place on a Pt wire at 10-70 mm pressure and 250-410° is about $^1/_{10}$ that of the orthopara conversion of H. The effect of pressure on the reaction indicates that H_2O is strongly adsorbed and H weakly.

305

VAPOR PRESSURE AND HEAT OF VAPORIZATION OF HEAVY WATER. E. H. Riesenfeld and T. L. Chang. Z. physik. Chem. B33, 120-6(1936). C.A. 30, 6255_1.

A differential manometer was used to measure the vapor-pressure difference between H_2O and D_2O between 20° and 230°. The difference $P(H_2O) - P(D_2O)$ first increase with temperature reaches a maximum of 82.6 mm at 170°, then decreases and finally becomes negative. The two pressures are equal at 225° and 25.151 atmospheres.

306

VAPOR PRESSURE, BOILING POINT AND HEAT OF VAPORIZATION OF HDO AND H_2O^{18}. E. H. Riesenfeld and T. L. Chang. Z. physik. Chem. B33, 127-32(1936). C.A. 30, 6255_2.

The vapor pressures of HDO at 100° and of H_2O^{18} between 65° and 100° were determined using the Rayleigh distillation method.

307

INTERCHANGE EQUILIBRIUM BETWEEN ACETYLENE AND HEAVY WATER. K. Hirota and G. Okamoto. Bull. Chem. Soc. Japan 11, 349-51(1936). C.A. 30, 6269_8.

The equilibrium constant is calculated and agrees with the data of Reyerson and Gillespie (C.A. 30, 1288_5, 2469_5).

308

EXCHANGE EXPERIMENTS WITH TRIHYDROXYBENZENES AND HEAVY WATER. F. K. Münzberg. Z. physik. Chem. B33, 23-38(1936). C.A. 30, 6270_2.

Rates of exchange of pyrogallol, sodium gallate, and phloroglucinol were measured. The OH groups exchange immediately.

309

EXCHANGE EXPERIMENTS WITH DIHYROXYBENZENES AND HEAVY WATER. F. K. Münzberg. Z. physik. Chem. B33, 39-46(1936). C.A. 30, 6270_3.

The rates of exchange of resorcinol, orcinol, and hydroquinone with D_2O were measured. OH groups exchanged immediately.

310

THE EXCHANGE REACTIONS BETWEEN HEAVY WATER AND AMINO ACIDS AND CARBOHYDRATES. E. Ogawa. Bull. Chem. Soc. Japan 11, 367-74(1936). C.A. 30, 6327_8.

$CO(NH_2)_2$ exchanges to 60% of the quilibrium value in 5 minutes. Several amino acids and various carbohydrates are reported.

311

CAN THE DIFFERENCE IN DENSITY BETWEEN SEA WATER AND FRESH WATER BE EXPLAINED BY THE FRACTIONAL DISTILLATION OF THE WATER ISOTOPES? K. Newmann and G. Tohmfor. Z. physik. Chem. A176, 226-8(1936). C.A. 30, 6615_5.

Measurements and calculations are the same order of magnitude.

312

DEUTERIUM EXCHANGE EQUILIBRIA IN SOLUTION AND THE QUINHYDRONE ELECTRODE. S. Korman and V. K. La Mer. J. Am. Chem. Soc. 58, 1396-1403(1936). C.A. 30, 6625_8.

The equilibrium between H- and D- forms of quinhydrone in homogeneous solutions is rapidly reached.

313

ACTIVITY OF SPECIFIC BONDS IN COMPLEX MOLECULES AT CATALYTIC SURFACES. I. THE CARBON-HYDROGEN BOND IN METHANE AND METHANE-d_4. Kiyoshi Morikawa, W. S. Benedict, and Hugh S. Taylor. J. Am. Chem. Soc. 58, 1445-9 (1936). C.A. 30, 6632_8.

CH_4 undergoes exchange with D_2, CD_4, and D_2O on active Ni catalysts at 138° and above.

314

THE SEPARATION OF GASEOUS ISOTOPES BY DIFFUSION. D. E. Wooldridge and W. R. Smythe. Phys. Rev. 50, 233-7(1936). C.A. 30, 6639_8.

The design and use of a 34-member apparatus of the Hertzian type for the separation of gaseous isotopes by diffusion are described. Results of tests of the speed of various types and number of separation members are given for isotopes of carbon and of nitrogen.

315

ISOTOPES OF OXYGEN AND NITROGEN. A. Krauss. German Patent 632,071, July 2, 1936. C.A. 30, 6652_4.

Liquid O and liquid N are rectified, suitably at subatmospheric pressure, to yield fractions in which the isotope of higher boiling point (O^{18} and N^{15}) are concentrated.

316

CONCENTRATION OF THE OXYGEN ISOTOPES. Harold C. Urey, G. B. Pegram, and J. R. Huffman. J. Chem. Phys. 4, 623(1936). C.A. 30, 7000_1.

A fractionating column was constructed, 6 in. by 35 ft, with 619 rotating and 619 stationary cones. The apparatus operated with an efficiency of 230 theoretical plates. O^{18} and D were increased by factors of 3 and 40, respectively, in the residual water.

317

PRODUCTION OF LIGHT WATER AND DETERMINATION OF THE DEUTERIUM CONCENTRATION OF ORDINARY WATER. N. Morita and T. Titani. Bull. Chem. Soc. Japan 11, 403-13(1936). C.A. 30, 7005_9.

By fractional electrolysis and catalytic recombination water was increased in density. Osaka tap water has a D/H ratio of $1/5600$.

318

A CONCENTRATION OF THE CARBON ISOTOPE. Harold C. Urey, A. H. W. Aten, Jr., and A. S. Keston. J. Chem. Phys. 4, 622-3(1936). C.A. 30, 7027_5.

By means of a very efficient fractionating column, a 25% solution of K_2CO_3 and CO_2 gas was fractionated in a countercurrent distillation which C^{13} was increased from 1.06 to 1.36% in 45 hr. In an experiment in which the enzyme carbonic anhydrase was used to catalyze the reaction $CO_2 + H_2O \rightarrow H_2CO_3$, a low liquid phase concentration of C^{13} was obtained.

319

STRUCTURE OF BENZENE. II. DIRECT INTRODUCTION OF DEUTERIUM INTO BENZENE AND THE PHYSICAL PROPERTIES OF HEXADEUTERIOBENZENE [BENZENE-d_6]. C. K. Ingold, C. G. Raisin, C. L. Wilson, C. R. Bailey, and B. Topley. J. Chem. Soc. 915-25(1936). C.A. 30, 7034_1.

C_6D_6 was prepared by shaking with 52 mole % D_2SO_4 for 3-4 days at room temperature. Physical properties of C_6D_6 are given.

320

THE EXCHANGE OF DEUTERIUM BETWEEN DEUTERIUM HYDROXIDE AND ETHYL ALCOHOL. W. J. C. Orr. Trans. Faraday Soc. 32, 1033-7(1936). C.A. 30, 7428_5.

The equilibrium constant for the reaction EtOH + HOD ⇌ EtOD + HOH was found to be 1.11. Rates are given for the foreward and backward reaction.

321

ACTIVATION OF SPECIFIC BONDS IN COMPLEX MOLECULES AT CATALYTIC SURFACES. II. CARBON-HYDROGEN AND CARBON-CARBON BONDS IN ETHANE AND ETHANE-d. Kiyoshi Morikawa, W. S. Benedict, and Hugh S. Taylor. J. Am. Chem. Soc. 58, 1795-1800 (1936). C.A. 30, 7435_2.

C_2H_6 and D_2, heated in contact with a Ni catalyst, undergo an exchange reaction at 100-130°, and yield mixed methanes at 160-300°.

322

MECHANISM OF ISOTOPIC EXCHANGE REACTIONS. Eijiro Ogawa. Bull. Chem. Soc. Japan 11, 425-7(1936). C.A. 30, 7448_8.

Two effects are found to be present: (1) that due to the effect of differences in reduced mass μ of the molecule formed by the combination of the isotope with a heavier or lighter element and (2) that due to polarization of the molecule. According to effect (2) it is concluded that the element is rich in the heavier isotope when it is in the more positively polarized state.

323

THE ISOTOPIC SEPARATION OF OXYGEN, CHLORINE, BROMINE, AND NITROGEN BY CHEMICAL METHODS. Eijiro Ogawa. Bull. Chem. Soc. Japan 11, 428-30(1936). C.A. 30, 7448_9.

By repeated distillations from sulfuric acid water showed a density increase of 8.2×10^{-6} compared with ordinary water. Water showed a density increase when part was decomposed with Na. Partial conversion of Cl^- to Cl_2 reduced the atomic weight of the remaining Cl^- to 35.416 (normal 35.354). Br_2 left behind after partial conversion to Br^-, BrO^-, and BrO_3^- with NaOH showed an atomic weight of 80.023 (normal 79.911). Partial decomposition of NH_4Cl solution increased the atomic weight of N from 14.009 to 14.014. These are explained in terms of a "polarizing effect."

324

THE SEPARATION OF ISOTOPES BY CENTRIFUGING. J. W. Beams and F. B. Haynes. Phys. Rev. 50, 491-2(1936). C.A. 30, 7449_1.

By means of an air-driven centrifuge with a peripheral velocity of 80,000 cm/sec., N_2 and CO_2 were separated at room temperature. This apparatus was also used for the fractionation of liquid CCl_4.

325

THE SEPARATION OF ISOTOPES BY RECTIFICATION AND RECTIFICATION AS A METHOD OF PURIFYING GASES. W. H. Keesom and H van Dijk. 7th Congr. intern. Froid. 1st Comm. interm., Rapports et Commun. June

1936, 103-11. C.A. 30, 7928_2.

The fractional distillation of Ne isotopes is reported.

326

THE LIBERATION OF PROTONS FROM MOLECULAR HYDROGEN WITH THE AID OF HYDROXYL IONS. K. Wirtz and K. F. Bonhoeffer. Z. physik. Chem. A177, 1-6 (1936). C.A. 30, 7972_5.

The O-H ion catalysis of the exchange of H atoms between H and D_2O was studied.

327

THE RELATIVE RATES OF COMBINATION OF H AND D WITH C_2H_4. A. Wheeler and R. N. Pease. J. Am. Chem. Soc. 58, 1665-8(1936). C.A. 30, 7976_9.

The rate of reaction of H with C_2H_4 is 2.5 times that of D with C_2H_4 at 500°, and 2 times the D-C_2H_4 rate in the catalytic reaction over Cu at 0°.

328

ISOTOPIC EXCHANGE BETWEEN WATER AND SEVERAL ORGANIC COMPOUNDS. M. Harada and T. Titani. Bull. Chem. Soc. Japan 11, 465-74(1936). C.A. 30, 7977_3.

The coefficient k, defined as the atom concentration of D in the total exchangeable H of the organic substance divided by the atom concentration of D in the total H of water, increases with increasing basicity or decreasing acidity of the organic compounds.

329

ON THE CHEMICAL DIFFERENCES BETWEEN THE NITROGEN ISOTOPES. H. C. Urey and A. H. W. Aten, Jr. Phys. Rev. 50, 575(1936). C.A. 30, 8012_4.

Various means of concentrating N^{15} are discussed. The exchange reaction $N^{15}N_3 + N^{14}H_4^+ \rightleftharpoons N^{14}H_3 + N^{15}H_4^+$ was found to give a fractionation factor of 1.027. In the exchange $HCN^{15} + CN^{14-} \rightleftharpoons HCN^{14} + CN^{15-}$, N^{15} was appreciably concentrated in the HCN gas.

330

TEMPERATURE COEFFICIENT OF THE ELECTROLYTIC SEPARATION OF HYDROGEN ISOTOPES. H. F. Walton and J. H. Wolfenden. Nature 138, 468(1936). C.A. 30, 8041_5.

The temperature variation (15 to 98°) of the electrolytic separation of the H isotopes at Hg and Ag cathodes has been measured. It was found that the separation coefficient at the Ag electrode falls with rising temperature while that at Hg remains almost constant.

331

PROTOTROPY IN RELATION TO THE EXCHANGE OF HYDROGEN ISOTOPES. I. RATES OF ISOMERIZATION AND OF HYDROGEN EXCHANGE IN UNSATURATED NITRILES. C. K. Ingold, E. de Salas, and C. L. Wilson. J. Chem. Soc. 1328-34(1936). C.A. 30, 8179_6.

Hydrogen exchange with solvent EtOD was rapid in the presence of EtONa.

332

CATALYTIC INTERCHANGE OF HYDROGEN WITH WATER AND ALCOHOL. D. D. Eley and M. Polányi. Trans. Faraday Soc. 32, 1388-97(1936). C.A. 31, 26_1.

A mixture of D_2 and H_2 was treated with activated charcoal at a temperature of liquid air to convert the latter into para-H_2. This mixture was then shaken with H_2O or EtOH containing Pt black at 0° and reduced pressures. The water formed was distilled and analyzed for D_2 or for para-H_2 and D content.

333

ACTIVATION OF HYDROGEN BY PHTHALOCYANINE AND COPPER PHTHALOCYANINE. M. Calvin, E. G. Cockbain, and M. Polányi. Trans. Faraday Soc. 32, 1436-43(1936). C.A. 31, 26_3.

Crystals of phthalocyanine and Cu phthalocyanine activate molecular hydrogen by causing an atomic interchange (1) between themselves and H_2, and (2) between H_2 and water vapor. Furthermore they catalyze (3) the formation of H_2O from H_2 and O_2.

334

PLATINUM ELECTRODE AS A CATALYST FOR THE ACTIVATION OF HYDROGEN. M. Calvin. Trans. Faraday Soc. 32, 1428-36(1936). C.A. 31, 26_6.

Small cathodic and anodic polarizations above 0.7 volt retard the exchange reaction, $D_2 + H_2O \rightleftharpoons HD + HDO$.

335

APPLICATION OF THE TRANSITION-STATE METHOD TO THE HETEROGENOUS REACTION ON THE HYDROGEN ELECTRODE: ABSOLUTE CALCULATION OF THE ISOTOPIC INTERCHANGE REACTION VELOCITY, CATHODIC AND ANODIC CURRENTS, AND ISOTOPIC SEPARATION FACTOR. G. Okamoto, J. Horiuchi, and K. Hirota. Sci. Papers Inst. Phys. Chem. Research (Tokyo) 29, 223-51(1936) C.A. 31, 26_8.

The statistical-mechanical treatment gave the order of magnitude for the anodic and cathodic currents, isotopic separation factor and isotopic interchange reaction velocity in the case of Ni electrodes.

336

THE ISOTOPE EXCHANGE BETWEEN ANILINE HYDROCHLORIDE AND HEAVY WATER. M. Harada and T. Titani. Bull. Chem. Soc. Japan 11, 554-6(1936). C.A. 31, 97_5.

Not only the three atoms in the NH_3Cl radical of $C_6H_5NH_3Cl$ but also some H atoms in the benzene nucleus may exchange with D_2O under certain conditions.

337

RELATIVE CATALYTIC ACTIVITIES OF SEVERAL METALS FOR THE ISOTOPIC INTERCHANGE REACTION, $H_2O + HD = HDO + H_2$. K. Hirota and J. Horiuchi. Sci. Papers Inst. Phys. Chem. Research (Tokyo) 30, 151-68 (1936). C.A. 31, 310_8.

D was shaken in a reaction vessel for a recorded time with pure water in the presence of Pt, Ni, Fe, Cu, Au, Ag, and Hg at 0°, 100°, and 180°. After the shaking the mixture of H and D was withdrawn and burned. The order of activity found was Pt > Ni > Fe > Cu > Au > Ag > Hg.

338

ENRICHMENT OF THE LIGHT ARGON ISOTOPE BY DIFFUSION. H. Barwich and W. Schütze. Naturwissenschaften 24, 667 (1936). C.A. 31, 315_7.

By use of the Hertz diffusion method in flowing Hg vapor, a light fraction was produced in 60 hours in which the ratio $A^{40}:A^{36}:A^{38}$ was 100:12:0.6.

339

THE SOLUBILITY OF DEUTERIUM AND HYDROGEN IN SOLID PALLADIUM. II. A. Sieverts and W. Danz. Z. physik. Chem. B34, 158-9(1936). C.A. 31, 591_5.

The solubility of H and D in Pd was measured between 20° and 350° and at various pressures. At 120°, the solubility of H is 60 cc and D only 3 cc per gram of Pd.

340

THE ESTIMATION OF EQUILIBRIA OF EXCHANGE REACTIONS WITH DEUTERIUM AND POLYATOMIC MOLECULES. K. Wirtz. Z. physik. Chem. B34, 121-40(1936). C.A. 31, 598_3.

The equilibria between D and polyatomic molecules containing H are estimated from spectroscopic data and statistical mechanics. Examples are benzene + HCl, acetone + H_2O and methanol + H_2O.

341

DIRECT INTRODUCTION OF DEUTERIUM INTO ALIPHATIC SYSTEMS. I. HYDROGEN EXCHANGE BETWEEN

SULFURIC ACID AND PARAFFINOID HYDROCARBONS. Christopher K. Ingold, Clifford G. Raisin, and Christopher L. Wilson. J. Chem. Soc. 1643-5(1936). C.A. 31, 653_8.

The deuteration of aliphatic hydrocarbons does not appear to stop perfectly sharply at equilibrium in relation to a limited number of positions in the molecule.

342

ORGANIC DEUTERIUM COMPOUNDS. I. INTERCHANGE EQUILIBRIUM BETWEEN BENZENE AND WATER. T. Koyano. J. Chem. Soc. Japan 57, 929-32(1936). C.A. 31, 667_3.

Equilibrium was reached at 100° in 90 hours with Pt black catalyst.

343

DIRECT INTRODUCTION OF DEUTERIUM INTO THE AROMATIC NUCLEUS. I. QUALITATIVE COMPARISON OF THE EFFICIENCIES OF SOME ACIDIC DEUTERATING AGENTS AND OF THE INFLUENCE OF SOME AROMATIC SUBSTITUENTS. Christopher K. Ingold, Clifford G. Raisin, and Christopher L. Wilson. J. Chem. Soc. 1637-43(1936). C.A. 31, 666_7.

A study of the deuterating efficiencies of various aqueous acids upon several aromatic compounds.

344

ORGANIC DEUTERIUM COMPOUNDS. II. INTERCHANGE REACTIONS BETWEEN BENZENE AND WATER. T. Koyano. J. Chem. Soc. Japan 57, 933-5(1936). C.A. 31, 667_4.

The reaction is of first order.

345

INTERCHANGE REACTION BETWEEN CHLOROFORM AND HEAVY WATER. Y. Sakamoto. J. Chem. Soc. Japan 57, 1169-74(1936). C.A. 31, 931_4.

The interchange takes place between $CHCl_3$ and heavy water at 100° in alkaline solution.

346

INTERCHANGE EQUILIBRIUM BETWEEN DEUTERIUM AND METHYL ALCOHOL. G. Okamoto and T. Kwan. J. Chem. Soc. Japan 57, 1179-89(1936). C.A. 31, 931_5.

With Pt black catalyst, only the H of the hydroxyl group exchanges.

347

THE RATE OF EXCHANGE BETWEEN CHLORIDE ION AND CHLORINE IN AQUEOUS SOLUTION. F. A. Long and A. R. Olson. J. Am. Chem. Soc. 58, 2114-15(1936). C.A. 31, 933_2.

Radioactive NaCl, acetanilide and chlorine were allowed to react to determine the quantitative rate of exchange. Indications show the acid reaction to be very rapid.

348

DETERMINATION OF THE NUMBER OF THE MUTUALLY INTERCHANGEABLE HYDROGEN ATOMS OF COMPLEX COMPOUNDS WITH HEAVY WATER. G. Okamoto and S. Abe. J. Chem. Soc. Japan 57, 1175-8(1936). C.A. 31, 966_7.

It has been observed that all the H atoms of the complex salts $[Co(NH_3)_6]_2(SO_4)_3 . 5H_2O$, $[Co(NH_3)_5NO_2]Cl_2$, $[Co(NH_3)_5 . H_2O]Cl_3$, and $[Co(NH_3)_4(CO_3)]Cl$ can be replaced by heavy hydrogen.

349

MERCURY-PHOTOSENSITIZED EXCHANGE REACTIONS OF DEUTERIUM WITH AMMONIA, METHANE, AND WATER. A. Farkas and H. W. Melville. Proc. Roy. Soc. (London) A157, 625-51(1936). C.A. 31, 1297_1.

Studies of these reactions were made in a temperature range 30-600° at a total pressure of 100 mm.

350

THE EXCHANGE OF HYDROGEN BETWEEN ETHYL ALCOHOL AND $Ca(OD)_2$. J. C. Jungers and K. Wirtz. Bull. soc. chim. Belg. 45, 679-83(1936). C.A. 31, 1683_5.

The exchange of D atoms between $Ca(OD)_2$ and alcohol vapor is complete at ordinary temperatures in less than an hour.

351

THE SEPARATION OF ISOTOPES. G. Champetier. Bull. soc. chim. France (5) 3, 1701-27(1936). C.A. 31, 1695_4.

A review with 140 references is presented.

352

THE SEPARATION OF LITHIUM ISOTOPES. G. N. Lewis and R. T. MacDonald. J. Am. Chem. Soc. 58, 2519-24(1936). C.A. 31, 1695_5.

By use of an 18-meter column in which fine drops of Li amalgam fall through a solution of LiCl in absolute C_2H_5OH or LiBr in C_2H_5OH-dioxane mixture, Li^6 was enriched from the ordinary mixture of Li isotopes. The Li was extracted from the amalgam at the bottom of the column and added as Li salt to the ascending solutions. Li^6 was enriched in the amalgam and the single stage separation factor estimated to be greater than 1.025.

353

INTERCHANGE OF HYDROGEN ISOTOPES IN COMPLEX COBALT-AMMINES. F. W. James, J. S. Anderson, and H. V. A. Briscoe. Nature 139, 109(1937). C.A. 31, 2117_3.

At 25° and 35° the half time of exchange is several hours. Complete exchange takes place of all H atoms.

354

THE VELOCITY OF EXCHANGE OF HYDROXYL HYDROGEN IN AQUEOUS SOLUTIONS. J. C. Jungers and K. F. Bonhoeffer. Z. physik. Chem. A177, 460-4(1936). C.A. 31, 2501_7.

The equilibrium is established extremely rapidly between alcoholic OH groups and heavy water.

355

ATOMIC INTERCHANGE BETWEEN WATER AND SATURATED HYDROCARBONS. C. Horrex and M. Polányi. Mem. Proc. Manchester Lit. & Phil. Soc. 80, 33-5(1935-6). C.A. 31, 2503_8.

On heating heavy water with cyclohexane or isopentane at 90-100° in the presence of a Pt catalyst for 10-20 hr, 30-40% of the H atoms of the hydrocarbon were replaced with D. With D_2 instead of H_2O only traces of exchange resulted.

356

EXCHANGE REACTIONS OF IODINE COMPOUNDS. H. A. C. McKay. Nature 139, 283-4 (1937). C.A. 31, 2908_8.

Iodine was exchanged at room temperature between NaI and MeI in EtOH, Me_2CO and AmOH solution. No exchange occurred in CCl_4, CS_2 or Et_2O solution. Iodine exchange occurred at 100°C in sealed tubes between NaI and EtI, PrI, iso-PrI, BuI, iso-AmI, and between CH_2I_2 and CHI_3 in EtOH solution. PhI, p-$C_6H_4NO_2I$ and p-$C_6H_4NH_2I$ did not exchange with NaI at 100°. At room temperature iodoacetic acid exchanged with aqueous NaI while β-iodopropionic acid, and m- and p-iodobenzoic acids in Me_2CO solution did not exchange with NaI. β-iodopropionic acid in H_2O exchanges at 100°. MeI and I_2 do not exchange at 100° in the absence of a solvent.

357

MERCURY-SENSITIZED REACTIONS OF METHANE, DEUTERIOMETHANES, AND THE HYDROGEN ISOTOPES. Kiyoshi Morikawa, W. S. Benedict, and Hugh S. Taylor. J. Chem. Phys. 5, 212-25(1937). C.A. 31, 3790_5.

The interactions of $CH_4 + D_2$ and $CH_4 + CD_4$ under the influence of excited Hg were studied.

358

DETERMINATION OF THE NUMBER OF INTERCHANGEABLE HYDROGEN ATOMS IN COMPLEX SALTS. J. Horiuchi and G. Okamoto. Sci. Papers Inst. Phys. Chem.

Research (Tokyo) 31, 205-10(1937). C.A. 31, 3810_2.

All the H atoms of three cobalt ammine complexes are interchangeable.

359

ISOTOPIC INTERCHANGE REACTION BETWEEN CHLOROFORM AND HEAVY WATER. J. Horiuchi and Y. Sakamoto. Bull. Chem. Soc. Japan 11, 627-8(1936). C.A. 31, 4189_4.

The rate of interchange between $CHCl_3$ and D_2O in the presence of alkali is far greater than the rate of decomposition.

360

PARTITION OF DEUTERIUM BETWEEN METHYL ALCOHOL AND WATER. G. Okamoto. Sci. Papers Inst. Phys. Chem. Research (Tokyo) 31, 211-16(1937): J. Faculty Sci. Hokkaido Imp. Univ. Ser. III 2, 81-7(1936). C.A. 31, 4189_2.

Within experimental error, no preference for D exists between H_2O and the OH group of MeOH.

361

SEPARATION OF OXYGEN ISOTOPES BY A FRACTIONATING COLUMN. J. R. Huffman and Harold C. Urey. Ind. Eng. Chem. 29, 531-5(1937). C.A. 31, 4546_3.

The fractionating column used consisted of alternately stationary and rotating cones with an equivalent surface of 500 plates. The concentration of O^{18} isotope was increased almost 5 times by fractionation of water.

362

HYDROGEN-DEUTERIUM EXCHANGE IN ACETATE SOLUTION. S. Liotta and V. K. La Mer. J. Am. Chem. Soc. 59, 946(1937). C.A. 31, 4567_3.

No exchange was detected in a 10% NaOAc solution in D_2O.

363

EQUILIBRIA OF THE REACTIONS BETWEEN ACETYLENE AND DEUTERIUM OXIDE AT 0° AND 100° AND THE HEATS OF REACTION. L. H. Reyerson and Bruce Gillespie. J. Am. Chem Soc. 59, 900-2(1937). C.A. 31, 4569_7.

The equilibrium constants for the reactions between H_2O HDO, D_2O, C_2H_2, C_2HD, and C_2D_2 were determined experimentally at 0° and 100°.

364

A THERMAL CONDUCTIVITY METHOD FOR THE DETERMINATION OF ISOTOPIC EXCHANGES IN THE SIMPLER GASEOUS MOLECULES. N. R. Trenner. J. Chem. Phys. 5, 382-92(1937). C.A. 31, 4855_1.

Details, specifications, and drawings are given for a simple high pressure thermal conductivity gage, possessing good mechanical stability, freedom from poisoning effects, and high accuracy. The theory of the gage is developed and is compared with experimental observations on H and D.

365

CALCULATION OF EQUILIBRIUM CONSTANTS AND ACTIVATION ENERGIES FOR SOME REACTIONS INVOLVING VARIOUS ISOTOPIC SPECIES OF HYDROGEN, WATER, AND HYDROGEN SULFIDE. Tom Jones and Albert Sherman. J. Chem. Phys. 5, 375-81(1937). C.A. 31, 4877_5.

Equilibrium constants and activation energies are calculated for exchange reactions involving H, D, H_2O, HDO, D_2O, H_2S, HDS, and D_2S.

366

INTERCHANGE EQUILIBRIUM OF DEUTERIUM; NUMBER OF INTERCHANGEABLE HYDROGEN ATOMS IN COMPLEX SALTS. G. Okamoto. J. Faculty Sci. Hokkaido Imp. Univ. Ser. III 2, 81-3, 88-94(1936). C.A. 31, 4878_2.

The ratio of the number of interchangeable atoms was determined by using 100% D_2O for the following complex salts: $[Co(NH_3)_6]_2SO_4 \cdot H_2O$; $[Co(NH_3)_5NO_2]Cl_2$; $[Co(NH_3)_5H_2O]Cl_3$; $[Co(NH_3)_4CO_3]Cl$. All H atoms in the salts were found to be interchangeable.

367

ENRICHMENT OF HEAVY WATER IN GLACIER ICE AND MELTING DIAGRAM OF SYSTEM H_2O-D_2O. A. Eucken and K. Schäfer. Nachr. Ges. Wiss. Göttingen, Math.-physik. Klasse, Fachgruppe III, 1, 109-25(1935). C.A. 31, 4880_3.

Enrichment in glacial ice may attain 50%. The enrichment of D_2O in the solid phase is calculated and compared with experimental values.

368

SEPARATION OF ISOTOPES BY DIFFUSION IN FAST-STREAMING MERCURY VAPOR. D. MacGillavoy. Rec. trav. chim. 56, 330-42(1937). C.A. 31, 5263_7.

With Hg flowing at the rate of $\frac{1}{3}$ to $\frac{2}{3}$ mols./min. under conditions to avoid turbulent flow and the H, containing 1 to 3% D, at nearly the same rate, the author studied in 2 apparatus the separation of protium and deuterium and compared it with the calculated separation. Description and drawings of the apparatus are given.

369

HEAVY WATER. F. Hansgirg. British Patent 462,191. March 4, 1937. C.A. 31, 5524_6.

Reactions that yield H by reduction of H_2O are carried out at as low temperatures as possible to equilibrium and the D_2O remaining at the end of the reaction is recycled. (e.g., the production of H from CO + steam.)

370

DISTILLING APPARATUS FOR THE SEPARATION OF ISOTOPES. G. B. Pegram, Harold C. Urey, and J. R. Huffman. Phys. Rev. 49, 883(1936). C.A. 31, 5623_3.

371

FURTHER INVESTIGATIONS OF THE ENRICHMENT OF HEAVY WATER IN GLACIAL ICE. A. Eucken and K. Schäfer. Nachr. Ges. Wiss. Göttingen, Math.-physik. Klasse, Fachgruppe III, 1, 137-46(1935). C.A. 31, 5633_8.

Glacial water shows up to 75% D enrichment.

372

PERCENTAGE INCREASE OF HEAVY WATER IN WATER THROUGH FRACTIONAL CRYSTALLIZATION. Mladen Deželičč. Bull. soc. chim. roy. Yougoslav. 7, 65-71(1936). C.A. 31, 5633_8.

Cooling curves of mixtures D_2O-H_2O show that the two types of water form an interrupted series of solid solutions in each other, and that it is consequently impossible to separate these two types of water by fractional crystallization.

373

THE RELATIVE EFFICIENCIES OF THE MULTISTAGE AND ONE-STAGE PROCESS IN THE ELECTROLYTIC PREPARATION OF HEAVY WATER. T. Chiplonkar. Proc. Indian Acad. Sci. 4A, 463-7(1936). C.A. 31, 5641_2.

Based on Urey's formula relating the initial and final D_2O concentration with the initial and final volume of water in the electrolytic process an equation is mathematically derived that gives the decrease in efficiency in the electrolytic separation of D_2O as a function of x, the fraction of fresh water added in each step. The decrease in efficiency becomes smaller as x becomes smaller, so that there is no loss in efficiency if fresh water is added continuously, instead of stagewise.

374

EXCHANGE REACTIONS OF HEAVY WATER WITH ORGANIC COMPOUNDS. I. PHENOL; ACETANILIDE, AND THE FORMATE ION. P. A. Small and J. H. Wolfenden. J. Chem. Soc. 1811-17(1936). C.A. 31, 5659_6.

At 100° the equilibrium with the OH of phenol and the NH

of acetanilide is rapid and the partition ratios 1.1 and 1.2 respectively favoring the organic compound. The exchange of D with formate ion is very slow.

375

CONCENTRATION OF N^{15} BY A CHEMICAL EXCHANGE REACTION. Harold C. Urey, M. Fox, J. R. Huffman, and H. G. Thode. J. Am. Chem. Soc. 59, 1407-8(1937). C.A. 31, 5673_8.

By using the exchange reaction between NH_3 gas and $(NH_4)_2SO_4$ solution and a method consisting of pumping a 30% solution of $(NH_4)_2SO_4$ at a constant rate into the top of a fractionating column under low pressure, refluxing the NH_3 from the salt solution at the bottom by the addition of NaOH and stripping the NH_3 from the solution by a packed stripping column, there was produced N containing 2.54% N^{15}, a 6.5 fold increase in concentration.

376

THE ELECTROLYTIC AND CHEMICAL-EXCHANGE METHODS FOR THE SEPARATION OF THE LITHIUM ISOTOPES. T. I. Taylor and Harold C. Urey. J. Chem. Phys. 5, 597-8(1937). C.A. 31, 5675_4.

Several methods of separating Li^6 from Li^7 are discussed. Electrolysis of LiOH; aqueous LiBr extracted with methylamyl alcohol; and aqueous LiCl extracted with small portions of a zeolite. LiCl and NH_4Cl solution passed through a 10-meter zeolite column showed the lighter Li^+ ion and the heavier NH_4^+ ion, respectively, were preferentially held by the resin.

377

THE VAPOR PRESSURE OF HYDROGEN DEUTERIDE. R. B. Scott and F. G. Brickwedde. Phys. Rev. 48, 483(1935). C.A. 31, 5676_1.

HD of 99.95% purity was obtained by distillation of liquid H_2. Empirical equations are given for the vapor pressure of the solid and the liquid. Measurements were made in the temperature range 13.92 to 20.38°K.

378

THE ISOLATION OF LITHIUM ISOTOPES WITH A MASS SPECTROMETER. L. H. Rumbaugh. Phys. Rev. 49, 882(1936). C.A. 31, 5678_6.

379

SEPARATION OF ISOTOPES BY DIFFUSION. R. Sherr and W. Bleakney. Phys. Rev. 49, 882-3(1936). C.A. 31, 5678_6

A set of diffusion pumps of the Hertz type were constructed to fractionate the isotopes of certain gases. H_2, Ne, and O_2 were used.

380

ABSORPTION SPECTRA, OPTICAL ACTIVITY, AND ISOTOPIC EXCHANGE. C. H. Johnson and N. H Poynton. Nature 139, 842-3(1937). C.A. 31, 5681_7.

Measurements of optical rotation can be used to determine the isotopic composition of a complex ion or of a solvent in equilibrium with it. This was illustrated with D substituted cobalt ammines.

381

EXCHANGE REACTIONS IN DEUTERIO ALCOHOL. M. S. Kharasch, W. G. Brown, and J. McNab. J. Org. Chem. 2, 36-48(1937). C.A. 31, 5755_6.

Various organic compounds were dissolved in EtOD and exchange measured.

382

THE PREPARATION OF HEAVY WATER. F. Schacherl. Příroda 28, 226-34(1935). Chem. Obzon. 12, 106. C.A. 31, 6073_5.

The current methods are reviewed for preparing protium, D, and Tritium. The author includes his methods and experiments with those of the Taylor-Schwarz method.

383

REACTIONS IN HEAVY WATER. A REVIEW. H. Suess. Österr. Chem. Ztg. 40, 239-43(1937). C.A. 31, 6088_2.

A discussion of the distribution of H and D between water and dissolved compounds such as ketones or acids. The calculation of the distribution ratio is discussed.

384

INTERCHANGES IN WATER AND DEUTERIUM OXIDE. H. B. Erlenmeyer, W. Schoenauer and G. Schwarzenbach. Helv. Chim. Acta 20, 726-32(1937). C.A. 31, 6104_1.

AcOK, $(CH_2CO_2K)_2$, $Ba(D_2PO_2)_2$ show little exchange with water at room temperature H_3PO_2 undergoes complete exchange with D_2O.

385

ENRICHING THE LIGHTER ARGON ISOTOPES BY MEANS OF DIFFUSION. H. Barwich and W. Schütze. Z. Physik 105, 395-8 (1937). C.A. 31, 6104_2.

The Hertz method of isotope separation by diffusion in Hg vapor is applied to the separation of the argon isotopes 36 and 38.

386

THE ENRICHING OF THE ARGON ISOTOPE A^{36} AND THE ISOTOPE DISPLACEMENT EFFECT IN THE SPECTRUM OF ARGON. I. Hans Kopfermann and Hubert Krüger. Z. Physik 105, 389-94 (1937) C.A. 31, 6104_3.

After a 300-hour run with a Hertz diffusion apparatus, A^{36} was enriched until the ratio of 36:40 was 1:1. One-half liter of the lighter isotope was separated.

387

FRACTIONAL ELECTROLYSIS OF THE ISOTOPES OF LITHIUM. PRELIMINARY EXPERIMENTS. G. Champetier and P. Regnaut. Bull. soc. chim. France (5) 4, 592-4(1937). C.A. 31, 6114_8.

A solution of LiCl was electrolyzed using a graphite anode and a continuously renewing Hg cathode. The amalgam dropped through a layer of CCl_4 into HCl, from which the Li was recovered as LiCl. The total separation was found to be less than 1.1.

388

THE EQUILIBRIUM BETWEEN HYDROGEN SULFIDE AND HEAVY WATER. P. A. Small. Trans. Faraday Soc. 33, 820-3(1937). C.A. 31, 6536_4.

The heterogeneous equilibrium between H_2S and D_2O was measured at 15° and from the results the homogeneous equilibrium constant for the reaction $H_2S + HDO \rightleftharpoons HDS + H_2O$ was calculated. The experimental value was 0.453 ± 0.020 compared with 0.436 or 0.448 calculated from spectral data.

389

HYDROGEN-DEUTERIUM EXCHANGE REACTION. III. EXCHANGE IN AMINO GROUPS. M. M. Slutskaya, Z. M. Shershever, and A. I. Brodskiĭ. J. Phy. Chem. U.S.S.R. 9, 417-20(1937). C.A. 31, 6536_5.

The H and D exchange is reversible with an exchange coefficient of 1.00 ± 0.05 in either direction for hydrazine sulfate, urea, acetamide, glycine, and O-aminobenzoic acid.

390

INTERCHANGE REACTIONS OF OXYGEN. I. INTERCHANGE OF OXYGEN BETWEEN WATER AND POTASSIUM PHOSPHATE IN SOLUTION. E. Bumenthal and J. B. M. Herbert. Trans. Faraday Soc. 33, 849-52(1937). C.A. 31, 6536_8.

The exchange of H_2O^{18} and K_3PO_4 was studied at room temperature. A mechanism for the reaction is presented.

391

MEASUREMENT OF A REACTION RATE AT EQUILIBRIUM BY MEANS OF A RADIOACTIVE INDICATOR. THE REACTION BETWEEN ARSENIC ACID AND IODINE. J. N. Wilson and R. G. Dickinson. J. Am. Chem. Soc. 59,

1358-61(1937). C.A. 31, 6539_6.

In the presence of iodine in acid solution an exchange takes place between radioactive As^{3+} and non radioactive As^{5+}.

392

THE CATALYTIC INTERACTION OF HEAVY HYDROGEN AND BENZENE ON PLATINUM. A. Farkas and L. Farkas. Trans. Faraday Soc. 33, 827-37(1937). C.A. 31, 6542_5.

The rate of interaction in the gas phase was measured at partial pressures of C_6H_6 and H ranging from 3 to 150 mm on Pt foil catalyst. Hydrogenation and exchange occur simultaneously and independently.

393

THE TEMPERATURE VARIATION OF SOME THERMODYNAMIC QUANTITIES. George M. Murphy. J. Chem. Phys. 5, 637-41(1937). C.A. 31, 6953_8

The quantity $(F^\circ-E_0^\circ)/T$, calculated from spectroscopic data, is fitted to a 5-constant equation in T for H_2, HD, D_2, HCl, DCl, HBr, DBr, HI, DI, Cl_2, Br_2, I_2, N_2, O_2, CO, H_2O, H_2S, CO_2, and SO_2. The equilibrium constant for exchange reactions involving isotopes is calculated. In each case a maxima exists. Therefore an optimum temperature exists for the separation of isotopes by exchange reactions.

394

IONS AND ISOTOPES. James Kendall. Proc. Roy. Soc. Edinburgh, 57, 182-93(1937). C.A. 31, 6964_3.

The attempted separation of isotopes by use of differences in ionic mobility is reviewed. Applications of this method to separation of similar elements, such as rare earths, are described as well as early attempts to effect isotope separation by use of differences in ionic discharge potentials.

395

EQUILIBRIA IN PROTIUM OXIDE-DEUTERIUM OXIDE MIXTURES. W. H. Hamill. J. Am. Chem. Soc. 59, 1492-4(1937). C.A. 31, 7314_7.

The conductivity and emf of H_2O-D_2O mixtures is explained in terms of the various isotopic equilibria.

396

HETEROGENEOUS EQUILIBRIA WITH DEUTERIUM. J. R. Partington and R. P. Towndrow. Nature 140, 156(1937). C.A. 31, 7316_4.

From the rates of reactions of H_2 and D_2 with $CoCl_2$ at 673 to 773°K, the equilibrium constant for the reaction $2DCl + H_2 = 2HCl + D_2$ was calculated and compared with the values of others.

397

MECHANISM OF SOME CATALYTIC EXCHANGE REACTIONS OF HEAVY HYDROGEN. A. Farkas and L. Farkas. Trans. Faraday Soc. 33, 678-90(1937). C.A. 31, 7322_7.

Information on the mechanism of the catalytic exchange reaction between liquid water and ortho-deuterium was obtained by comparing the exchange reaction in vapor and liquid phase, by varying the exchange partner and by comparing systematically the exchange reaction and ortho-para-hydrogen conversion.

398

THE EFFECT OF ISOTOPES IN ION SOLVATION AND THE HEAT OF SOLUTION. E. Large, W. Martin, and H. Sattler. Z. ges. Naturw. 1, 441-2(1936). C.A. 31, 7324_2.

It is shown that the energy of isotopic action has an unexpectedly large effect on the heats of solution. A H_2O-D_2O mixture was subjected to fractional distillation with and without addition of salts.

399

SEARCH FOR ISOTOPES OF HYDROGEN AND HELIUM OF MASS 3. Ernest Rutherford. Nature 140, 303-5(1937). C.A. 31, 7330_8.

A review of the separation methods used for hydrogen and helium isotopes is presented.

400

EXCHANGE EQUILIBRIA OF THE HYDROGEN ISOTOPE BETWEEN WATER AND POLYATOMIC MOLECULES. K. Wirtz. Z. Electrochem. 43, 662-3(1937). C.A. 31, 7727_7.

Calculation from spectroscopic data and statistical mechanics of the exchange equilibria of the hydrogen isotope between water and polyatomic molecules.

401

EXCHANGE REACTIONS OF ORGANIC COMPOUNDS WITH SULFURIC ACID-d_2. R. Schoenheimer, D. Rittenberg, and A. S. Keston. J. Am. Chem. Soc. 59, 1765(1937). C.A. 31, 7843_6.

Some exchange took place on heating 24 hours at 100°.

402

THE CONCENTRATION OF "HEAVY" WATER IN A STEAM BOILER. R. Stumper. Vom Wasser 10, 207-8 (1935). C.A. 31, 8276_3.

No concentration effect was found.

403

REACTION OF THE EXCHANGE OF HYDROGEN FOR DEUTERIUM. IV. EQUILIBRIUM CONSTANTS OF THE EXCHANGE REACTIONS IN SOLUTION. A. I. Brodskiĭ. J. Phys. Chem. U.S.S.R., 9, 755-62(1937). C.A. 31, 8335_8.

In the great majority of cases the equilibrium exchange coefficient α = (D/H in water)/(D/H in compound) is close to unity. Exceptions are acetone, 1.2-1.4; NH_4Cl, 0.8; AcH, 2.2; sugar, up to 1.2; pyrrole, 0.8; hydroquinone, 1.13.

404

THE EXCHANGE OF HYDROGEN WITH DEUTERIUM IN SOLUTION. A. I. Brodskii. Trans. Faraday Soc. 33, 1180-5(1937). C.A. 31, 8335_9.

The exchange of D_2O with various organics was investigated. The distribution ratio α = (D/H in water)/(D/H in solute) is approximately unity except for acetone, for which it is 1.2 ± 0.01 at 18°.

405

ACTIVATION OF SPECIFIC BONDS IN COMPLEX MOLECULES AT CATALYTIC SURFACES. III. CARBON-HYDROGEN AND CARBON-CARBON BONDS IN PROPANE AND ETHYLENE. K. Morikawa, N. R. Trenner, H. S. Taylor. J. Am. Chem. Soc. 59, 1103-11(1937). C.A. 31, 8340_7.

The exchange reaction between propane and D on a Ni catalyst takes place at temperatures about 90° lower than the hydrogenation-decomposition.

406

MERCURY-PHOTOSENSITIZED EXCHANGE REACTION OF DEUTERIUM AND PHOSPHINE. H. W. Melville and J. L. Bolland. Proc. Roy. Soc. (London) A160, 384-406(1937). C.A. 31, 8378_8.

Exchange reactions were studied in the temperature range 20-600° at pressures of 100-500 mm. The equilibrium constant for the reaction $PH_3 + HD \rightleftharpoons PH_2D + H_2$ calculated from spectral data varies from 1.37 at 0° to 1.05 at 700°. The exchange reaction of D with NH_3 is compared with that of D with PH_3.

407

THE ELECTROLYTIC SEPARATION OF THE HYDROGEN ISOTOPES ON A PALLADIUM CATHODE. A. Farkas. Trans. Faraday Soc. 33, 552-9(1937). C.A. 31, 8389_7.

Mixtures of H_2O and D_2O were electrolyzed in acid and alkaline solution with a Pd cathode. The separation factors of the evolved and occluded gas were found to be 6.6 and 4.4 respectively.

408

THE QUANTITATIVE SEPARATION OF HYDROGEN ISOTOPES BY FRACTIONAL DESORPTION. K. Peters and W. Lohmar. Z. physik. Chem. A180, 51-7(1937). C.A. 32, 20_9.

In studies of the separation of H_2 and D_2, fractional desorption in a vacuum at a properly selected temperature was found superior to all other methods.

409

THE EXCHANGE OF HYDROGEN ATOMS BETWEEN PYRROLE AND WATER. PRELIMINARY COMMUNICATION. M. Koizumi and T. Titani. Bull. Chem. Soc. Japan 12, 107-8(1937). C.A. 32, 28_1.

At pH 2 and 14-30° exchange of D between pyrrole occurs very slowly and only 1 H is replaced. Below pH 1 the rate of exchange becomes fast and all 5 H atoms can be replaced.

410

THE VELOCITIES OF THE EXCHANGE REACTIONS OF RESORCINOL AND PYROGALLOL IN HEAVY WATER. K. H. Geib. Z. physik. Chem. A180, 211-32(1937). C.A. 32, 28_2.

The exchange of the nuclear H atoms with water was studied under various conditions.

411

CONCENTRATION OF N^{15} BY CHEMICAL METHODS. Harold C. Urey, J. R. Huffman, H. G. Thode, and M. Fox. J. Chem. Phys. 5, 856-68(1937). C.A. 32, 41_6.

Reactions involving NH_3 as a gas phase and solutions of NH_3 in H_2O and EtOH, NH_4NO_3, and $(NH_4)_2SO_4$ in H_2O as a liquid phase were considered. NH_4NO_3 is probably the most satisfactory, however, the steel column was badly corroded by this solution.

412

CATALYTIC ISOTOPE EXCHANGE BETWEEN WATER AND OXYGEN. N. Morita and T. Titani. Bull. Chem. Soc. Japan 12, 104-6(1937). C.A. 32, 41_7.

Exchange of oxygen isotopes between gaseous O_2 and liquid or gaseous H_2O does not occur over Cu, Fe, or Ag catalysts. If the vapor of H_2O which contains heavy oxygen is passed over Pt with O_2 gas, exchange occurs, but below 400 to 500°C, the exchange is very slight.

413

POLAROGRAPHIC STUDIES WITH THE DROPPING-MERCURY CATHODE. LXX. HYDROGEN OVERVOLTAGE IN MIXTURES OF LIGHT AND HEAVY WATER AND THE SEPARATION COEFFICIENT. J. Heyrovsky. Collection Czechoslov. Chem. Communs. 9, 345-59(1937). C.A. 32, 54_2.

An equation for the overvoltage of H in acidified mixtures of light and heavy water is derived. Values for the electrolytic separation factor are calculated.

414

EXCHANGE REACTIONS WITH RADIOSULFUR. H. H. Voge, and W. F. Libby. J. Am. Chem. Soc. 59, 2474(1937). C.A. 32, 421_7.

Sulfide and sulfate did not show appreciable interchange in 36 hr at 100°, nor did sulfite and sulfate. Sulfide and thiosulfate show exchange at 100°, though this is not appreciable in less than 2 hr; that the reaction $S_2O_3^{2-} + S^{2-} = SO_3^{2-} + S_2^{2-}$ could be effective in this interchange is shown by an experiment with polysulfide.

415

THE SOLUBILITY OF DEUTERIUM AND HYDROGEN IN SOLID PALLADIUM. III. A. Sieverts and W. Danz. Z. physik. Chem. B38, 46-60(1937). C.A. 32, 855_3.

The solubility isobars for H_2 and D_2 were determined on Pd black between 350° and 20° at 740 mm pressure and corresponding isotherms at 300°, 120°, 100°, and 80° up to pressures of 1150 mm. The ratio of the solubilities, L_D/L_H = 0.68, 0.60 and 0.96 at 300°, 200° and room temperature respectively.

416

FRACTIONATION OF OXYGEN ISOTOPES IN THE DISTILLATION OF WATER. A. I. Brodskii, V. A. Aleksandrovich, and O. K. Skarre. Zhur. Fiz. Khim. 10, 538-9(1937). C.A. 32, 1155_5.

Fractionation of O^{16} and O^{18} was obtained by distillation of water through a 200 cm. constant temperature column with a counter stream of air or CO_2.

417

THE ELECTROLYTIC SEPARATION FACTOR OF DEUTERIUM AT VERY LOW CONCENTRATIONS. H. F. Walton and J. H. Wolfenden. J. Chem. Soc. 1677-9(1937). C.A. 32, 1186_9.

The electrolytic separation factor for D on Ni electrodes for both natural H_2O and H_2O containing 2% D was found to be about 6-8 after correction for evaporation.

418

DEUTERIUM AND HEAVY WATER. A. L. Borocco. Rev. chim. ind. (Paris), 46, 322-9(1937). C.A. 32, 1528_9.

A review.

419

INVESTIGATION OF THE CONCENTRATION OF D_2O IN NATURAL ICE. IV. E. Baroni and A. Fink. Monatsh. 71, 128-30(1937). C.A. 32, 1529_1.

It was shown from a study of 9 snow samples that atmospheric moisture is lighter than inland or sea water.

420

THE PLATINUM ELECTRODE AS A CATALYST FOR THE ACTIVATION OF HYDROGEN. II. M. Calvin and H. E. Dyas. Trans. Faraday Soc. 33, 1492-5 (1937). C.A. 32, 1554_4.

The rate of interchange between hydrogen and water is considerably diminished by cathodic polarization of the Pt catalyst.

421

ISOTOPIC EXCHANGE REACTIONS OF ORGANIC COMPOUNDS. II. A SURVEY OF THE MONOCARBOXYLIC ACID SERIES. D. J. G. Ives. J. Chem. Soc. 81-91(1938). C.A. 32, 2084_9.

This work is concerned with the isotopic exchange reactions of hydrogen linked with carbon in a series of monocarboxylic acids. A modified and improved density method of isotopic analysis, accurate to a few ppm and suitable for small samples, is described.

422

ISOTOPIC EXCHANGE REACTIONS OF ORGANIC COMPOUNDS. III. KINETICS OF THE ISOMERATION AND ISOTOPE EXCHANGE OF VINYLACETIC ACID. D. J. G. Ives. J. Chem. Soc. 91-7(1938). C.A. 32, 2085_5.

It has been found that the exchange reaction of vinylacetic acid and water proceeds faster than the isomerization.

423

PROTOTROPY IN RELATION TO THE EXCHANGE OF HYDROGEN ISOTOPES. III. COMPARISON OF THE RATES OF RACEMIZATION AND OF HYDROGEN EXCHANGE IN A ψ-ACIDIC KETONE. S. K. Hsü, C. K. Ingold, and C. L. Wilson. J. Chem. Soc. 78-81(1938). C.A. 32, 2106_6.

It is concluded that bromination, racemization and H exchange are all controlled by the same fundamental process, which is the ionization of the ketone.

424

THE ELECTROLYTIC SEPARATION OF HYDROGEN AND DEUTERIUM AND THE CATALYZED EXCHANGE REACTION $HD + H_2O \rightarrow H_2 + HDO$. J. A. V. Butler. Z. Elektrochem. 44, 55-62(1938). C.A. 32, 2410_9.

A review article including 19 references is presented.

425

EXCHANGE REACTIONS BETWEEN LIGHT AND HEAVY HYDROGEN. C. K. Ingold and C. L. Wilson. Z. Elektrochem. 44, 62-72(1938). C.A. 32, 2411_1.

Review of work on exchange reactions in homogeneous solutions, rates of exchange, catalysis by H_2SO, and active metal catalysts. 64 references.

426

THE CATALYTIC INTERACTION OF ETHYLENE AND HEAVY HYDROGEN ON PLATINUM. A. F. Farkas and L. Farkas. J. Am. Chem. Soc. 60, 22-8(1938). C.A. 32, 2414_5.

The interaction of D_2 and C_2H_4 on platinized Pt foil at pressures of 10-100 mm. in the temperature range 0-236° has been studied. The temperature coefficient of the exchange reaction ($C_2H_4 + D_2 = C_2H_3D + HD$) is larger than that of the hydrogenation and corresponds to an activation energy of 22 kcal.

427

THE INTERACTION OF HYDROGEN AND DEUTERIUM ON ZINC OXIDE. E. A. Smith and H. S. Taylor. J. Am. Chem. Soc. 60, 362-71(1938). C.A. 32, 2815_3.

The rate of the reaction $H_2 + D_2 \rightarrow 2HD$ on ZnO was determined between 140° and 491°K.

428

THE ISOTOPIC INTERCHANGE EQUILIBRIUM BETWEEN HEAVY WATER AND ITS VAPOR. M. Ikushima and S. Azakami. J. Chem. Soc. Japan 59, 40-6(1938). C.A. 32, 2831_1.

The constants of the equilibrium HDO (g) + H_2O (l) $\rightleftharpoons$ HDO (l) + H_2O (g) have been determined between 0 and 160°. The structure of water in the liquid state is discussed.

429

WATERS OF DIFFERENT DENSITIES. E. W. Washburn. U. S. Patent 2,108,570. Feb. 15, 1938. C.A. 32, 2851_3.

Water with an added electrolyte is electrolyzed.

430

EXCHANGE BETWEEN LIGHT AND HEAVY OXYGEN. I. OXYGEN INTERCHANGE BETWEEN SULFATE IONS AND WATER. S. C. Datta, J. N. E. Day, and C. K. Ingold. J. Chem. Soc. 1968-71(1937). C.A. 32, 3242_1.

Experiments show that O_2 exchange between Na_2SO_4 and neutral H_2O is at most very slow. By contrast, in the presence of a one normal concentration of OH ions, rapid interchange of O_2 occurs between the sulfate ion and the solvent H_2O.

431

THE SEPARATION OF THE LITHIUM ISOTOPES. THE PARTIAL SEPARATION OF Li^6 AND Li^7 BY ELECTROLYSIS. Ludwig Holleck. Z. Elektrochem. 44, 111-120 (1938). C.A. 32, 3271_1.

A solution of LiCl was electrolyzed with a flowing Hg cathode. The Li was reconverted to LiCl and re-electrolyzed. The Li^6 was enriched 71%, and the separation factor calculated for the electrolytic fractionation of the Li isotopes is 1.079.

432

CONCENTRATING HEAVY WATER. A. I. Brodskiĭ, V. A. Aleksandrovich, M. M. Slutskaya, and M. K. Shelud'ko. Ber. Inst. physik. Chem. Akad. Wiss. Ukr. S.S.R. 5, 151-4(1936). C.A. 32, 3685_6.

Work is reported on the extraction of 99% D_2O from H_2O in 6 electrolytic steps, of which the first 2 were performed in alkaline medium with Fe electrodes, and one with Pb and 3 with Pt electrodes in acid medium.

433

HEAVY WATER IN GLACIAL ICE. H. Mark. Russ.-Ger. Vestnik Nauki-Tekh. No. 9, 19(1935). Chem. Zentr., II, 1293(1936). C.A. 32, 4023_9.

A review of the subject of heavy water and the possibility of determining the age of glaciers from the D_2O content of the glacial ice.

434

OXYGEN EXCHANGE REACTIONS OF ORGANIC COMPOUNDS AND WATER. Mildred Cohn and H. C. Urey. J. Am. Chem. Soc. 60, 679-87(1938). C.A. 32, 4054_3.

The O of hydroxyl and carboxyl groups (except chloroacetic acids) does not exchange with water, but the O of the carbonyl group in Me_2CO and AcH does exchange. The O exchange reaction between Me_2CO and water is catalyzed by H^+, OH^- and salicylic and molecules.

435

RAPID EXCHANGE BETWEEN DEUTERO-AMMONIA [AMMONIA-d_3] AND HYDRAZINE. Paul C. Cross and Philip A. Leighton. J. Am. Chem. Soc. 60, 981-2(1938). C.A. 32, 4055_3.

ND_3 and N_2H_4 in contact at 26.5° for 30 seconds gave a product with 45% of D_2 in the N_2H_4, while the NH_3 contained 39% of ND_3; mixtures from which the N_2H_4 was frozen out within a few minutes showed similar analyses.

436

INTERCHANGE REACTIONS OF OXYGEN. II. THE INTERCHANGE OF OXYGEN BETWEEN WATER AND ACETALDEHYDE. J. B. M. Herbert and I. Lauder. Trans. Faraday Soc. 34, 432-5(1938). C.A. 32, 4055_4.

AcH in aqueous solution forms ethylidene glycol in an equilibrium mixture. If water containing excess of O^{18} is used, the reversible reaction occurs $CH_3CHO + H_2O^{18} \rightleftharpoons CH_3CH(OH)\cdot(O^{18}H)$. In the reverse change, there is equal probability that the O^{18} isotope will be in the AcH or in the water. The time for half-change at 20° is about 2 hours.

437

EXCHANGE REACTIONS OF HYDROGEN WITH DEUTERIUM. III. EXCHANGE IN AMINO GROUPS. M. M. Slutskaya, Z. M. Shershever and A. I. Brodskiĭ. Acta Physicochim. U.R.S.S. 6, 441-6(1937). C.A. 32, 4056_3.

The H and D exchange is reversible with an exchange coefficient of 1.00 ± 0.05 for hydrazine sulfate, urea, acetamide, glycine, and O-aminobenzoic acid.

438

THE ELECTROLYTIC SEPARATION OF DEUTERIUM; THE INFLUENCE OF TEMPERATURE AND CURRENT DENSITY AT VARIOUS CATHODE METALS. H. F. Walton and J. H. Wolfenden. Trans. Faraday Soc. 34, 436-49(1938). C.A. 32, 4084_4.

The electrolytic separation of the isotopes of H was carried out with different metallic cathodes at current densities of 1 ma/cm^2. These metals fall into two groups: Ag, Pt, and Ni with separation factors of 5 to 7, which fall considerable with a rise in temperature; and Hg and Sn with separation factors of about 3.

439

PROTOTROPY IN RELATION TO THE EXCHANGE OF HYDROGEN ISOTOPES. IV. ISOMERIZATION AND EXCHANGE IN METHYLENEAZOMETHINE. F. De Salas and C. L. Wilson. J. Chem. Soc. 319-21(1938). C.A. 32, 4544_1.

Exchange with EtOD solvent was measured.

440

EXCHANGE REACTION OF OXYGEN ATOM BETWEEN CARBONATE ION AND WATER. PRELIMINARY COMMUNICATION. T. Titani, N. Morita and K. Goto. Bull. Chem. Soc. Japan 13, 329-30(1938). C.A. 32, 4862_6.

A sample of D_2O that had been concentrated with respect to O^{18} by fractional distillation was allowed to stand over dry K_2CO_3. The water was removed by distillation and repeated until 30g of salt had been treated. No exchange between oxygen of CO_3 and H_2O was shown.

441

EXCHANGE REACTION OF HYDROGEN ATOMS BETWEEN NITROPHENOL AND WATER. I. EXCHANGE REACTION AND HYDROGEN BINDING. M. Koizumi and T. Titani. Bull. Chem. Soc. Japan 13, 318-28(1938). C.A. 32, 4863_1.

The H atom of the OH group exchanges almost immediately. All H atoms eventually exchange.

442

EXCHANGE OF HYDROGEN ATOMS BETWEEN PYRROLE, INDOLE, AND THEIR METHYLENE DERIVATIVES AND WATER. IV. EXCHANGE OF HYDROGEN ATOMS BETWEEN INDOLE AND WATER. M. Koizumi and T. Titani. Bull. Chem. Soc. Japan 13, 307-18(1938). C.A. 32, 4863_2.

Between pH 2.5 and 7 the H atom attached to the N of melted indole exchanged rapidly with D_2O, at lower pH values other H's exchange.

443

SEPARATION OF GASEOUS ISOTOPES BY DIFFUSION. R. Sherr. J. Chem. Phys. 6, 251-9(1938). C.A. 32, 4874_8.

The behavior of a set of 12 Hertz Hg diffusion pumps was investigated, separation factors were determined for: Br in MeBr; C in CH_4; O_2; O_2 in H_2O; Ne; A. Increased factors are obtained by eliminating back diffusion.

444

EXCHANGE REACTIONS OF ACETIC ACID AND ACETATE ION IN HEAVY WATER. L. D. C. Bok and K. H. Geib. Naturwissenschaften 26, 122(1938). C.A. 32, 5283_3.

In K acetate solutions the exchange is independent of the acetate concentration. Alkali catalyzes the exchange. The exchange with undissociated AcOH is catalyzed by H ion.

445

CONCENTRATION OF CHLORINE ISOTOPES BY CENTRIFUGING. J. W. Beams and A. V. Masket. Phys. Rev. 51, 384(1937). C.A. 32, 5293_5.

CCl_4 was ultracentifuged and fractions of its vapor were collected. The density measurements agree with the theoretical separation factor.

446

CATALYTIC ISOTOPIC EXCHANGE OF GASEOUS OXYGEN. I. EXCHANGE REACTION OF OXYGEN ATOMS BETWEEN OXYGEN AND WATER VAPOR AS WELL AS CARBON DIOXIDE ON THE SURFACE OF PLATINUM SPONGE AND METALLIC PLATINUM. N. Morita and T. Titani. Bull. Chem. Soc. Japan 13, 357-70(1938). C.A. 32, 5697_3.

The exchange reaction between O_2 and H_2O was studied by passing gases over Pt sponge and over Pt metal. The reaction between O_2 and CO_2 over Pt sponge is also reported.

447

EXCHANGE REACTIONS WITH DEUTERIUM. II. THE PHOTOCHEMICAL EXCHANGE BETWEEN DEUTERIUM AND HYDROGEN CHLORIDE. P. A. Leighton and P. C. Cross. J. Chem. Phys. 6, 345-9(1938). C.A. 32, 6136_2.

The photochemically initiated reaction between D_2 and HCl is a chain reaction.

448

ENRICHMENT OF THE RADIOACTIVE POTASSIUM ISOTOPE IN THE ORGANISM. J. Pohlmann and H. Netter. Naturwissenschaften 26, 138 (1938). C.A. 32, 6270_4.

K isolated from the ash of various organs was counted. Evidence for isotopic concentration was inconclusive.

449

PRECISION DETERMINATIONS OF THE DENSITIES OF DEUTERIUM OXIDE AND WATER. ELECTROLYTIC SEPARATION OF THE OXYGEN ISOTOPES. L. Tronstad and J. Burn. Trans. Faraday Soc. 34, 766-73(1938). C.A. 32, 6520_4.

One hundred % D_2O and H_2O of the same oxygen isotopic ratio as in air were prepared by the reaction of D_2 and H_2, made by electrolysis of large quantities 99.5% D_2O and of natural water, with CuO. The electrolytic separation factor of the O_2 isotopes is 1.036.

450

ENRICHMENT OF DEUTERIUM OXIDE BY ELECTROÖSMOSIS. St. V. Thyssen. Naturwissenschaften 26, 198(1938). C.A. 32, 6526_6.

The dielectric constant of D_2O is 80.5, its internal friction coefficient 12.6; hence it migrates more slowly in electroösmosis. An anodic cell consisting of a magnetic rod anode and a Zn cathode separated by a porous clay diaphragm used in this experiment produced an enrichment of 10.6.

451

FRACTIONATION OF THE LITHIUM AND POTASSIUM ISOTOPES BY CHEMICAL EXCHANGE WITH ZEOLITES. T. I. Taylor and Harold C. Urey. J. Chem. Phys. 6, 429-38(1938). C.A. 32, 7340_9.

The fractionation of the Li isotopes by electrolysis and of the Li, K, and N isotopes by chemical exchange with zeolites was investigated. The mechanism of the process is discussed.

452

EXCHANGE REACTION OF CELLULOSE AND HEAVY WATER. HYDRATION OF CELLULOSE. G. Champetier and R. Villard. Bull. soc. chim. France (5) 5, 1042-8(1938). C.A. 32, 8767_3.

Samples of ashless filter paper and of ordinary and mercerized cotton linters were dried at 120°C in vacuo over P_2O_5 and immersed under D_2O in one leg of an inverted U-tube. The exchange reaction corresponds to $C_6H_7O_2(OH)_3 + 3D_2O = C_6H_7O_2(OD)_3 + 3HDO$.

453

THE SATURATED VAPOR PRESSURE OF NEON ISOTOPES. W. H. Keesom and M. J. Haantjes. Proc. 7th Intern. Congr. Refrig., The Hague-Amsterdam 1936, 2, No. 14, 112-16 (1937). C.A. 32, 8866_2.

Studies were made to determine the constants appearing in the theoretical vapor pressure equation of solid Ne. By measuring various isotopic compositions, it was possible to calculate by extrapolation the vapor pressures of the pure isotopes with masses 20 and 22.

454

EXCHANGE REACTION OF HYDROGEN ATOMS BETWEEN SUGAR AND WATER. M. Koizumi and T. Titani. Bull. Chem. Soc. Japan 13, 427-36(1938). C.A. 32, 8892_2.

The exchange reaction is complete in less than 1 minute. The apparent distribution coefficient of D between the OH of several hexoses and water is 1.15.

455

EXCHANGE OF DEUTERIUM BETWEEN METHANOL AND WATER: VIBRATIONS OF THE HYDROXYL GROUP IN METHANOL AND METHANOL-d; THE ENTROPY OF METHANOL. J. O. Halford and B. Pecherer. J. Chem. Phys. 6, 571-5(1938). C.A. 32, 8892_4.

The equilibrium constant for the reaction MeOH + DOH = MeOD + HOH is 0.481 ± 0.015.

456

THE CATALYTIC INTERACTION OF HYDROGEN AND DEUTERIUM WITH ETHYLENE AND DEUTEROETHYLENES ON COPPER. G. G. Joris, H. S. Taylor, and J. C. Jungers. J. Am. Chem. Soc. 60, 1982(1938). C.A. 32, 8897_1.

In experimental studies over the temperature range-20° to 40° it is found that the reaction of D with the several ethylenes is approximately one-half that of H.

457

THE SEPARATION OF THE CARBON ISOTOPES BY DIFFUSION. P. Capron, J. M. Delfosse, M. de Hemptinne, and Hugh S. Taylor. J. Chem. Phys. 6, 656(1938). C.A. 32, 8923_6.

C^{13} was concentrated to 30-32% in a Hertz type diffusion system using CH_4 gas.

458

THE SEPARATION OF THE HYDROGEN ISOTOPES IN THE PHOTOCHEMICAL LIBERATION OF HYDROGEN FROM AQUEOUS SOLUTIONS. A. Farkas and L. Farkas. Trans. Faraday Soc. 34, 1120-7(1938). C.A. 32, 8942_5.

The separation of H isotopes during the photochemical liberation of H from aqueous solutions (15-78% D) of acidified iodide, sulfite, and Fe^{2+} ions shows factors of 3.7-6.5, 10.6, and 3.8-4.8 respectively.

459

HEAVY WATER. F. Hansgirg. British Patent 487,066. June 15, 1938. C.A. 32, 9415_6.

D_2O is obtained by reducing H_2O with a chemical reducing agent (such as CO) to produce H_2 which is equilibrated with H_2O at above 100° using Pt black catalyst. The H_2O is condensed and the cycle repeated.

460

THE RELATIVE ADSORBABILITIES OF HYDROGEN AND DEUTERIUM. A. Wheeler. J. Chem. Phys. 6, 746-8(1938). C.A. 33, 21_4.

By constructing simple partition functions of the absorbed molecules and atoms, equal adsorption at low temperatures and an inversion temperature at higher temperatures are predicted. Both predictions are fulfilled by the experimental results.

461

VELOCITY OF HYDROGEN-ATOM EXCHANGE OF ACETONE IN DILUTE AQUEOUS SODIUM HYDROXIDE. W. D. Waters and K. F. Bonhoeffer. Z. physik. Chem. A182, 265-74(1938). C.A. 33, 28_2.

The velocity of introduction of D into acetone from a NaOH solution in H_2O and D_2O was studied and found to be proportional to the hydroxyl ion concentration.

462

ENRICHMENT OF N^{15} ISOTOPE AND SPECTROSCOPIC STUDY OF N^{15}. H. Krüger. Naturwissenschaften 26, 445(1938). C.A. 33, 34_9.

By using a N^{14}-N^{15} mixture of 1.9% N^{15} there was obtained a 4:1 ratio by enrichment in a 42-step Hertz diffusion apparatus. The ionized N^{15} molecular spectrum indicated that the N^{15} nucleus follows Fermi statistics and has a mechanical moment of ½.

463

ISOTOPIC EXCHANGE REACTIONS OF ORGANIC COMPOUNDS. IV. THE MECHANISM OF RACEMIZATION OF PHENYL-p-TOLYLACETIC ACID. D. J. G. Ives and G. C. Wilks. J. Chem. Soc. 1455-8(1938). C.A. 33, 169_9.

The rate of exchange with solvent 3% D_2O was studied.

464

NEW PROCESS FOR SEPARATION OF GAS MIXTURES AND ISOTOPES. Klaus Clusius and G. Dickel. Naturwissenschaften 26, 546(1938). C.A. 33, 474_8.

The gas or isotope mixture is placed between vertical walls, one cold, one hot. Because of thermal diffusion and thermosiphon effect the heavier component collects at the bottom, the lighter one at the top.

465

KINETICS OF EXCHANGE REACTIONS. H. A. C. McKay. Nature 142, 997-8(1938). C.A. 33, 1199_9.

In isotopic exchange reactions, such as AX* + BX = AX + BX* (where X* is labeled), where the isotopes have identical chemical properties, it would not be possible, even in principle, to determine the order of the reaction from a single concentration-time curve.

466

VAPOR PRESSURE OF ISOTOPES. K. F. Herzfeld and E. Teller. Phys. Rev. 54, 912-15(1938). C.A. 33, 1559_3.

If all the degrees of freedom in a vapor are nearly classical and if there is no association, the vapor pressure of the lighter isotope is always higher. Inharmonicity and the change in the van der Waals forces probably account for those cases in which the heavier isotope has the higher vapor pressure.

467

AN ATTEMPTED EXCHANGE OF PHOSPHORUS BETWEEN PHOSPHOROUS AND PHOSPHORIC ACIDS. J. Norton Wilson. J. Am. Chem. Soc. 60, 2697-9 (1938). C.A. 33, 1559_8.

No exchange of radioactive P between phosphorous acid and phosphoric acid in acid or alkaline solution was found beyond the limits of experimental error.

468

THE EXCHANGE OF PHOSPHORUS IN SOME COMPOUNDS. C. Perrier and E. Segrè. Ricerea sci 9, I, 638-9 (1938). C.A. 33, 1587_9.

No exchange of radioactive P was found between 0.1N $NaNH_4HP^*O_4$ and 0.1N Na_3PO_2 heated together at 100°C for 24 hours.

469

THE FURTHER CONCENTRATION OF N^{15}. H. G. Thode and Harold C. Urey. J. Chem. Phys. 7, 34-9(1939). C.A. 33, 1588_3.

A study was made on the application of the chemical exchange reaction between gaseous NH_3 and aqueous NH_4NO_3 in securing high concentrations of N^{15}. The apparatus consists of several glass columns packed and arranged in cascade.

470

CONCENTRATING ISOTOPES SUCH AS THOSE OF HYDROGEN AND OXYGEN DERIVED FROM WATER. Wells A. Webb. U. S. Patent 2,137,430, Nov. 22, 1938. C.A. 33, 1606_4.

A process for concentrating isotopes by electrolysis comprising of simultaneously decomposition and of recombining products from one batch to that of another. Various details of the apparatus are described.

471

INTERCHANGE REACTIONS OF OXYGEN. III. THE INTERCHANGE OF OXYGEN BETWEEN WATER AND ACETIC ACID. J. B. Herbert and I. Lauder. Trans. Faraday Soc. 34, 1219-21(1938). C.A. 33, 1661_5.

The results show that there is no detectable exchange of oxygen between water and HOAc, KOAc, or Acetamide, respectively. There should be an exchange if hydration of the acid to the ortho form occurs.

472

EXCHANGE REACTION OF THE OXYGEN ATOM BETWEEN A FEW INORGANIC ANIONS AND WATER. PRELIMINARY COMMUNICATION. T. Titani and K. Goto. Bull. Chem. Soc. Japan 13, 667-8(1938). C.A. 33, 2021_9.

There is no exchange of oxygen between K_2SO_4 and H_2O at 180°C in 100 hr but the addition of $KHSO_4$ causes complete exchange of oxygen in both SO_4- and HSO_4-ions in 20 hr. Similar results were obtained with $NaClO_3$ where addition of HCl causes complete exchange in 10 hr at 100°C.

473

EXCHANGE REACTIONS OF HYDROGEN ATOMS BETWEEN NITROPHENOL AND WATER. II. CHEMISTRY OF THE REACTION. M. Koizumi and T. Titani. Bull. Chem. Soc. Japan 13, 595-600; 631-43(1938). C.A. 33, 2022_2.

The rate of exchange of the second exchangeable H-atom in nitrophenol may be determined graphically from the exchange rate studies.

474

EXCHANGE OF HYDROGEN ATOMS BETWEEN PYRROLE, INDOLE, AND THEIR METHYLENE DERIVATIVES AND WATER. V. EXCHANGE OF HYDROGEN ATOMS BETWEEN N-METHYLINDOLE AND WATER. M. Koizumi, Y. Komaki, and T. Titani. Bull. Chem. Soc. Japan 13, 643-51(1938). C.A. 33, 2022_3.

The exchange of H was studied between melted N-methylindole and D_2O at 60°. Below pH 2.5 rapid exchange occurs with the H atom attached to the carbon in the β position.

475

CATALYTIC ISOTOPIC EXCHANGE OF GASEOUS OXYGEN. II. EXCHANGE REACTION OF OXYGEN ATOM BETWEEN OXYGEN AND WATER VAPOR ON SURFACES OF AMORPHOUS SILICON DIOXIDE, QUARTZ GLASS AND PUMICE STONE. N. Morita and T. Titani. Bull. Chem. Soc. Japan 13, 601-7(1938). C.A. 33, 2024_2.

There is no exchange between oxygen atom and H_2O on amorphous SiO_2 below 650°C but there is exchange above 700°. If 2 volumes of oxygen and one of water are allowed to flow slowly over quartz, asbestos, or pumice, there is no exchange at 800°.

476

HEAVY WATER AND HYDROGEN. A. E. Knowles. German Patent 666,393. Oct. 19, 1938. C.A. 33, 2294_1.

Stagewise electrolysis in which condensed water vapor from the electrolysis cell is used to feed the next stage. The hydrogen from the later stages is liquified and separated by fractional distillation.

477

SEPARATION PROCESSES. SEPARATION OF ISOTOPES BY FRACTIONAL DISTILLATION OF WATER. M. Randall and W. A. Webb. Ind. Eng. Chem. 31, 227-30(1939). C.A. 33, 2381_6.

Preliminary experiments showed that a fractionating column of 12 inches diameter increased the D_2O concentration to the point that almost pure D_2O could be obtained from the product by the electrolytic process.

478

THE EXCHANGE REACTION OF THE NUCLEAR HYDROGEN ATOMS OF PHENOL. I. EXCHANGE REACTION IN ALKALINE SOLUTION. M. Koizumi and T. Titani. Bull. Chem. Soc. Japan 13, 681-90(1938). C.A. 33, 2399_4.

The velocity constants for the exchange of the o-o′ and p-H atoms of phenol with D in an alkaline solution of dilute heavy H_2O were determined for temperatures between 89 and 120°.

479

OXYGEN EXCHANGE BETWEEN CARBON DIOXIDE; BICARBONATE ION, CARBONATE ION, AND WATER. G. A. Mills and Harold C. Urey. J. Am. Chem. Soc. 61, 534(1939). C.A. 33, 2399_5.

Preliminary details of experiments to be reported in more detail later.

480

THE CONCENTRATION OF C^{13} BY CHEMICAL EXCHANGE. I. Roberts, H. G. Thode and Harold C. Urey. J. Chem. Phys. 7, 137-8(1939). C.A. 33, 2409_2.

A 20% solution of NaCN is added at the rate of 1 cc/min. to the top of a 3 meter column. The solution draining from the bottom reacts with H_2SO_4, and the HCN returns through the column. C^{13} concentrates in the gas phase and N^{15} in the liquid phase by ratios of 1.84 and 1.09, respectively, at equilibrium.

481

VAPOR PRESSURES AND EXCHANGE CONSTANTS OF ISOTOPIC COMPOUNDS. Harold C. Urey, A. Mills, I. Roberts, H. G. Thode, and J. R. Huffman. J. Chem. Phys. 7, 138(1939). C.A. 33, 2409_3.

When MeOH was distilled, O^{18} was accumulated in the bottom of the column, but C^{13} was unchanged. Distillation of HCOOH gave no change in C. CO_2 versus CO_2 dissolved in acetone gave no change in C. SO_2 versus SO_2 dissolved in $PhNO_2$, MeOH or H_2O gave no change in S^{34} concentration. The HCl versus HCl in H_2O exchange gave slight concentrations of Cl^{35} in the liquid phase. The exchange of H_2S with NaSH gave an increased concentration of S^{34} in the gas. C_2H_2 versus C_2H_2 dissolved in acetone gave concentration of heavy C in the liquid phase. CO exchanging with CuCl-CO complex in acid solution gave a concentration of C^{13} in the solution.

482

ACID AND BASE CATALYSIS IN LIGHT AND HEAVY WATER. II. HYDROLYSIS AND DEUTERIUM EXCHANGE OF ACETAMIDE AND ACETONITRILE. O. Reitz. Z. physik. Chem. A183, 371-91(1939). C.A. 33, 3240_4.

In alkaline solution the hydrolysis velocity and the D exchange in the Me groups are commensurable; in the nitrile the exchange is 30 to 40 times faster than the hydrolysis, in the amide only 0.5 times as fast.

483

EXCHANGE OF HYDROGEN IN AQUEOUS SOLUTIONS OF ACETIC ACID AND ACETATES. L. D. C. Bok and K. H. Geib. Z. physik. Chem. A183, 353-70(1939). C.A. 33, 3240_7.

The exchange of H in the Me group of ordinary acetate and HOAc with D in D_2O and correspondingly with deuterated acetate and DOAc with H in H_2O were measured at 100-200°.

484

CONCENTRATION OF THE HEAVY ISOTOPE OF OXYGEN AND THE ISOTOPIC ANALYSIS OF WATER. O. K. Skarre and A. I. Brodskii. Doklady Akad. Nauk S.S.S.R. 20, 565-8(1938). C.A. 33, 3642_6.

By continuous distillation of water through a Cu fractionating column containing rotating and stationary inverted cones, a concentration of H_2O^{18} and D_2O was obtained in the reflux and bottoms. Equations are given connecting separation with a number of theoretical plates in the column.

485

DO THE ISOTOPES OF AN ELEMENT HAVE IDENTICAL CHEMICAL PROPERTIES? T. I. Taylor. Science 89, 176-7(1939). C.A. 33, 3687_6.

The chemical separation of the isotopes of H, N, C, O, Li, and K by Urey, et. al., is discussed.

486

THE SEPARATION OF ISOTOPES FOR THE INVESTIGATION OF NUCLEAR TRANSMUTATIONS. E. L. Yates. Proc. Roy. Soc. (London) A168, 148-58 (1938). C.A. 33, 3687_7.

A mass spectrograph was used to prepare deposits of 2-30 μg of the separated isotopes of Li, B, and C. A filament-type ion source was used with Li; B, and C in ions were produced in a low voltage capillary arc running in BF_3 and in CD_4 + He, respectively. The apparatus is described.

487

CATALYTIC EXCHANGE OF DEUTERIUM AND HYDROGEN IN HYDROCARBONS. A. Farkas and L. Farkas. Nature 143, 244(1939). C.A. 33, 3754_9.

Gaseous mixtures of D_2 and cyclohexane were brought into contact with a platinized Pt foil. The temperatures and half-times were determined. The reaction in each case was: RH + D_2 = RD + HD. This is a convenient method for the preparation of deuterated hydrocarbons.

488

HYDROGEN-DEUTERIUM EXCHANGE IN ACETONE. A. I. Brodskiĭ and M. M. Slutskaya. J. Phys. Chem. U.S.S.R. 11, 278-9(1938). C.A. 33, 4112_1.

The coefficient of exchange was 1.21.

489

EXCHANGE REACTION OF HYDROGEN ATOMS BETWEEN NITROPHENOL AND WATER. III. ACTIVATION ENERGY. M. Koizumi and T. Titani. Bull. Chem. Soc. Japan 14, 40-7(1939). C.A. 33, 4498_3.

The exchange was studied in N KOH between 100 and 139°.

490

CATALYTIC ISOTOPIC EXCHANGE OF GASEOUS OXYGEN. IV. THE EXCHANGE REACTION OF THE OXYGEN ATOM BETWEEN OXYGEN AND WATER VAPOR ON SURFACE OF THE OXIDES OF CALCIUM, TITANIUM, VANADIUM, CHROMIUM, MANGANESE, IRON AND NICKEL. N. Morita, H. Tanaka, and T. Titani. Bull. Chem. Soc. Japan 14, 9-15(1939). C.A. 33, 4500_5.

The catalytic activity of a surface is measured as that temperature at which exchange is first detected. The catalytic effect on the exchange between oxygen atom and H_2O vapor increases in the order: TiO_2, V_2O_5, Fe_2O_3, NiO, CaO, Cr_2O_3, and Mn_3O_4. The oxides may be arranged in two groups within which the activity increases with increasing atomic number.

491

CATALYTIC EXCHANGE OF DEUTERIUM AND HYDROGEN IN HYDROCARBONS. S. R. Craxford, G. H. Twigg, and E. K. Rideal. Nature 143, 472-3(1939). C.A. 33, 4858_2.

In the catalytic exchange reaction between D and olefins, the elementary step involves the additon of a D atom and not the loss of an H atom. There is also evidence that in the chemisorption and rupture of saturated hydrocarbons on a catalyst surface, chemisorbed H plays a part.

492

CATALYTIC EXCHANGE OF HYDROGEN. C. Horrex, R. K. Greenhalgh, and M. Polanyi. Trans. Faraday Soc. 35, 511-20(1939). C.A. 33, 4858_6.

Gas phase exchanges using Pt an glass wool were studied. Benzene exchanges more rapidly with H_2 than do saturated hydrocarbons: however the exchange of benzene with water proceeds at about the same rate as water with saturated hydrocarbons. Cyclohexane exchanges more slowly with HCl than with water or hydrogen.

493

EXCHANGE REACTIONS WITH RADIOSULFUR. H. H. Voge. J. Am. Chem. Soc. 61, 1032-5(1939). C.A. 33, 4869_2.

S^{35} was used as an indicator to determine the extent to which exchange of S takes place between various compounds. Exchange is rapid in polysulfide ion at 100°. One of the S atoms in thiosulfate ion is rapidly transferred to sulfite ion at 100°, but exchange between thiosulfate and sulfide is much slower.

494

CONCENTRATION OF CARBON OF ATOMIC WEIGHT 13 BY THE DIFFUSION METHOD. M. de Hemptinne and P. Capron. J. phys. radium 10, 171-5(1939). C.A. 33, 5281_8.

In a battery of 51 Hg-diffusion pumps the single stage coefficient for the separation of C^{13} in CH_4 was determined to be 1.10-1.14. Product 50% C^{13} was obtained.

495

THE SEPARATING-TUBE PROCESS FOR LIQUIDS. Klaus Clusius and G. Dickel. Naturwissenschaften 27, 148-9(1939). C.A. 33, 5705_8.

With a 20 × 1 mm. tin vessel, 1.5 m. long, the top of which was heated by steam or hot water, the bottom cooled by cold water and the slope varied to give optium convection conditions there was obtained from a D_2O-H_2O mixture in 8 hr at 80° temperature difference. The D_2O content at the light end was 62.9% and at the heavy end 64.5%.

496

MEASUREMENT AND STATISTICAL CALCULATION OF THE EQUILIBRIUM $D_2 + H_2S \rightleftharpoons H_2 + D_2S$. D. Grafe, K. Clusius, and A. Kruis. Z. physik. Chem. B43, 1-19(1939). C.A. 33, 5730_5.

The equilibria: $3H_2S + 2Bi \rightleftharpoons 3H_2 + Bi_2S_3$ and the corresponding are for D_2S were measured for 350 to 600°. Combination of the results gives $K = (D_2)(H_2S)/(H_2)(D_2S)$. The results were $K = 0.85_5$, 0.88_9, 0.91_9, 0.94_3, 0.96_3 at 350, 400, 450, 500, 550, and 600° respectively. Spectroscopic data was used to calculate theoretical constants.

497

DETERMINATION AND CALCULATION OF THE EQUILIBRIUM CONSTANTS FOR ISOTOPIC HYDROGEN EXCHANGE IN THE SYSTEMS n-AMYL ALCOHOL-WATER AND ETHYLTHIOL-WATER. VAPOR PRESSURES AND RAMAN SPECTRA OF n-AMYL DEUTERIOALCOHOL AND ETHYL DEUTERIOTHIOL. F. W. Hobden, E. F. Johnston, L. H. P. Weldon, and C. L. Wilson. J. Chem. Soc. 61-7(1939). C.A. 33, 5730_7

Data on the OH, SH, NH and CH bonds.

498

THE EXCHANGE REACTION BETWEEN ETHYLENE AND DEUTERIUM ON A NICKEL CATALYST. G. H. Twigg and E. K. Rideal. Proc. Roy. Soc. (London) A171, 55-69(1939). C.A. 33, 5732_7.

The exchange and hydrogenation reactions between C_2H_4 and D_2 were investigated over the range 60-207°.

499

THE CATALYTIC INTERACTION OF ACETONE AND ISOPROPYL ALCOHOL WITH DEUTERIUM ON PLATINUM. A. Farkas and L. Farkas. J. Am. Chem. Soc. 61, 1336-41(1939). C.A. 33, 6128_3.

Above 0° on Pt foil catalyst an exchange of H between acetone and H_2 accompanies the reduction. The exchange reaction between H_2 and iso-PrOH is stepwise.

500

THE THEORY OF ISOTOPE SEPARATION BY THERMAL DIFFUSION. W. H. Furry, R. Clark Jones, and L. Onsager. Phys. Rev. 55, 1083-95(1939). C.A. 33, 6148_2.

501

A CHEMICAL SEPARATION OF THE ISOTOPES OF HYDROGEN. L. H. Reyerson, Q. Johnson, and C. Bemmels. J. Am. Chem. Soc. 61, 1594-5(1939). C.A. 33, 6148_2.

On treating H_2O-D_2O mixtures with CaC_2, it was found that the $Ca(OH)_2$ formed contained 0.6-3.2% more D than the original water.

502

NEW PROSPECTS IN ISOTOPE SEPARATION. Hugh S. Taylor. Nature 144, 8-9(1939). C.A. 33, 6148_2.

503

THE SEPARATION OF CHLORINE ISOTOPES. Klaus Clusius and G. Dickel. Naturwissenschaften 27, 148(1939). C.A. 33, 6148_3.

The separation of Cl isotopes was studied by the use of the thermal method with a separation tube of 36 m; the heavy side yielded daily 8cc HCl of 99.4% Cl^{37}; from the light side there was obtained 2l HCl and Cl of atomic weight 35.147, 1l with Cl of 35.06.

504

THE ENRICHING OF THE N^{15} ISOTOPE AND SOME SPECTROSCOPIC INVESTIGATIONS ON N^{15}. H. Kruger. Z. Physik. 111, 467-74(1939). C.A. 33, 6154_7.

The method of Hertz is employed with 43 pumps and clay tubes. The $N^{14}N^{15}$ molecule is separated from the N_2^{14}

molecule since the latter is present to the extent of 0.8%, but the concentration of N_2^{15} is only 0.0016% and it cannot be separated. The separation achieved is such that the end product has a ratio $N^{14}:N^{15}$ of 4:1.

505

PRODUCTION OF "HEAVY WATER." F. Hansgirg. U. S. Patent 2,156,851. May 2, 1939. C.A. 33, 6538_4.

In this process water is partially reduced with CO to H. This H is equilibriated with water in the presence of a catalyst and the water-partially recycled. The cycle is repeated.

506

THE THEORY OF GAS-SEPARATION PROCESS OF CLUSIUS AND DICKEL. Ludwig Waldmann. Naturwissenschaften 27, 230-1(1939). C.A. 33, 6672_6.

The arrangement for separation of gases including isotopes based on convection and diffusion currents between hot and cold plates is calculated mathematically. Expressions are derived for the currents, the densities, etc.

507

ISOTOPIC EXCHANGE EQUILIBRIA. W. H. Hamill. Proc. Indiana Acad. Sci. 48, 110-12(1939). C.A. 33, 6689_9.

Isotopic exchange equilibrium constants with water were measured for $CO(NH_2)_2$, NaOH, $KHSO_4$, KH_2PO_4, $C_2H_4(COOH)_2$ and $p\text{-}C_6H_4(OH)_2$ at two concentrations of D_2O.

508

A THERMAL METHOD FOR THE SEPARATION OF ISOTOPES. Arthur Bramley and A. Keith Brewer. J. Chem. Phys. 7, 553-4(1939). C.A. 33, 6714_5.

Tests were made using NH_3-CH_4 mixtures in concentric glass tube separation chambers. The efficiency of separation of a component of low concentration is improved by adding sufficient inert gas of the same mass to give an initial 1:1 mass mixture. In the mixture used $C^{13}H_4$ and $N^{14}H_3$ had the same separation factors.

509

HEAVY WATER. F. Hansgirg. German Patent 674,965. Apr. 26, 1939. C.A. 33, 7054_3.

The water remaining after the catalytically accelerated preparation of H from CO and excess steam is returned to such processes untill no further addition of D occurs.

510

THE THEORY OF THE GAS SEPARATION PROCESS OF CLUSIUS AND DICKEL. W. Van der Grinten. Naturwissenschaften 27, 317(1939). C.A. 33, 7163_8.

An equation for the equilibrium condition similar to that of Waldmann but differing in numerical constants was found.

511

INDUSTRIAL MANUFACTURE AND APPLICATIONS OF HEAVY WATER AND OF DEUTERIUM DERIVATIVES. E. Darmois. Tech. ind. chim. No. 284 bis 16-18(1939). C.A. 33, 7497_8.

A review.

512

SEPARATION OF LIQUID MIXTURES IN THE CLUSIUS SEPARATION TUBE (Separation of Zinc Isotopes). Horst Korsching and Karl Wirtz. Naturwissenschaften 27, 367-8 (1939). C.A. 33, 7643_1.

Separation was effected by thermal diffusion of $ZnSO_4$ and $ZnCl_2$ solutions. The concentration ratio of Zn^{64}/Zn^{68} above and below were 3.2 and 2.7; of Zn^{64}/Zn^{66}, 1.95 and 1.7. In normal zinc the ratios are 2.93 and 1.89.

513

CONCENTRATION OF THE HEAVY OXYGEN ISOTOPES BY DISTILLATION OF WATER AND THE ISOTOPIC ANALYSIS OF WATER. A. I. Brodskii and O. K. Skarre. Acta Physicochim. U.R.S.S. 10, 729-52(1939). C.A. 33, 7662_6.

A description and discussion of the theory of a 200 cm, 400-cone, Cu fractionation column are given.

514

USE OF ISOTOPES IN CHEMICAL REACTIONS. I. THE MECHANISM OF THE WAGNER-MEERWEIN REARRANGEMENT. EXCHANGE OF RADIOACTIVE CHLORINE AND DEUTERIUM BETWEEN CAMPHENE HYDROCHLORIDE AND HYDROGEN CHLORIDE. T. P. Nevell, E. De Salas, and C. L. Wilson. J. Chem. Soc. 1188-99(1939). C.A. 33, 7766_4.

The speed of H exchange and Cl exchange were calculated.

515

INTERCHANGE BETWEEN CHROMIOXALATE ION AND OXALATE ION USING RADIOCARBON. F. A. Long. J. Am. Chem. Soc. 61, 570-2(1939). C.A. 33, 8087_2.

The exchange of $C_2O_4^{2-}$ at 35° is negligibly small, hence racemization of optically active $[Cr(C_2O_4)_3]$ does not involve ionization of the coordination complex.

516

EXCHANGE REACTION OF THE OXYGEN ATOM BETWEEN A FEW INORGANIC ANIONS AND WATER. T. Titani and K. Goto. Bull. Chem. Soc. Japan 14, 77-85 (1939). C.A. 33, 8094_9.

The exchange of O was studied in acid, alkaline, and neutral solutions of K_2SO_4, KNO_3, $NaClO_3$, K_2CO_3, KH_2AsO_4, KH_2PO_4, and $KHSO_4$ and at various temperatures. At higher temperatures and in acid solutions, the mechanism involves the intermediate formation of an anhydride molecule of the acid.

517

HOMOGENEOUS CATALYTIC HYDROGENATION. M. Calvin. J. Am. Chem. Soc. 61, 2230-4(1939). C.A. 33, 8095_5.

Quinone in quinoline solution is hydrogenated with dissolved CuOAc as a catalyst. The rate is proportional to the concentration of the dissolved H_2, and to somewhat higher than the second power of the CuOAc concentration. The reaction is inhibited slightly by quinone, and the amount of H adsorbed is sufficient for reduction to quinhydrone.

518

EXPERIMENTS ON SEPARATION OF ISOTOPE MOLECULES IN A DIRECT-CURRENT GLOW DISCHARGE. W. Groth and P. Harteck. Naturwissenschaften 27, 390-1 (1939). C.A. 33, 8102_6.

Efforts to separate Xe isotopes in a glow discharge were unsuccessful. H_2/D_2 ratios were changed from 1.00 to 1.30 with D concentrating at the cathode.

519

THE SEPARATION OF ISOTOPES. Harold C. Urey. Pub. Am. Assoc. Advance. Sci. No. 7, Recent Advances in Surface Chemistry and Chem. Phys. 73-87(1939). C.A. 33, 8109_7.

A review article with 37 references.

520

A NOTE ON THE CONSTRUCTION AND OPERATION OF A THERMAL DIFFUSION COLUMN FOR THE SEPARATION OF ISOTOPES. T. I. Taylor and George Glockler. J. Chem. Phys. 7, 851-2(1939). C.A. 33, 8109_8.

521

ISOLATION OF THE LIGHT CHLORINE ISOTOPE OF ATOMIC WEIGHT 34.979 IN A SEPARATING TUBE. Klaus Clusius and G. Dickel. Naturwissenschaften 27, 487(1939). C.A. 33, 8109_9.

522

SEPARATION OF THE ISOTOPES OF CHLORINE BY ELECTROLYSIS. Krikor V. Yacoubyan. Helv.

Chim. Acta 22, 808-9 (1939). C.A. 33, 8110_2.

A solution of 3N HCl and 20% NaCl was electrolyzed. Thirty-six kg of Cl ion was electrolyzed until only 24 g remained. The atomic weight was found to increase from 35.464 to 35.480 with Cl^{37} concentrating in the residue.

523

FRACTIONATION OF THE HYDROGEN ISOTOPES IN THE DISTILLATION OF ETHYL ALCOHOL. A. H. Widiger and W. G. Brown. J. Am. Chem. Soc. 61, 2453-4(1939). C.A. 33, 8463_8.

C_2H_5OD and C_2H_5OH undergo a partial separation when fractionally distilled with small laboratory columns. The degree of isotopic separation is comparable with that observed in the distillation of water.

524

REACTIVITY OF LOWER HYDROCARBONS. VIII. MERCURY-SENSITIZED REACTIONS OF METHANE, DEUTERIOMETHANES AND THE HYDROGEN ISOTOPES (EXCHANGE REACTION). K. Morikawa. J. Soc. Chem. Ind. Japan 42, Suppl. binding 133-6(1939). C.A. 33, 8529_4.

The interactions of $CH_4 + D_2$ and $CH_4 + CD_4$ under the influence of excited Hg were studied.

525

THE EFFECT OF BAFFLES ON THE THERMAL SEPARATION OF GASES. A. Keith Brewer and Arthur Bramley. J. Chem. Phys. 7, 972 (1939). C.A. 33, 9053_4.

The separation factor for gases, particularly isotopes, is enhanced by the addition of baffles to the apparatus.

526

THERMAL METHOD FOR THE SEPARATION OF GASES AND ISOTOPES. Arthur Bramley and A. Keith Brewer. Science 90, 165-6(1939). C.A. 33, 9068_3.

Tests were made using NH_3-CH_4 mixtures in concentric glass tube separation chambers. The mechanism involves thermal diffusion and an over-all convection current.

527

CONCENTRATION OF HEAVY CARBON BY THERMAL DIFFUSION. W. W. Watson. Phys. Rev. 56, 703(1939). C.A. 33, 9093_9.

A 3-stage apparatus is described. A separation factor of 2.0 was obtained with methane; this is considerably below the theoretical value.

528

HYDROGEN AND DEUTERIUM EXCHANGE BETWEEN NITRAMIDE AND WATER. V. K. La Mer and S. Hochberg. J. Am. Chem. Soc. 61, 2552-3(1939). C.A. 33, 9099_7.

From a study of the decomposition of $D_2N_2O_2$ and direct exchange it is seen that in the decompositon of nitranide in D_2O-H_2O both H atoms are promptly exchanged.

529

MECHANISM OF CATALYTIC EXCHANGE REACTIONS BETWEEN DEUTERIUM AND OLEFINS. G. H. Twigg. Trans. Faraday Soc. 35, 934-45(1939). C.A. 33, 9103_2.

All the H atoms in the higher olefins are exchangeable with D under conditions where no exchange takes place between ethane and D. Energies of activation for exchange and hydrogenation on Ni catalyst over the range 55 to 120° were determined for various olefins.

530

CATALYTIC EXCHANGE OF HYDROGEN ATOMS BETWEEN MOLECULAR DEUTERIUM AND HEXANE AND CYCLOHEXANE. A. Farkas and L. Farkas. Trans. Faraday Soc. 35, 917-20(1939). C.A. 33, 9103_4.

This catalytic exchange takes place on platinized Pt foil at 15-200°.

531

ACTIVATION OF HYDROGEN IN CATALYTIC REACTIONS OF HYDROCARBONS. A. Farkas. Trans. Faraday Soc. 35, 906-17(1939). C.A. 33, 9103_5.

The rate of dissociation of H_2 on catalyst surfaces can be followed by the rate of the exchange reaction $H_2 + D_2 = 2HD$. In exchange reactions hydrocarbons are partially split into H atoms and hydrocarbon radicals at the surface.

532

SEPARATION OF BROMINE ISOTOPES BY CENTRIFUGATION. Richard F. Humphries. Phys. Rev. 56, 684-91 (1939). C.A. 33, 9126_5.

The theory of isotope separation by ultracentrifugation is developed. Br^{79} was enriched 11% relative to Br^{81} by centrifugation of EtBr.

533

THE KINETICS OF EXCHANGE REACTIONS. I. n-BUTYL BROMIDE. L. J. LeRoux and S. Sugden. J. Chem. Soc. 1279-83(1939). C.A. 33, 9128_1.

Rate measurements were made on the exchange reaction $BuBr + Br^{*-} \rightleftharpoons BuBr^* + Br^-$, in a Me_2CO solution. The rate of the reaction in solution is of the same order of magnitude as that predicted by the collision theory for a gaseous system.

534

EXCHANGE REACTIONS OF NITROGEN ISOTOPES ON IRON AND TUNGSTEN SURFACES. George G. Joris and Hugh S. Taylor. J. Chem. Phys. 7, 893-8(1939). C.A. 33, 9128_2.

The activities of Fe synthetic-NH_3 catalysts and of W filaments in promoting the reaction between N_2^{15} and N_2^{14} were studied from room temperature to 725° with Fe and to 900° with W. The exchange is accelerated by the presence of H. The data suggest that measurements of the velocity of N adsorption at about 400° on synthetic-NH_3 catalysts are measurements of true activated adsorption.

535

THE CONCENTRATION OF ISOTOPES BY THE EVAPORATIVE CENTRIFUGE METHOD. J. W. Beams and C. Skarstrom. Phys. Rev. 56, 266-72(1939). C.A. 33, 9128_5.

The air-driven vacuum-type tubular centrifuge was used for the concentration of the isotopes of Cl by the evaporative centrifuge method. The method is believed to be practical for the heavier elements.

536

SEPARATION OF ISOTOPES. W. Walcher. Ergeb. exakt. Naturw. 18, 155-228(1939). C.A. 34, 23_7.

The following methods of isotope separation are reviewed and compared: electrolysis, diffusion, fractional distillation, chemical exchange reactions, diffusion with a thermal gradient, centrifuge, mass spectroscope, and photochemical reactions. Methods of determining isotopic ratios in mixtures are also treated. 192 references to literature between 1932 and 1939 are presented.

537

EXPERIMENTS ON THE SEPARATION OF ISOTOPES. E. H. Riesenfeld. Arkiv. Kemi. Mineral. Geol. 13A, No. 16, 11(1939). C.A. 34, 23_8.

The Hertz diffusion (sweep diffusion) method of separating isotopes is improved by using continuous flow in an open system instead of a closed system. Nitrogen isotopes were used as an experimental example.

538

THE EXCHANGE OF HYDROGEN IONS BETWEEN HYDROGEN SULFIDE AND METHANOL. K. H. Geib. Z. Elektrochem. 45, 648-50 (1939). C.A. 34, 311_3.

The rates of the H-D exchange reactions between MeOH and D_2S and between MeOD and

H_2S were studied at -79 and -115°. At -79° the half time is 0.2 to 0.5 minutes.

539

HYDROGEN EXCHANGE OF DIMETHYL SULFONE AND SODIUM-METHANE-SULFONATE IN ALKALINE SOLUTION. J. Hochberg and K. F. Bonhoeffer. Z. physik. Chem. A184, 419-28(1939). C.A. 34, 311_5.

Dimethyl sulfone dissolved in alkaline D_2O shows a gradual exchange of its H atoms with those of the solvent. Na methanesulfonate exchanges much more slowly.

540

NONINTERCHANGE OF ELEMENTARY RADIOSULFUR WITH CARBON DISULFIDE. R. A. Cooley, Don M. Yost and E. McMillan. J. Am. Chem. Soc. 61, 2970-1(1939). C.A. 34, 319_8.

541

EXCHANGE REACTIONS IN DEUTERIOALCOHOL. II. W. G. Brown, M. S. Kharasch and W. R. Sprowls. J. Org. Chem. 4, 442-55(1939). C.A. 34, 390_2.

Compounds of the type $PhNMe_2$, Ph_3N, Ph_2NH, and various substituted derivatives were exchanged with EtOD at various pH values. Fluorene and its derivatives were also examined and some other organic compounds.

542

THE SEPARATION TUBE. I. PRINCIPLES OF A NEW METHOD OF GAS AND ISOTOPE SEPARATION BY THERMAL DIFFUSION. Klaus Clusius and G. Dickel. Z. physik. Chem. B44, 397-450(1939). C.A. 34, 673_9.

Complete details of the method are given. Preliminary experiments were made with CO_2-H_2, Xe-H_2, and Br_2-He mixtures.

543

THE SEPARATION TUBE. II. SEPARATION OF THE CHLORINE ISOTOPES. Klaus Clusius and G. Dickel. Z. physik. Chem. B44, 451-73(1939). C.A. 34, 674_3.

The method was applied to HCl in a 36 meter tube. Atomic weight determinations were made to measure the extent of separation. Comparison is made with other methods of isotope separation.

544

THE CATALYTIC INTERCHANGE OF ACETYLENE AND HYDROGEN ON PLATINIUM. A. Farkas and L. Farkas. J. Am. Chem. Soc. 61, 3396-3401(1939). C.A. 34, 932_1.

The catalytic hydrogenation of C_2H_4 was investigated at pressures of 70-150 mm in the temperature range of 20-140° on a Pt catalyst. The mechanisms of hydrogenation and exchange reactions are discussed.

545

ISOTOPE EXCHANGE REACTION BETWEEN DEUTERIUM OXIDE AND CIS- AND TRANS-GLUTACONIC ACIDS. E. M. Evans, H. N. Rydon, and H. V. A. Briscoe. J. Chem. Soc. 1673-9(1939). C.A. 34, 989_1.

The exchange reactions between cis- and trans-glutaconic acids and D_2O in the presence of an excess of alkali have been studied. The results clearly show that 3 H atoms are concerned, a result in accordance with modern views on tautomerism. The exchange reaction with glutaric acid was also studied in order to establish that CH_2 groups exchanged only slowly even when present in a molecule containing 2 activating groups such as CO_2H.

546

INVESTIGATION OF THE EXCHANGE BETWEEN A METAL AND IONS IN SOLUTION BY USING RADIOACTIVE INDICATORS. B. V. Rollin. J. Am. Chem. Soc. 62, 86-7(1940). C.A. 34, 1230_5.

Experiments using radioactive silver show that exchange takes place between a solution of Ag^+ ions and a surface of metallic Ag. The exchange was increased by a factor of 10 if the surface was pretreated with $NaNO_3$ solution; these results are unexplained.

547

HYDROGEN EXCHANGE REACTIONS OF ESTERS IN RELATION TO REACTIVITY IN CONDENSATION REACTIONS. W. G. Brown and K. Eberly. J. Am. Chem. Soc. 62, 113-15 (1940). C.A. 34, 1303_8.

NaOEt-catalyzed H exchange reactions of various types of esters with EtOD have been studied.

548

THEORY OF THE CLUSIUS SEPARATION. P. Debye. Ann. physik. 36, 284-94(1939). C.A. 34, 1531_3.

The theory of the Clusius separation (thermal diffusion) as applied to liquids is developed for the case of two plates, where the concentration dependence of the diffusion constants is neglected as is the temperature dependence of the viscosity. The equilibrium and the time course of the process are discussed.

549

THEORY OF THE ISOTOPE SEPARATION PROCESS OF CLUSIUS AND DICKEL. Ludwig Waldmann. Z. Physik 114, 53-81(1939). C.A. 34, 1557_2.

The combination of convection, thermo-diffusion and ordinary diffusion is considered. The equations are solved for a plane arrangement. The equilibrium separation efficiency is obtained under simplifying assumptions and also the time of establishment of a steady state with and without gas flow.

550

THE EXCHANGE REACTION OF THE NUCLEAR HYDROGEN ATOMS OF PHENOL. II. THE EXCHANGE REACTION IN ACID SOLUTION. M. Koizumi. Bull. Chem. Soc. Japan 14, 1353-62(1939). C.A. 34, 1902_8.

The reaction $C_6H_5OH + HDO = C_6H_4DOH + H_2O$ was studied at 4 temperatures between 90 and 120°.

551

CONCENTRATION OF N^{15} BY THE SEPARATING-TUBE PROCESS OF CLUSIUS AND DICKEL. R. Fleischmann. Z. Physik. 41, 14-18(1940). C.A. 34, 1910_8.

With 2 tubes 12 meter long and 9 and 11 mm in diameter, 770 cc gas with 9.2% $N^{14}N^{15}$ was obtained in 6 weeks. From this concentrate 110 cc containing 18% $N^{14}N^{15}$ was obtained in 2.5 weeks.

552

THE CONCENTRATION OF CARBON 13 BY THERMAL DIFFUSION. A. O. Nier. Phys. Rev. 57, 30-4(1939). C.A. 34, 2250_3.

A thermal diffusion column employing CH_4 gas has been constructed for the purpose of concentrating C^{13}. A determination of the separation factor of the column for various pressures indicated a quantitative agreement between experiment and theory. When a reservoir was attached to the top of the column it was possible to produce CH_4 containing over 4 times the normal amount of $C^{13}H_4$.

553

CONCENTRATION OF ISOTOPES BY THERMAL DIFFUSION: RATE OF APPROACH TO EQUILIBRIUM. J. Bardeen. Phys. Rev. 57, 35-41(1939). C.A. 34, 2250_4.

The time-dependent partial differential equation involved in the theory of the operation of a Clusius thermal-diffusion column is discussed. Solutions presented give the concentration of a given isotope at any point in the column as a function of time.

554

EXCHANGE REACTIONS OF NUCLEAR HYDROGEN ATOMS OF ANILINE HYDROCHLORIDE IN AQUEOUS SOLUTION. I. THE REACTION IN NEUTRAL AND ACID SOLUTION.

M. Koizumi. Bull. Chem. Soc. Japan 14, 530-9(1939). C.A. 34, 2342_7.

The rate of the reaction was studied.

555

EXCHANGE OF HYDROGEN ATOMS BETWEEN PYRROLE, INDOLE AND THEIR METHYLENE DERIVATIVES AND WATER. VI. EXCHANGE OF HYDROGEN ATOM BETWEEN α-METHYL-, β-METHYL-, AND α,β-DIMETHYLINDOLE AND WATER. M. Koizumi. Bull. Chem. Soc. Japan 14, 453-61(1939). C.A. 34, 2371_4.

The exchange was studied between dilute D_2O and the above compounds at pH values from −0.5 to 7.0.

556

EXCHANGE OF HYDROGEN ATOMS BETWEEN PYRROLE, INDOLE AND THEIR METHYLENE DERIVATIVES AND WATER. VII. EXCHANGE OF HYDROGEN ATOM BETWEEN INDOLE, INDENE AND WATER IN ALKALINE SOLUTION. M. Koizumi. Bull. Chem. Soc. Japan 14, 491-500(1939). C.A. 34, 2371_6.

Both the H atom bound to N and that bound to C in the pyrrole ring exchange in indole and indene in alkaline solution.

557

THE VAPOR PRESSURES, HEATS OF VAPORIZATION AND MELTING POINTS OF N^{14} AND N^{15} AMMONIAS. H. G. Thode. J. Am. Chem. Soc. 62, 581-3(1940). C.A. 34, 2664_4.

The vapor pressure difference between 70.6% $N^{15}H_3$ and ordinary NH_3 was measured for the liquids over the temperature range 197.7−239.5°K. Assuming the vapor pressure of an isotopic mixture is a linear function of the mole fractions the equation

$$\log_{10} [P(N^{14}H_3)]/[P(N^{15}H_3)] \quad \frac{1.3665}{T} - 0.004632$$

represents the ratio of the pressures.

558

HYDROGEN ISOTOPE EXCHANGE REACTION. J. O. Halford. J. Chem. Phys. 8, 243-7(1940). C.A. 34, 2710_1.

The possibility of deriving the equilibrium constants for the higher D substitutions from the isotope exchange coefficient are examined. Calculations on the NH_3 and CH_4 reactions with water are used.

559

EXCHANGE REACTIONS BETWEEN DEUTERIUM AND HYDROGEN HALIDES. I. HYDROGEN CHLORIDE. H. Steiner and E. K. Rideal. Proc. Roy Soc. (London) A173, 503-30(1939). C.A. 34, 3159_4.

The reactions D_2 + HCl and H_2 + DCl were studied at temperatures from 752-900°K.

560

THERMAL SEPARATION RATIOS CALCULATED FROM VISCOSITY DATA. Harrison Brown. Phys. Rev. 57, 242-3(1940). C.A. 34, 3550_8.

An index of the ease (or difficulty) of separation of isotopes by the thermal diffusion-thermal siphoning method is calculated for He, Ne, A, Xe, Cl, Br, I, HCl, HI, O, H, N, NH_3, NO, N_2O, CH_4, C_2H_6, C_3H_8, C_2H_2, CO_2, CO, and SO_2.

561

CALCULATION OF THE THERMAL DIFFUSION CONSTANT FROM VISCOSITY DATA. R. Clark Jones and W. H. Furry. Phys. Rev. 57, 547 (1940). C.A. 34, 3550_9.

A correction factor which should be applied to Brown's values of R_T (C.A. 34, 3550_8) is calculated. It is not sufficient to invalidate Brown's qualitative arguments.

562

MECHANISM OF THE EXCHANGE REACTION BETWEEN GASEOUS BROMINE AND HYDROGEN BROMIDE. W. F. Libby. J. Chem. Phys. 8, 348(1940). C.A. 34, 3567_6.

A rapid homogeneous reaction was observed between Br_2 and HBr in the gaseous state at room temperature. The reaction takes place in a direct reaction between Br_2 and HBr through a HBr_3 complex.

563

EXCHANGE REACTIONS BETWEEN GASEOUS ALKYL BROMIDES, BROMINE AND HYDROGEN BROMIDE. L. C. Liberatore and E. O. Wiig. J. Chem. Phys. 8, 349(1940). C.A. 34, 3567_7.

An investigation, using radioactive Br_2, of the exchange reactions EtBr + Br_2 and EtBr + HBr confirms the conclusion that the exchange reaction Br_2 + HBr proceeds by an atom chain. The bi-molecular mechanism, which goes through a HBr_3 complex and which requires an energy of activation less than 11 kg/cal is highly improbable.

564

THE INTERCHANGE OF HEAVY OXYGEN BETWEEN WATER AND INORGANIC OXY-ANIONS. E. R. S. Winter, M. Carlton, and H. V. A. Briscoe. J. Chem. Soc. 131-8 (1940). C.A. 34, 3570_2.

No measurable exchange was found between water and sulfate, phosphate or perchlorate in neutral, acid, or alkaline solutions in two days at 100°. Oxygen exchange is rapid with $NaSiO_3$, $Na_2B_4O_7$ and H_3BO_3 at 100°. Complete interchange with chlorate takes place in acid solution but not in neutral or alkaline solution. Nitrate exchanges completely in acid solution, but no interchange with N_2O occurs in 14 days at 20°. Dichromate or chromate in neutral or alkaline solutions exchange completely at 100° in one day. O interchange with oxy-anions may be attributed to known reactions involving the reversible addition of water to the anion.

565

THE EXCHANGE OF OXYGEN BETWEEN NO AND NO_2. E. Leifer. J. Chem. Phys. 8, 301-3 (1940). C.A. 34, 3570_4.

The reaction $N^{14}O + N^{15}O_2 = N^{15}O + N^{14}O_2$ was studied in the gas phase at −35° and 2.5 cm total pressure. The lower limit of the reaction rate constant is 10^6 cc moles^{-1} sec.$^{-1}$. The equilibrium constants for the exchange at 298.1 °K are 0.967 (calculated from spectroscopic data) and 9.96 ± 0.02 (observed). The energy of activation for the formation of N_2O_3 is small; it is probably less than 1 kg cal.

566

A NOTE ON THE EFFICIENCY OF THE THERMAL DIFFUSION PROCESS FOR SEPARATING ISOTOPES. J. W. Westhaver and A. Keith Brewer. J. Chem. Phys. 8, 314-16(1940). C.A. 34, 3587_3.

An ideal system of cells each having temperature limit of 300° and 500°K is found to require a minimum of 880 kw hr of conducted heat per g $C^{13}H_4$ extended to a concentration of 20%.

567

ENRICHMENT OF THE KRYPTON ISOTOPES BY THE SEPARATING TUBE PROCESS. W. Groth and P. Harteck. Naturwissenschaften 28, 47(1940). C.A. 34, 3587_4.

The enrichment of krypton isotopes using a thermal diffusion tube is described.

568

CATALYTIC ISOTOPIC EXCHANGE OF GASEOUS OXYGEN. V. ADSORPTION OF OXYGEN BY MANGANESE OXIDE AND THE EXCHANGE REACTION OF OXYGEN

ATOM BETWEEN OXYGEN GAS AND MANGANESE OXIDE. 2. EXCHANGE EXPERIMENTS AND DISCUSSION. N. Morita. Bull. Chem. Soc. Japan 15, 1-8(1940). C.A. 34, 3974_9.

Gaseous O, enriched in O^{18} was passed over a mixture of Mn_2O_3 and MnO_2 at temperatures of 200, 300 and 400°. Exchange of O was first detected at 300°. For the latter reaction, successive oxidation and decomposition of the oxide is an important factor.

569

EXCHANGE REACTIONS OF NUCLEAR HYDROGEN ATOMS OF ANILINE HYDROCHLORIDE IN AQUEOUS SOLUTION. II. THE REACTION IN ALKALINE SOLUTION. M. Koizumi. Bull. Chem. Soc. Japan 15, 8-15(1940). C.A. 34, 4061_7,

In alkaline solutions exchange takes place by the reaction. Ph NH_2 + Ph NH_2D^+ = $C_6H_4DNH_2$ + Ph NH_3^+.

570

THE KINETICS OF ISOTOPIC EXCHANGE BETWEEN CARBON DIOXIDE, BICARBONATE ION, CARBONATE ION AND WATER. G. A. Mills and Harold C. Urey. J. Am. Chem. Soc. 62, 1019-26(1940). C.A. 34, 4328_8.

Data are given for the O exchange between Na_2CO_3 and H_2O at 25.00 ± 0.02° and for the reaction-rate constants for the velocity of hydration of CO_2. The rate of C exchange between CO_2 and the bicarbonate ion was studied. Approximate rate constants were determined which are consistent with those established independently from the rate of hydration of CO_2. The rate of O exchange between CO_2, bicarbonate and carbonate ions, and H_2O was investigated. The exchange between CO_2 and H_2O is due to reversible hydration only. The addition of salts or acids does not affect this rate.

571

DIFFUSION OF HYDROGEN AND DEUTERIUM IN PALLADIUM. II. W. Jost and A. Widmann. Z. physik. Chem. B45, 285-96(1940). C.A. 34, 4632_2.

The ratio of the diffusion coefficients is less than the square root of two.

572

A METHOD FOR EXCHANGE OF LIGHT HYDROGEN WITH DEUTERIUM IN DIFFICULTLY SOLUBLE SUBSTANCES. A. Loebenstein. Helv. Chim. Acta. 23, 243-4(1940). C.A. 34, 4649_4.

By an extraction method all the material was eventually treated with D_2O. Uric acid exchanged all 4 H's with D_2O.

573

EXCHANGE REACTIONS OF NUCLEAR HYDROGEN ATOMS OF ANILINE HYDROCHLORIDE IN AQUEOUS SOLUTION. III. ACTIVATION ENERGY. M. Koizumi. Bull. Chem. Soc. Japan 15, 37-46(1940). C.A. 34, 4649_6.

The reaction was studied between 79 and 100°.

574

CATALYTIC ISOTOPIC EXCHANGE OF GASEOUS OXYGEN. VI. EXCHANGE REACTION OF OXYGEN ATOM BETWEEN OXYGEN AND WATER VAPOR ON THE SURFACE OF OXIDES OF THE SECOND, FOURTH, AND SIXTH GROUP OF THE PERIOD SYSTEM. I. EXPERIMENTAL PART. N. Morita. Bull. Chem. Soc. Japan 15, 47-55(1940). C.A. 34, 4650_7.

Gaseous O_2 enriched in O^{18} was passed over MgO, SrO, BaO, ZnO, CdO, ZrO_2, ThO_2, SnO_2, MoO_3, and WO_3 at 300-840°.

575

CATALYSIS OF ELECTROLYTIC GAS REACTION ON PLATINIZED CHARCOAL IN SOLUTIONS OF ELECTROLYTES. S. Levina and R. Rozentreter. Zhur. Fiz. Khim. 13, 942-7(1939). C.A. 34, 4650_8.

The catalysis was performed in pure H_2O and in the presence of 0.01-2.0N. HCl, NaCl, and NaOH. The H_2-D_2 exchange reaction and the $2H_2 + O_2$ reaction show a maximum rate in approximately 0.01N HCl solution.

576

ISOTOPE SEPARATION BY TRANSIENT PRESSURE DIFFUSION. E. J. Hellund. Phys. Rev. 57, 743-4(1940). C.A. 34, 4659_2.

A gas mixture is separated from a pure gas by a diaphragm. When the latter is removed, diffusion separates the mixture. For the diffusion of H_2 into air, the change in concentration of the latter is 1/2000. If the diffusing gas has a larger molecular diameter, the separation is increased by a factor of 60-70.

577

PRODUCTION OF HEAVY WATER. V. A. Aleksandrovich. Novosti Tekhniki, No. 26-7; 50-1(1939). C.A. 34, 4671_3.

A 5 stage electrolysis plant is described. For each ton of Dnieper River water 17-20 grams of 98% heavy water was produced with a current consumption of 150,000 ampere hours/gram of heavy water.

578

CATALYTIC EXCHANGE OF HYDROGEN ATOMS BETWEEN MOLECULAR DEUTERIUM AND PROPANE AND BUTANE. A. Farkas. Trans. Faraday Soc. 36, 522-7 (1940). C.A. 34, 4724_8.

The exchange of H atoms between molecular D and propane and butane on a Pt catalyst was investigated at pressures around 40-50 mm at 26-126°. These hydrocarbons exchange all their H atoms in a reversible manner, the exchange taking place readily at room temperature on a very active catalyst.

579

EXCHANGE REACTION BETWEEN AMMONIA AND HYDROGEN IN THE PRESENCE OF PLATINUM CATALYST. I. M. Mitani. Bull. Inst. Phys. Chem. Research Tokyo 18, 879-83(1939). C.A. 34, 4971_7.

The reaction between H_2-D_2 and NH_3 in presence of Pt black at −20°, 0°, 20°, and 50° was followed by the decrease in the D_2 concentration of the gas; this confirms the theoretical prediction of the exchange reaction.

580

CATALYTIC ISOTOPIC EXCHANGE OF GASEOUS OXYGEN. VI. THE EXCHANGE OF OXYGEN ATOM BETWEEN OXYGEN AND WATER VAPOR ON THE SURFACE OF OXIDES OF THE SECOND, FOURTH AND SIXTH GROUPS OF THE PERIODIC SYSTEM. (2) THEORETICAL PART. N. Morita. Bull. Chem. Soc. Japan 15, 71-6(1940). C.A. 34, 4972_2.

The catalytic activities of the oxides of Mg, Ca, Sr, Ba, Zn, Cd, Ti, Zr, Th, Cr, Mo and W are compared. Elements of the 4th group have the lowest activity. Activity for those in the 2nd group increases with increasing atomic number and in the 6th group, it decreases with increasing atomic number.

581

A THERMAL-GRAVITATIONAL METHOD FOR THE SEPARATION OF GASES AND ISOTOPES. A. Keith Brewer and Arthur Bramley. Phys. Rev. 55, 590(1939). C.A. 34, 4978_3.

A thermal diffusion apparatus using two concentric tubes is described.

582

SEPARATION OF GAS (ISOTOPE) MIXTURES BY IRREVERSIBLE PROCESSES. L. Onsager. Phys. Rev. 55, 1136(1939). C.A. 34, 4981_4.

The potentialities and limitations of processes like diffusion and thermal diffusion as a means of separating isotopes is discussed.

583

SEPARATION OF URANIUM ISOTOPES. W. Krasny-Ergen.

Nature 145, 742-3(1940). C.A. 34, 4984_9.

An apparatus for the concentration of U^{235} by thermal diffusion is described.

584

THERMAL SEPARATION OF ISOTOPES. Wm. W. Watson. Phys. Rev. 57, 899-902(1940). C.A. 34, 4985_2.

A multi-stage apparatus is described. The parts are built of Cu pipe and each unit is based on a 0.5 in. G. E. Calrod heater of 2 m effective heating length. Units can be connected from top to bottom as shown by tests on CH_4-N_2 mixtures.

585

NOTES ON THE SEPARATION OF ALLOYS AND ISOTOPES BY THE CENTRIFUGE. H. C.Pollock. Phys. Rev. 57, 935-6(1940). C.A. 34, 5032_7.

586

KINETICS OF INTERSOLVATE EXCHANGE. S. Z. Roginskiĭ and P. B. Afanaśev. Compt. rend. acad sci. U.R.S.S. 26, 376-9(1940). C.A. 34, 5724_5.

Equivalent solutions of NaBr in H_2O and acetone were prepared separately, the NaBr dissolved in H_2O being indicated by radiobromine. The exchange is a first-order reaction; its temperature coefficient is small. The results indicate that the redistribution involves only halogen ions of different origin, which form the nucleus of the solvate.

587

CATALYTIC ISOTOPIC EXCHANGE OF GASEOUS OXYGEN. VII. EXCHANGE MECHANISM OF THE OXYGEN ATOM BETWEEN OXYGEN AND WATER VAPOR ON THE SURFACE OF CALCIUM OXIDE. N. Morita. Bull. Chem. Soc. Japan 15, 119-29(1940). C.A. 34, 5732_9.

At temperatures up to 600°C, no adsorption or desorption of O gas was observed in the presence of CaO and at a pressure of ⅔ atmosphere. Exchange depends on activated adsorption of water vapor on the surface of the oxide and the same mechanism occurs with the oxides of the other alkaline earth metals.

588

THE CONCENTRATION OF C^{13}. Clyde A. Hutchison, David W. Stewart, and Harold C. Urey. J. Chem. Phys. 8, 532-7(1940). C.A. 34, 5747_9.

The chemical exchange methods was applied to the separation of the isotopes of C. Various exchange reactions were tested, by use of countercurrent flow in packed fractionation columns, and of these, the exchange between HCN gas and a solution of NaCN in H_2O was found to be the most efficient. The liquid and gas phases used and the separations obtained were: aqueous $KHCO_3$, CO_2, none; aqueous $KHCO_3$ with enzyme carbonic anhydrase, CO_2, 1.28; MeOH, MeOH, practically none; acid CuCl solution of CO, CO, 1.69; Me_2CO solution of C_2H_2, C_2H_2, 1.19 (−80°); Me_2CO solution of CO_2, CO_2, none; HCOOH, HCOOH, none; aqueous $MeNH_2$. HCl, $MeNH_2$, none; aqueous HCN, HCN, 0.9; aqueous NaCN, HCN, 6.7.

589

EQUILIBRIUM BETWEEN H_2O AND D_2O. I. R. Rao and Y. P. Rao. Current Sci. (India) 9, 171-2(1940). C.A. 34, 5755_9.

The shift in positions and change in intensity of the Raman bonds of H_2O and D_2O and of their mixtures are described and discussed.

590

THERMAL DIFFUSION SEPARATION OF RADIOACTIVE AND ORDINARY HYDROGEN ISOTOPES. G. T. Seaborg, A. C. Wahl and J. W. Kennedy. J. Chem. Phys. 8, 639-40 (1940). C.A. 34, 6522_4.

The separation factor of a thermal diffusion column was found to be substantially the same at moderate and at extremely small molecular fractions, from tests made on mixtures of H with D and of D with H^3. The separation factor increases with the temperature of the hot wire.

591

CONCENTRATION OF ISOTOPES BY THERMAL DIFFUSION. RATE OF APPROACH TO EQUILIBRIUM. J. Bardeen. Phys. Rev. 58, 94-5(1940). C.A. 34, 6522_5.

Additions and corrections are made to the previous article. (See Reference No. 534)

592

THE THEORY OF THE THERMAL DIFFUSION COEFFICIENT FOR ISOTOPES. R. C. Jones. Phys. Rev. 58, 111-22(1940). C.A. 34, 6522_6.

Various theories of thermal diffusion are discussed and treated in detail.

593

PACKED FRACTIONATION COLUMNS AND THE CONCENTRATION OF ISOTOPES. Karl Cohen. J. Chem. Phys. 8, 588-97(1940). C.A. 34, 6522_8.

The behavior of isothermal packed fractionating columns is calculated from their differential equation.

594

CATALYTIC ISOTOPIC EXCHANGE OF GASEOUS OXYGEN. IV. METHOD OF PREPARATION AND CATALYTIC ACTIVITY OF THE CATALYST; THE MIXED CATALYTIC EFFECT OF IMPURITIES. N. Morita. Bull. Chem. Soc. Japan 15, 226-34(1940). C.A. 34, 6523_1.

The catalytic exchange of water vapor with O was studied with CuO catalysts prepared in different ways. Pure samples of the catalyst showed the same activity. Those prepared with NaOH showed abnormally high activity. This is interpreted as a mixed catalytic effect due to small amounts of NaOH or Na_2O as impurity.

595

SEPARATION OF ISOTOPES BY CHEMICAL MEANS. Harold C. Urey. J. Wash. Acad. Sci. 30, 277-94(1940). C.A. 34, 6880_4.

The topics discussed are: theory of the separation by fractionation columns, concentration of O isotopes, chemical exchange reactions, critique of separation methods.

596

SEPARATION OF ISOTOPES OF POTASSIUM: LITHIUM, ETC. J. G. Dean. U. S. Patent 2,204,072, June 11, 1940. C.A. 34, 6882_4.

A process for changing the ratio of isotopes of an element contained in the cation of a salt such as LiCl or KCl involves bringing a solution of the salt into contact with extensive surfaces of a zeolitic material having a selective affinity for one of the isotopes, and segregating a portion of the solution containing the isotopes in a changed ratio.

597

CONCENTRATION OF THE HEAVY ISOTOPE OF OXYGEN AND THE ISOTOPIC ANALYSIS OF WATER. O. K. Skarre and A. I. Brodskiĭ. Repr. L. V. Pisarzhevs'kii Inst. Phys. Chem. Acad. Sci. Ukrain. S.S.R. 11, 75-98(1938). C.A. 34, 7153_6.

By continuous distillation of water through a Cu fractionating column containing rotating and stationary inverted cones, a concentration of H_2O^{18} and D_2O was obtained. Equations are given connecting separation with the number of theoretical plates in the column.

598

THE RATE OF EXCHANGE OF ELEMENTARY RADIO-SULFUR WITH SULFUR MONOCHLORIDE. R. A. Cooley and Don M. Yost. J. Am. Chem. Soc. 62, 2474-7(1940). C.A. 34, 7166_1.

Data are given for the rate of exchange of S between S_8 and S_2Cl_2. A satisfactory mechanism for the reaction consists in the slow dissociation $S_8 = S_6 + S_2$ followed by the rapid reversible reaction $S_2 + S_2Cl_4 = 2S_2Cl_2$.

599

CATALYTIC ISOTOPIC EXCHANGE OF GASEOUS OXYGEN. X. EXCHANGE REACTION OF GASEOUS OXYGEN BETWEEN OXYGEN AND WATER VAPOR ON THE SURFACE OF ALUMINUM OXIDE. INFLUENCE OF THE COMPOSITION OF THE GASEOUS REACTION MIXTURE ON THE DEGREE OF THE EXCHANGE REACTION. N. Morita. Bull. Chem. Soc. Japan 15, 298-308(1940). C.A. 34, 7712_3.

With an O_2-H_2O ratio of 2/1, the reaction rate becomes measurable at 520°C, and above 700°C the rate is rapid and equilibrium is established quickly. It is concluded that desorption of water vapor from the oxide surface determines the rate.

600

OXYGEN EXCHANGE BETWEEN WATER AND INORGANIC OXYANIONS. G. A. Mills. J. Am. Chem. Soc. 62, 2833-8 (1940). C.A. 34, 7714_3.

A weighed amount of the inorganic salt was dissolved in a definite amount of H_2O containing O^{18}. After a certain time the H_2O was distilled off in vacuo, purified and analyzed for O^{18}. The amount of exchange was then determined by comparison with the theoretical O^{18} value for complete exchange. The O exchange between water and Na_2CrO_4 proceeds at a rate faster than can be accounted for by the reaction $Cr_2O_7^{2-} + H_2O = 2HCrO_4^-$. Data are given for the O exchange between H_2O^{18} and the oxy-anions in the following: Pyrex glass, CrO_3, Na_2CrO_4, $KHSO_4$, K_2SO_3, $Na_2S_2O_5$, $K_2S_2O_3$, $KMnO_4$.

601

SEPARATION OF ISOTOPES BY THERMAL DIFFUSION. A. Bijl. Nederland Tijdschr. Natuurk. 7, 147-53(1940). C.A. 34, 7736_9.

Separation of molecules of different weights by thermal diffusion is briefly discussed and the underlying theory given. The results obtained by Clusius and Dickel and several others are mentioned.

602

SEPARATION OF ISOTOPES IN VALONIA AND NITELLA. A. G. Jacques. J. Gen. Physiol. 23, 741-2 (1940). C.A. 34, 7736_9.

Valonia and Nitella sap showed variation in the K^{39}/K^{41} ratio. Experiments were done by shaking a solution of 0.2M KOH with a mixture of 70% guaiacol and 30% p-cresol and recovering the KOH. After 13 repetitions the ratio K^{39}/K^{41} was 14.20 which was regarded as possibly significant.

603

ELECTROLYTIC WINNING OF HEAVY WATER. IV. T. Noguti. J. Electrochem. Assoc. Japan 6, 299-303(1938). Rev. Phys. Chem. Japan 13, 50(1939). C.A. 34, 7757_1.

The isotopic separation factor in electrolysis is due not to direct effect of temperature rise, but to the secondary effect of corrosion of the electrodes at high temperatures. In the present report, the experimental verification for this suggestion is given. By continuously polishing the Fe cathode with steelwool brushed, about 70% or more of the separation factor at high temperatures was recovered.

604

ELECTRODES FOR THE CONCENTRATION OF DEUTERIUM BY ELECTROLYSIS. T. Noguti and M. Awada. Japanese Patent 128,676. Feb. 6, 1939. C.A. 34, 7764_2.

The electrodes are kept clean by an automatic brush.

605

SEPARATION OF THE URANIUM ISOTOPES BY CENTRIFUGATION. H. W. Schulz. Sept. 15, 1940. 26p. (NP-1872).

Design of a centrifuge for multiple effect separation and a scheme of continuous operation in series is presented. No experiments were done.

606

DEPENDENCE OF THERMAL DIFFUSION ON THE CONCENTRATION RATIO. S. Chapman. Nature 146, 431(1940). C.A. 35, 354_9.

In the separation of isotopes by thermal diffusion, a great deal depends on the value of α in the equation $\alpha = k_T/c_1c_2$, where c_1 and c_2 are the volume-fractions of the consituents 1 and 2 ($c_1 + c_2 = 1$), k_T is the thermal diffusion ratio, and α is the thermal diffusion factor.

607

EFFICIENCY OF THE ELECTROLYTIC SEPARATION OF LITHIUM ISOTOPES. Herrick L. Johnston and Clyde A. Hutchison. J. Chem. Phys. 8, 869-77(1940). C.A. 35, 378_5.

The electrolytic separation coefficient was determined for the Li isotope separation in the electrolysis of LiCl solutions at a Hg cathode. Its value is 1.055 ± 0.005.

608

THE FURTHER CONCENTRATION OF S^{34}. D. W. Stewart and K. Cohen. J. Chem. Phys. 8, 904-7 (1940). C.A. 35, 688_5.

The exchange reaction $S^{34}O_2(g) + NaHS^{32}O_3(aq.) \rightleftharpoons S^{32}O_2(g) + NaHS^{34}O_3(aq.)$ was used to concentrate S^{34} from the usual abundance of 4.2 atom % to 25 atom %.

609

ISOTOPIC EXCHANGE REACTIONS OF ORGANIC COMPOUNDS. V. THE KINETICS OF THE ISOMERIZATION AND THE DEUTERIUM EXCHANGE REACTION OF 2-PENTENOIC ACID. D. J. G. Ives and R. H. Kerlogue. J. Chem. Soc. 1362-70(1940). C.A. 35, 731_4.

The D exchange which accompanies the isomerization in heavy water has been studied.

610

DISTILLATION COLUMN SUITABLE FOR PRODUCING HEAVY WATER. G. B. Pegram. U. S. Patent 2,218,342. Oct. 15, 1940. C.A. 35, 936_7.

611

OXYGEN EXCHANGE BETWEEN ANIONS AND WATER. N. F. Hall and O. R. Alexander. J. Am. Chem. Soc. 62, 3455-62(1940). C.A. 35, 960_2.

Determinations are reported of the extent of O exchange between H_2O and 22 inorganic compounds completely dissolved in it.

612

PREPARATION OF HEAVY WATER. V. A. Aleksandrovich and M. K. Shelud'ko. Zhru. Priklad. Khim. 13, 483-98 (1940). C.A. 35, 981_6.

An electrolytic separation method for the preparation of D_2O is described and data are tabulated. The electrolyzer with automatic circulation of electrolyte and with bipolar electrodes (with inner cooling) and apparatus for neutralization of alkali electrolyte and for safe combusion of explosive gas mixture evolved during electrolysis are described.

613

MEASUREMENT OF THE EQUILIBRIUM REACTION $H_2O + D_2 \rightleftharpoons D_2O + H_2$. Z. Sibata and M. Kuzirai. J. Chem Soc. Japan 61, 1199-1206(1940). C.A. 35, 1296_3.

By studying the two reactions, $FeO + H_2 \rightleftharpoons Fe + H_2O$ and $FeO + D_2 \rightleftharpoons Fe + D_2O$ at 700-1000° the equation $\log K_P = (305.982/T) - 0.13412$ is obtained for the exchange equilibrium $H_2O + D_2 \rightleftharpoons D_2O + H_2$.

614

OPTIMAL DIMENSIONS OF A CLUSIUS AND DICKEL ISOTOPE SEPARATOR. Wm. Krasny-Ergen. Phys.

Rev. 58, 1078-85(1940). C.A. 35, 1312_6.

The problem treated is: how to choose the dimensions of the apparatus in order to obtain, at the smallest possible cost, a given quantity of isotope mixture containing one isotope in a given concentration. The production of C^{13} is given as an example.

615

THEORY OF THE SEPARATION OF MIXTURES AND ITS APPLICABILITY TO THE THERMODIFFUSION METHOD. A. I. Brodskiĭ. Acta Physicochim. U.R.S.S. 13, 294-304 (1940). C.A. 35, 1679_1.

Using the formulas of Chapman (C.A. 19, 426) and Enskog (C.A. 16, 1169), Brodskiĭ obtains an equation for the time required to establish equilibrium. A thermodiffusion apparatus is described for separating D.

616

THERMAL DIFFUSION. III. MEASUREMENT OF THERMAL DIFFUSION IN A MIXTURE OF H_2 AND HD. H. Kitagawa. J. Chem. Soc. Japan 61, 1243-8(1940). C.A. 35, 2045_8.

The change in the concentration of a mixture of H_2 and HD caused by thermal diffusion was studied.

617

THE NON-EXCHANGE OF COBALT IN CERTAIN COMPLEX SALTS. John F. Flagg. J. Am. Chem. Soc. 63, 557-9 (1941). C.A. 35, 2086_3.

No exchange between radioactive cobaltous ion and $[Co(NH_3)_6][NO_3]_3$, $[Co(NH_3)_5Cl][Cl]_2$, $[Co\text{-}pn_2Cl_2][Cl]$, (pn = propylenediamine), $[Co(NH_3)_3(NO_2)_3]$ and $[Co(NH_3)_3(NO_2)_2Cl]$ was found. No exchange of Co atoms in cobaltous cobalticyanide was found.

618

HYDROGEN-EXCHANGE REACTIONS OF AROMATIC TERTIARY AMINES. W. G. Brown and N. J. Letang. J. Am. Chem. Soc. 63, 358-361(1941). C.A. 35, 2137_1.

Exchange number were determined for various aromatic amines at 115° with EtOD in the presence of small amounts of H_2SO_4.

619

VAPOR PRESSURE OF LIQUID PROTIUM AND DEUTERIUM COMPOUNDS. K. Stokland. Kgl. Norske Videnskab. Selskabs, Forh. 12, 126-8(1939). C.A. 35, 2380_9.

Although the vapor-pressure curves of the protium and deuterium halides have been shown to intersect (Urey and Teal, C.A. 29, 2442_5) near their boiling points, those for the silicanes for which intersections have been found are from 30 to 100° at variance.

620

EXCHANGE OF SULFATE ION WITH WATER. J. L. Hyde. J. Am. Chem. Soc. 63, 873-4(1941). C.A. 35, 2774_4.

Data are given for H_2SO_4 (59 hr.), Na_2SO_4 (87 hr.) and NaOH + Na_2SO_4 (84 hr.) at 100° which indicate complete exchange in the acid but no exchange in the neutral or alkaline solutions. The mechanism for the exchange of the SO_4 is the same type of reversible anhydride formation that has satisfactorily accounted for the exchange of CO_3 under all conditions of acidity. The difference in the rates appears to be due chiefly to the fact that H_2SO_4 is much stronger acid than H_2CO_3 and that a much smaller quantity of the anhydride is present in solution.

621

A COMPARISON OF THE METHODS OF PREPARING HEAVY WATER. A. I. Brodskiĭ. Zhur. Priklad. Khim. 13, 670-5(1940). C.A. 35, 3133_5.

A review with 12 references. The best and most practical method for D_2O preparation is electrolysis in successive stages.

622

KINETIC PRINCIPLES OF THE METHOD OF ISOTOPIC INDICATORS. I. KINETICS OF EXCHANGE REACTIONS. S. Z Roginskiĭ. Bull. acad. sci. U.R.S.S. Classe sci. chim. 601-15(1940). C.A. 35, 3150_4.

The principal methods by which the mechanism of the isotopic exchange can be derived from kinetics are indicated. A law governing the equidistribution of isotopes for complex heterogeneous systems was derived.

623

THE SEPARATION TUBE. III. PRODUCTION OF 2.5 LITERS OF PURE ISOTOPE Ne^{22} AND Ne^{20}. G. Dickel and Klaus Clusius. Z. physik Chem. B48, 50-62; Naturwissenschaften 28, 461-2(1940). C.A. 35, 3162_8.

A summary of various methods for separating the Ne isotopes is given. The thermal diffusion method has several advantages over other methods, one of which is that by introducing separation tubes at the ends, the original gas which is to be separated may contain small amounts of impurities.

624

SEPARATION OF ISOTOPES. Harold C. Urey. Reports on Progress in Physics VI, 48-77(1939). C.A. 35, 3493_5.

A review.

625

ADSORPTION AND NITROGEN-ISOTOPE EXCHANGE ON METALLIC OSMIUM CATALYSTS. W. R. F. Guyer, George G. Joris, and Hugh S. Taylor. J. Chem. Phys. 9, 287-94(1941). C.A. 35, 3512_9.

Os catalysts show activated adsorption of H (80-537°K). The N isotope exchange reaction $N_2^{28} + N_2^{30} = 2N_2^{29}$ on these catalysts is just measurable at 473°K. and is very rapid at at 573°K, with an activation energy of 21.8 kg./cal. The mechanism is discussed.

626

SEPARATION AND USE OF STABLE ISOTOPES. Harold C. Urey. J. Appl. Phys. 12, 270-7(1941). C.A. 35, 3517_1.

A review.

627

PARA-ORTHO CONVERSION OF HYDROGEN AND THE EXCHANGE REACTION BETWEEN LIGHT AND HEAVY HYDROGEN ON CHARCOAL. R. Burshteĭn. Zhur. Fiz. Khim. 14, 1195-9(1940). C.A. 35, 3881_9.

Data at temperatures from 90 to 773°K are shown in 5 figures. The ortho-para conversion indicates two types of active centers, the H_2-D_2 exchange only one type.

628

ATTEMPTED EXCHANGE OF RADIOPHOSPHORUS BETWEEN ORTHO-, PYRO- AND METAPHOSPHORIC ACIDS. D. E. Hull. J. Am. Chem. Soc. 63, 1269-72 (1941). C.A. 35, 4268_5.

No exchange was found either in acid or alkaline solutions at temperatures from 20° to 100°.

629

THE EXCHANGE OF OXALATES OF SOME COMPLEX TRIOXALATE IONS OF TRIVALENT METALS. F. A. Long. J. Am. Chem. Soc. 63, 1353-7(1941). C.A. 35, 4302_6.

The interchange of oxalates between uncombined oxalates ions and complex Al, ferric and cobaltic oxalate ions was studied by means of radio-carbon. It is concluded that the existence of a stable optically active ion is unlikely. However, the present work does not exclude the possibility of a shortlived optically active ion.

630

STATISTICS OF ISOTOPE DISTRIBUTION IN CONDENSED PARTICLES. ASSUMPTIONS FOR AN ISOTOPE SEPARATION BASED ON DENSITY FLUCTUATIONS OF CONDENSED PARTICLES. Ludwig Holleck. Z. Physik. 116, 624-31(1940). C.A. 35, 4678_2.

Statistical calculations were made for density fluctuations in a mixture of Li^6 and Li^7. If the particles are of the size

of colloids, there is no hope of effecting an isotope separation by this method.

631

HEAVY CARBON PRODUCTION BY THERMAL DIFFUSION. Wm. W. Watson. Science 93, 473-4(1941). C.A. 35, 4678_3.

A few new details and improvements of the apparatus are described.

632

CONCENTRATION OF C^{13} AND MEASUREMENT OF ITS NUCLEAR SPIN. C. H. Townes. Phys. Rev. 56, 850. C.A. 35, 4684_4.

Heavy carbon was concentrated with a Hertz diffusion apparatus of 34 members to a maximum of 50%. CH_4 was the gas used.

633

CONCENTRATION OF CHLORINE ISOTOPES BY CENTRIFUGING AT DRY-ICE TEMPERATURES. F. C. Armistead and J. W. Beams. Phys. Rev. 57, 359(1940). C.A. 35, 4686_3.

The isotopic ratio in the first and in the last samples of C_2H_5Cl concentrated by the evaporative centrifuge method differed by 12%.

634

THEORY OF ISOTOPE SEPARATION BY THERMAL DIFFUSION: THE CYLINDRICAL CASE. W. H. Furry and R. Clark Jones. Phys. Rev. 57, 561-2(1940). C.A. 35, 4686_6.

635

SEPARATION OF ISOTOPES BY THERMAL DIFFUSION. L. Onsager. Phys. Rev. 57, 562. C.A. 35, 4686_6.

The effect of the ratio of convection to diffusion on thermal diffusion separation is discussed.

636

THE THEORY OF THE THERMAL DIFFUSION COEFFICIENT FOR ISOTOPES. II. R. C. Jones. Phys. Rev. 59, 1019-33(1941). C.A. 35, 5389_5.

The temperature dependence of the thermal diffusion constant of a mixture of isotopes is determined for the 9,5 Lennard-Jones model of intermolecular forces, by means of the Chapman-Enskog theory of transport phenomena in gases.

637

THE VAPOR PRESSURE AND HEAT OF VAPORIZATION OF OF N^{15}. Isidor Kirshenbaum. J. Chem. Phys. 9, 660(1941). C.A. 35, 6168_8.

Vapor pressures for natural N and for a mixture containing 34.6% N^{15} were determined from 64.11°K to 74.61°K.

638

THE EXCHANGE REACTION BETWEEN GASEOUS AND COMBINED NITROGEN. Y. Nisina, T. Iimori, H. Kubo, and H. Nakayama. J. Chem. Phys. 9, 571-2(1941). C.A. 35, 6177_4.

The exchange between gaseous radioactive N^{13} and some compounds was determined. The compounds and their relative intensities of radioactivity after the exchange were: $NaNO_2$, 10; $NaNO_3$, 1; $NH_2OH.HCl$, 5; NH_4Cl, KCN, $N_2H_4.H_2SO_4$, each <0.01; $Na_3Co(NO_2)_6$, 3-5; 8-hydroxyquinoline acetate, 3; $CO(NH_2)_2 \sim 0.1$.

639

THE HOMOGENEOUS ISOTOPIC INTERCHANGE REACTION BETWEEN HYDROGEN AND A SOLUTION OF ALKALI IN HEAVY WATER. Sakuya Abe. Sci. Papers Inst. Phys. Chem. Research (Tokyo) 38, 287-97(1941). C.A. 35, 6177_9.

When H_2 is shaken at 100° with a 1N solution of KOH in D_2O appreciable transfer of D takes place from the solution to the gas; this interchange does not take place with acid solutions nor with neutral D_2O.

640

THE ISOTOPIC CONSTITUTION OF POTASSIUM IN VARIOUS RAT TISSUES. Arthur Lasnitzki and A. Keith Brewer. Biochem. J. 35, 144-51 (1941). C.A. 35, 6989_7.

A kinetic mechanism is proposed to account for the difference in the isotopic ratios of tissue and plasma K as measured with a mass spectrograph.

641

THE EXCHANGE REACTION BETWEEN CHLORIDE ION AND TERTIARY BUTYL CHLORIDE. W. Koskoski, H. Thomas, and R. D. Fowler. J. Am. Chem. Soc. 63, 2451-3(1941). C.A. 35, 7271_1.

The exchange was studied in formic acid by means of radio-chlorine prepared by bombarding $CHCl_3$ with neutrons. The exchange proceeded through the equilibrium established between butyl chloride, isobutylene and Cl^-. The constant corresponding to rate of ionization was found to be in good agreement with the constant for the rate of hydrolysis under similar conditions.

642

THE PRODUCTION OF CONCENTRATED CARBON (13) BY THERMAL DIFFUSION. A. O. Nier and J. Bardeen. J. Chem. Phys. 9, 690-2(1941). C.A. 35, 7284_5.

The design and operation of the apparatus are described.

643

EXCHANGE REACTION BETWEEN GASEOUS AND COMBINED NITROGEN. T. H. Norris, S. Ruben, and M. D. Kamen. J. Chem. Phys. 9, 726(1941). C.A. 35, 7284_6.

The exchange of radioactive N^{13} with $NaNO_2$ and $NaNO_3$ is less than 0.01%.

644

ISOTOPIC EXCHANGE BETWEEN CARBON TETRABROMIDE AND BROMINE. J. H. Hodges and A. S. Miceli. J. Chem. Phys. 9, 725(1941). C.A. 35, 7284_7.

The reaction is homogeneous (170-200°); the rate is directly proportional to the concentration of CBr_4 and to the square root of the concentration of the Br_2. In the liquid phase (107-160°) the reaction has the same mechanism, with an energy of activiation of 3 kg/cal.

645

THE EXCHANGE REACTION BETWEEN GASEOUS AND COMBINED NITROGEN. George G. Joris. J. Chem. Phys. 9, 775(1941). C.A. 35, 7825_6.

The exchange reaction between gaseous and combined N was reinvestigated, with stable heavy N and the compounds $NaNO_3$, $NaNO_2$ and $NH_2OH.HCl$. No exchange was found.

646

METHOD OF SEPARATION OF ISOTOPES BY MEANS OF THE LINEAR ACCELERATOR. D. Alkhazov and A. N. Murin. Doklady Akad. Nauk S.S.S.R. 30, 204-5(1941). C.A. 35, 7825_7.

The authors present a discussion of theory of separation of isotopes by resonant accelerators: cyclotron and the linear accelerator of Sloan and Lawrence. As an example the separation of U^{235} and U^{238} ions is briefly discussed and shown to be readily attainable.

647

THEORY OF THE SEPARATION OF ISOTOPES BY THERMAL OR CENTRIFUGAL METHODS. Arthur Bramley. Science 92, 427-8(1940). C.A. 35, 7825_8.

An equation is derived for the determination of the total change of isotopic composition along a column. It is possible to use it for the calculation of variation in vertical mass motion in the presence of baffles within the column.

648

THERMAL DIFFUSION IN HYDROGEN-DEUTERIUM MIXTURES. K. E. Grew. Proc. Roy. Soc. (London) A178,

390-9(1941). C.A. 36, 12_8.

The thermal diffusion in H-D mixtures was measured over a temperature range of −183 to 425°. The thermal diffusion ratio was found and compared with a calculated value.

649

THE DIFFUSION AND THERMAL DIFFUSION OF HYDROGEN-DEUTERIUM WITH A NOTE ON THE THERMAL DIFFUSION OF HYDROGEN-HELIUM. H. R. Heath, T. L. Ibbs, and N. E. Wild. Proc. Roy. Soc. (London) A178, 380-9 (1941). C.A. 36, 12_9.

The diffusion coefficient was measured for hydrogen-deuterium, and the experimental value found to be close to that predicted by calculations with the classical theory. Thermal diffusion experiments were also done and an appreciable separation of mixtures of H and D produced.

650

SEPARATION OF ISOTOPES BY THERMAL DIFFUSION. I. PRELIMINARY TEST OF THE SEPARATION COLUMN. H. Akabori. Proc. Phys.-Math. Soc. Japan 23, 590-8(1941) C.A. 36, 333_5.

A thermal diffusion column was designed and tested on non-isotopic gases.

651

SEPARATION OF ISOTOPES BY THERMAL DIFFUSION. II. SEPARATION OF CHLORINE ISOTOPES. H. Akabori. Proc. Phys.-Math. Soc. Japan 23, 599-604(1941). C.A. 36, 333_7.

With a 7.5 meter thermal diffusion tube Cl isotopes were separated to a concentration of 44% of Cl^{37}.

652

SEPARATION OF GASES AND ISOTOPES. A. Keith Brewer and Arthur Bramley. U. S. Patent 2,258,594, Oct. 14, 1940. C.A. 36, 345_8.

A process is employed for separating constituents of unequal molecular mass in a fluid mixture, which comprises subjecting a vertically elongated confined body of fluid to a temperature gradient transversely of such body, while inducing a partial separation of the heavier and lighter components, and while inducing a circulation of gas in an upwardly flowing direction in a region of higher temperature and in a downwardly flowing direction in a region of lower temperature, obstructing the direction flow of these streams at a plurality of points and thereby establishing a secondary circulation of fluid in a plurality of intercommunicating localized swirls, and withdrawing the heavier constituents from the bottom and the lighter from the top.

653

EXCHANGE REACTION OF BIACETYL WITH DEUTERIUM OXIDE. W. D. Walters. J. Am. Chem. Soc. 63, 2850-1 (1941). C.A. 36, 408_8.

The exchange in the presence of acid is rapid in comparison with the rate in D_2O alone.

654

THE EXCHANGE OF RADIOACTIVE POTASSIUM WITH BODY POTASSIUM. W. O. Fenn, T. R. Noonan, L. J. Mullins and L. Haege. Am. J. Physiol. 135, 113-23 (1941). C.A. 36, 815_6.

The evidence indicates that in all animals studied, practically all the K of the body exchanges with the injected radioactive material in the course of a few days.

655

EXCHANGE AND TRANSFER EQUILIBRIA OF ACIDS, BASES AND SALTS IN DEUTERIUM-PROTIUM OXIDE MIXTURES. THE ION PRODUCT CONSTANT OF DEUTERIUM OXIDE. R. W. Kingerley and V. K. La Mer. J. Am. Chem. Soc. 63, 3256-63(1941). C.A. 36, 954_1.

Values are tabulated for the exchange and transfer equilibria in solution for various acids, bases and salts at 25°.

656

ISOTOPE SEPARATION BY THERMAL DIFFUSION. A. J. E. Welch. Sci. J. Roy. Coll. Sci. 11, 19-30(1941). C.A. 36, 965_4.

A review of thermal-diffusion separations in gases and in liquids. The possibility of producing separation in fused salts is also discussed.

657

AN ATTEMPTED ISOTOPIC SEPARATION BY FRACTIONAL CRYSTALLIZATION. William J. C. Orr. Trans. Faraday Soc. 37, 587-90(1941). C.A. 36, 1544_3.

An apparatus is described in which a continuous flow of saturated NaCl solution in a 9% CH_3OH-water mixture moves upward in a long column, while a continuous stream of NaCl crystals, precipitated from the saturated solution as it reaches the top, passes down the column.

658

INEXPENSIVE EQUIPMENT FOR THE PREPARATION AND CONCENTRATION OF PURE D_2O OR OF DEUTRIUM RICH WATER. DESCRIPTION OF CONSTRUCTION AND OPERATION OF THE FORMER OHIO STATE U. HEAVY-WATER PLANT. Herrick L. Johnston and W. H. Hall. Ohio J. Sci. 41, 357-65(1941). C.A. 36, 2784_3.

Batteries of small electrolytic cells made from laboratory glass-ware were used. Fe electrodes gave better yields than those of Ni. Equipment and procedure are described in great detail.

659

EXCHANGE REACTION BETWEEN DEUTERIUM AND HYDROGEN ON NICKEL. S. Levina. Acta Physicochim. U.R.S.S. 14, 294-5(1941). C.A. 36, 3091_9.

The rate coefficient of the exchange reaction between D and H an Ni in aqueous NaOH increases with NaOH concentration.

660

RADIOHALOGEN EXCHANGE IN THE PHOSPHORUS HALIDES. W. Koskoski and R. D. Fowler. J. Am. Chem. Soc. 64, 850-2(1942). C.A. 36, 3097_3.

Exchanges between radiobromine and PBr_3, between radiochlorine and PCl_3 and between radiochlorine and PCl_5 were studied in CCl_4 solution. All of the exchanges studied were found to be rapid and complete in less than 3 minutes, and the conclusion is drawn that the 5 halogen atoms in PCl_5 and in PBr_5 are probably equally reactive.

661

COLUMN PACKING AND THE SEPARATION OF ISOTOPES. H. G. Thode and F. O. Walkling. Can. J. Research 20B, 61-8(1942). C.A. 36, 3399_1.

An expanded shale aggregate packing material for fractionating columns has been investigated. The new packing is inert, cheap and easily wetted by water. The packing was tested by distilling CH_4 and H_2O.

662

THE EFFECT OF VAN DER WAALS FORCES ON THE THERMAL DIFFUSION COEFFICIENT OF GASEOUS ISOTOPIC MIXTURES. R. C. Jones. Phys. Rev. 59, 688-9(1941). C.A. 36, 3422_8.

The temperature dependence of the thermal diffusion coefficient of a mixture of isotopes is calculated.

663

THE THEORY OF GASEOUS-ISOTOPE SEPARATION IN A FORCE FIELD WITH APPLICATION TO THE ULTRA-CENTRIFUGE. G. Harold Wilson. Phys. Rev. 58, 209. C.A. 36, 3430_9.

664
MASS SPECTRA AND ISOTOPES. F. W. Aston. E. Arnold and Co., London, 1942 (2nd Ed. 276 p). C.A. 36, 4029_3.

665
ISOTOPE SEPARATION AND THE MECHANISM OF COMBUSTION IN ASCENDING HYDROGEN-DEUTERIUM FLAMES. K. Clusius, W. Kölsch and L. Waldmann. Z. Electrochem. 47, 820; Z. physik. Chem. A189, 131-62 (1941). C.A. 36, 4378_8.

A note on rising flames in H_2-D_2-O_2 mixtures in which, as a result of partial combustion, a slight separation of isotopes occurs. D is enriched in the unburned gas and H in the water of combustion.

666
THE SEPARATION OF MOLECULES OF EQUAL MASSES IN A [DIFFUSION] TUBE. K. Clusius and H. Kowalski. Z. Elektrochem. 47, 819(1941). C.A. 36, 4378_9.

A note on the separation of H_2-HD mixtures by means of thermal diffusion in a separation tube.

667
EXCHANGE OF RADIOACTIVE SILVER WITH SILVER CHLORIDE SUSPENSIONS. A. Langer. J. Chem. Phys. 10, 321-7(1942). C.A. 36, 4411_1.

Ag ions in solution exchange constantly with Ag ions in AgCl. The exchange is not limited to the surface of the crystals, but is propagated into the precipitate, probably by self-diffusion. The time necessary to obtain a given fraction of complete exchange for a given amount of precipitate depends mainly on the area of the crystal surface.

668
THE THEORY OF THE CLUSIUS SEPARATION TUBE. Hans Jensen and Ludwig Waldmann. Naturwissenschaften 29, 467-8(1941). C.A. 36, 4411_5.

The theory of the thermal diffusion tube is discussed.

669
EXCHANGE REACTION BETWEEN HYDROGEN AND DEUTERIUM IN HETEROGENOUS SYSTEMS. L. V. Korchagin and M. I. Urizko. J. Phys. Chem. U.S.S.R. 14, 1566-8(1940). C.A. 36, 5413_8.

Alizarin, o-anisidine and o-toluidine when shaken with D_2O exchange 2H per molecule while dimethylglyoxime exchanges 8H.

670
EFFICIENCY OF THE ELECTROLYTIC SEPARATION OF CHLORINE ISOTOPES. Herrick L. Johnston and D. A. Hutchison. J. Chem. Phys. 10, 469-72(1942). C.A. 36, 5424_8.

The electrolytic separation coefficient α was determined for the Cl^- isotope separation in the electrolysis of NaCl solutions at a Pt anode. The electrolytic separation factor for Cl isotopes was found to be 1.0060 ± 0.005 for temperature range 25-40°.

671
SEPARATION OF ISOTOPES AND THERMAL DIFFUSION. James Kendall. Nature 150, 136-40(1942). C.A. 36, 5697_1.

A review.

672
THE METHODS OF SEPARATION OF THE ISOTOPES. H. Vigneron. La Nature 1939, No. 3040, 30. C.A. 36, 6894_3.

673
SOME EXCHANGE EXPERIMENTS WITH RADIOACTIVE TRACERS. S. Ruben, M. D. Kamen, M. B. Allen, and P. Nahinsky. J. Am. Chem. Soc. 64, 2297-8(1942). C.A. 36, 7036_1.

By use of radioactive tracers the following observations were made. Magnesium 8-hydroxyquinolate exchanges quite readily with Mg^{2+}. Neither ferriheme nor ferrihemoglobin, both of which are paramagnetic, exchanges with Fe^{3+}. Copper and iron pheophytins also do not exchange with Cu^{2+} and Fe^{3+}. Ferric tetraphenylporphyrin does not exchange with Fe^{3+} in 5 days. Ferrous orthophenanthroline and ferrous α,α'-dipyridyl also exchange slowly with Fe^{2+}. It appears that the rate of exchange depends more on structure than on bond type (i.e., covalent of ionic).

674
THE CONSUMPTION OF ENERGY IN THE SEPARATION OF ISOTOPES. F. G. Houtermans. Ann. Physik. 40, 493-508(1941). C.A. 37, 31_4.

675
THERMODIFFUSION METHOD FOR THE SEPARATION OF ISOTOPES. A. N. Murin. Uspekhi Khim. 10, 671-9(1941). C.A. 37, 31_4.

The work of Clusius, et al. on the separation of the isotopes of Ne, Cl_2 and N_2 as well as the work of various American authors is discussed. Separation of Zn and other isotopes in aqueous solutions is also considered.

676
CHEMICAL SEPARATION OF THE ISOTOPES OF HYDROGEN BY THE ADDITION OF METALS AND COMPOUNDS OF METALS TO WATER, ACIDS, AND BASES. I. RELATIVE EFFICIENCIES OF SPECIFIC REACTIONS. THE EFFECTS OF CERTAIN FACTORS OTHER THAN TEMPERATURE. Herrick L. Johnston and C. O. Davis. J. Am. Chem. Soc. 64, 2613-20(1942). C.A. 37, 31_5.

Quantitative data were secured on the extent of isotopic separation which occurs in the following respective reactions which liberate H or gaseous hydrides: Li, Na, K, Ca, CaC_2 and Al_4C with water; Mg, Fe, Zn, Mn, Al and FeS with aqueous H_2SO_4; and aluminum with aqueous NaOH. With a few exceptions the runs were made at or near room temperature.

677
HYDROGEN EXCHANGE OF AROMATIC AMINES WITH D_2O AND T_2O. B. J. Fontana. J. Am. Chem. Soc. 64, 2503-4(1942). C.A. 37, 562_9.

Data are given for the exchange numbers and partition ratios of various aromatic amine dyes.

678
THE DIFFERENCES IN THE VAPOR PRESSURES AND ENTROPIES OF THE LIQUID NITROGENS. Isidor Kirshenbaum. J. Chem. Phys. 10, 717-22(1942). C.A. 37, 807_6.

The differences in the thermodynamic properties of liquid N^{14} and liquid N^{15} are discussed on the basis of several Debye-like models.

679
DISTRIBUTION OF ISOTOPES OF HYDROGEN AND OXYGEN DURING THE FREEZING OF WATER. R. V. Teĭs and K. P. Florenskiĭ. Doklady Akad. Nauk S.S.S.R. 32, 199-202 (1941). C.A. 37, 819_4.

In the process of freezing of water there is an accumulation of O^{18} and a decrease of D in the ice. This separation is pronounced in the first stages of freezing, then gradually decreases. Conditions under which the freezing occurs change the quantitative but not the quality nature of the separation. Thus, e.g., stirring increases the amount of D and lowers the O^{18} in the ice. Water frozen in the laboratory behaved like ice collected in gullies and streams.

680
THE DIFFERENCES IN THE VAPOR PRESSURES, HEATS OF VAPORIZATION, AND TRIPLE POINTS OF NITROGEN (14) AND NITROGEN (15) AND OF AMMONIA AND TRIDEUTERIOAMONIA. Isidor Kirshenbaum and Harold C. Urey. J. Chem. Phys. 10, 706-17(1942). C.A. 37, 821_9.

Using Raoult's law and measurements of 34.6% N^{15} the ratio of the vapor pressures of the pure isotopes N^{14} and N^{15}

are log $(P_{14}/P_{15}) = (0.7230/T) - 0.005822$. The differences in the vapor pressures of the liquid ammonias are log $(P_{NH_3}/P_{ND_3}) = (46.25/T) - 0.14003$.

681

ISOTOPE EXCHANGE IN INORGANIC CHEMISTRY. A. L. G. Rees. Ann. Repts. Progress Chem. (Chem. Soc. London) 38, 83-90(1941). C.A. 37, 1343_2.

682

TRACER STUDIES WITH RADIOACTIVE CARBON. THE EXCHANGE BETWEEN ACETIC ANHYDRIDE AND SODIUM ACETATE. S. Ruben, M. B. Allen, and P. Nahinsky. J. Am. Chem. Soc. 64, 3050(1942). C.A. 37, 1379_8.

Labelled AcONa was shaken with Ac_2O for 20 minutes at room temperatures; the percentage of random distribution of Ac is 55 or 62. A similar result was obtained with butyrate and Ac_2O after 40 minutes at room temperature.

683

VIBRATIONAL FREQUENCIES OF THE ISOTOPIC WATER MOLECULES; EQUILIBRIA WITH THE ISOTOPIC HYDROGENS. W. F. Libby. J. Chem Phys. 11, 101-9(1943). C.A. 37, 2627_3.

The equilibrium constants for the 9 equilibria involving the HDO, HTO, DTO, and T_2O molecules are calculated from spectral data. Experimental values for the reactions $HD + H_2O = H_2 + HDO$ and $HT + H_2O = H_2 + HTO$ are compared with the calculated values. (See errata in J. Chem. Phys. 15, 339(1947)).

684

ENRICHMENT OF THE CHLORINE ISOTOPES BY IRRADIATION OF CHLORINE DIOXIDE AT LOW PRESSURE (THE PHOTOCHEMISTRY OF CHLORINE DIOXIDE). W. Kuhn, H. Martin, and K. H. Eldau. Z. physik. Chem. B50, 213-54(1941). Chem. Zentr. I, 579(1942). C.A. 37, 2655_5.

The factors which make it difficult or impossible to separate isotopes by photochemical means are discussed. An apparatus for the preparation of pure ClO_2 is described. ClO_2 is partially decomposed photochemically to $Cl_2 + O_2$. The ratio of Cl^{35}/Cl^{37} in the separated Cl_2 is 3.57 compared with 3.41 in ordinary Cl_2.

685

THE STATISTICS OF ISOTOPE DISTRIBUTION WITH CONDENSED PARTICLES. Ludwig Holleck. Z. Physik 118, 340-2(1941). C.A. 37. 2987_8.

A method is presented for obtaining an integral determination of the probabilities of the appearance of condensed particles within definite isotopic limits.

686

ISOTOPE-SEPARATION FACTOR OF A THERMAL-DIFFUSION COLUMN. Ralph Simon. Phys. Rev. 61, 388. C.A. 37, 2991_1.

687

KINETICS OF SOME EXCHANGE REACTIONS OF THE TYPE $RI + I^{*-} = RI^* + I^-$ IN ALCOHOLIC SOLUTION. H. A. C. McKay. J. Am. Chem. Soc. 65, 702-6 (1943). C.A. 37, 3324_3.

The reactions are bimolecular. The dependence of the bimolecular velocity constant on the concentrations of reactants was determined for EtI at 30°. The velocity constants and their temperature coefficients were determined for a series of alkyl iodides.

688

THE PHOSPHORUS EXCHANGE BETWEEN SODIUM PHOSPHATE AND RADIOPHOSPHORUS PRESENT IN VIRUS OF TOBACCO MOSAIC. G. Schramm, H. J. Born and A. Lang. Naturwissenschaften 30, 170-1 (1942). C.A. 37, 3799_5.

No exchange was found.

689

EVIDENCE OF DEUTERIUM EXCHANGE IN THE SYSTEM $DCl-CH_3OH$. A. G. Gassmann, C. J. Hochanadel, and R. J. Hartman. J. Am. Chem. Soc. 65, 988(1943). C.A. 37, 3999_7.

The rate at which DCl reacts with MeOH at 25, 40, 50, and 60° is approximately the same as that for HCl and MeOH.

690

SELF-EXCHANGE REACTION OF ANILINE HYDROCHLORIDE AND ITS DERIVATIVES. I. ANILINE HYDROCHLORIDE. N. Okazaki. J. Chem. Soc. Japan 62, 52-6(1941). C.A. 37, 4058_6.

Exchange between the ring H's and the $-NH_2DCl$ group was studied. The number of ring hydrogen exchanging is 3 (2,4, and 6 positions).

691

SELF-EXCHANGE EQUILIBRIA OF ANILINE HYDROCHLORIDE AND ITS DERIVATIVES. II. p-TOLUIDINE HYDROCHLORIDE. N. Okazaki and Z. Kuroda. J. Chem. Soc. Japan 62, 57-61(1941). C.A. 37, 4059_1.

Exchange between the ring H's and the $-NH_2DCl$ group was studied at elevated temperatures.

692

EXCHANGE BETWEEN OXYGEN ISOTOPES IN INORGANIC SOLVENTS. A. I. Brodskiĭ and E. I. Dontsova. Dopovidi Akad. Nauk. U.R.S.R. 1940. No. 6, 3-7. Chem. Zentr. I, 837(1942). C.A. 37, 4957_4.

The exchange of O^{16} for O^{18} in aqueous solutions of K_2CrO_4 and $Na_2Cr_2O_7$ was investigated at 16.5°. With K_2CrO_4 the constant of the reaction (first order) fell from 0.12/min in neutral solution to 0.05 and 0.012/min on addition of 0.0042 and 0.0074 g respectively, of NaOH/cc and increased to 0.13/min on addition of 0.0065 g HCl/cc. With $Na_2Cr_2O_7$ there was qualitatively a considerable retardation of exchange with acid addition.

693

THE EXCHANGE OF Cl ATOMS OF HCl^{35} with $AsCl_3$, PCl_3, $POCl_3$, CCl_4, $SiCl_4$, S_2Cl_2 AND KCl. Klaus Clusius and H. Haimerl. Z. physik. Chem. 51B, 347-51(1942). C.A. 37, 5639_2.

HCl^{35} exchanges rapidly with $AsCl_3$ and PCl_3, more slowly with $POCl_3$, very slowly with $SiCl_4$ and S_2Cl_2, and not at all with CCl_4. With solid KCl exchange takes place on the surface.

694

ENRICHMENT OF N^{15} BY EXCHANGE. Klaus Clusius, E. Becker, and H. Lauckner. Sitzber. math. naturw. Abt. bayer. Akad. Wiss. Munchen 145-8(1941). Chem. Zentr. II, 1089(1942). C.A. 37, 5648_9.

Experiments are reported in which N^{15} is enriched by use of the exchange reaction $N^{15}H_3(g) + N^{14}H_4^+(aq) = N^{14}H_3(g) + N^{15}H_4^+(aq)$. K = 1.022. NH_4NO_3 solution flows countercurrent to NH_3 refluxed at the base of the tower with NaOH.

695

SEPARATION TUBE. IV. PREPARATION OF THE ISOTOPES Kr^{84} AND Kr^{86}. Klaus Clusius and G. Dickel. Z. physik. Chem. B52, 348-68(1942). Z. physik. Chem. B53, 178(1943). C.A. 37, 5907_8.

Kr^{86} (850cc.) with 0.5% Kr^{84} and 500 cc. of Kr^{84} with 1% Kr^{86} and 0.8% Kr^{88} were prepared in 28 months with an expenditure of 32,000 kw/hours. The course of the separation was followed by gas-density measurements and mass spectrography. The results are examined in terms of separation-tube theory.

696

EQUILIBRIUM IN HYDROGEN-WATER SYSTEMS CONTAINING TRITIUM. J. F. Black and H. S. Taylor. J. Chem. Phys. 11, 395-402(1943). C.A. 37, 6183_9.

The equilibrium constant of the reaction $HT + H_2O =$

H_2 + HTO was determined (289-576°K) in contact with a Pt-charcoal catalyst. The results are compared with calculations by Libby (C.A. 37, 2627_3).

697

THE USE OF THE EXCHANGE BETWEEN CO_2, H_2CO_3, HCO_3 ION AND H_2O FOR ISOTOPIC CONCENTRATION. Allen Francis Reid and Harold C. Urey. J. Chem. Phys. 11, 403-12(1943). C.A. 37, 6186_5.

A study was made of the exchange of O and C in the reactions: (1) CO_2 (dissolved) + $H_2O \rightleftharpoons H_2CO_3$, and (2) CO_2 (dissolved) + $OH^- \rightleftharpoons HCO_3^-$. The rate of (1) can be increased 4 or 5 times and the rate of (2) up to 2000 times by heterogeneous catalysis. There reactions were used in fractionating columns to concentrate O and C isotopes.

698

INTERCHANGE OF HYDROGEN ISOTOPES WITH COMPLEX SALTS. I. KINETICS OF THE INTERCHANGE WITH THE LUTEOCOBALTIC COMPLEX. J. S. Anderson, H. V. A. Briscoe and N. L. Spoor. J. Chem. Soc. 361-7 (1943). C.A. 37, 6528_3.

The H of $Co(NH_3)_6Cl_3$ and $Co(NH_3)_3Cl_3$ undergoes isotopic exchange with heavy water in solution.

699

INTERCHANGE OF HYDROGEN ISOTOPES WITH COMPLEX SALTS. II. KINETICS OF THE INTERCHANGE WITH PLATINOUS AND PALLADOUS TETRAMMINES. J. S. Anderson, H. V. A. Briscoe, L. H. Cobb, and N. L. Spoor. J. Chem. Soc. 367-72(1943). C.A. 37, 6528_4.

The rate of exchange of isotopic H between H_2O and the ammines $Pt(NH_3)_4Cl_2$ and $Pd(NH_3)_4Cl_2$ decreases in the order Co > Pt > Pd.

700

ENRICHMENT OF THE HEAVY OXYGEN ISOTOPE $^{18}O_2$ AND THE NITROGEN $^{14}N^{15}N$. K. Clusius, G. Dickel, E. Becker. Naturwissenschaften 31, 210 (1943). C.A. 38, 19_9.

By use of thermal diffusion tubes, 250 cc of O_2^{18} of 99.0% purity has been prepared in the course of 1-1/2 years. 800 cc of $N^{14}N^{15}$ has been isolated by thermal diffusion. The hot Pt wire does not establish the $N^{14}N^{15} = N_2^{14} + N_2^{15}$ equilibrium.

701

THE THEORY OF ISOTOPE SEPARATION BY EXCHANGE REACTIONS. Ludwig Waldmann. Naturwissenschaften 31, 205-6 (1943). C.A. 38, 20_1. Translation AEC-tr-1911.

In the separation of isotopes between gaseous and liquid phases, the rule holds that the heavier isotope is enriched in the liquid if the ions have more internal degrees of freedom than the gas molecules. The theory of the Urey process of isotope separation is discussed.

702

ISOTOPE SEPARATION BY THERMAL DIFFUSION IN LIQUIDS ACCORDING TO KINETIC THEORY. K. Wirtz. Naturwissenschaften 31, 349(1943). C.A. 38, 1673_8.

Results obtained in separation of isotopes in the liquid phase seem to indicate that the mass of the molecules is not the primary factor causing separation but the volume instead. The volume of the heavy molecule is assumed smaller than that of the light molecule. It will cause the heavy molecules to collect at the cold end. Obviously this explanation would make separation by thermal diffusion extremely questionable for isotopes other than those of H and their compounds.

703

SEPARATION OF C_6H_6 AND C_6D_6 BY THERMAL DIFFUSION IN THE LIQUID. H. Korsching. Naturwissenschaften 31, 348-9(1943). C.A. 38, 1673_8.

A total separation of 2.05 was obtained in a thermal diffusion tube using benzene.

704

ENERGY CONSUMPTION IN A CLUSIUS SEPARATION COLUMN WHICH IS RUN CONTINUOUSLY. H. Steinwedel. Chemie, Die, 55, 152-3 (1942). Chem. Zentr. II, 2765 (1942). C.A. 38, 2538_2.

The problems concerning the energy consumed in a separation column are discussed in detail. The energy to one gram-mole of chlorine is calculated to be 3×10^9 calories compared with an experimental value of 3.7×10^{10} given by Clusius and Dickel.

705

THERMAL DIFFUSION SEPARATION OF ISOTOPES. W. W. Watson, Ralph Simon, and D. L. Woernley. Phys. Rev. 62, 558(1942). C.A. 38, 2874_8.

Thermal diffusion apparatus was constructed and used as the isotopes of A, C, and others.

706

COMPARISON OF THE VAPOR-PRESSURE CURVES FOR NORMAL H AND D COMPOUNDS. K. Stokland. Nord. Kemikermode, Forh. 5, 204-5(1939). Chem. Zentr. II, 2673(1942). C.A. 38, 3176_2.

The regularities of the vapor-pressure curves of H and D compounds described by Clusius (C.A. 32, 2410_8) do not hold for H and D silanes. The curves of the tri and tetra silanes do not cross.

707

ENRICHMENT OF CCl_4 IN Cl^{37} BY THERMAL DIFFUSION. André Fournier. Compt. rend 215, 529-30(1942). C.A. 38, 3185_1.

The thermal diffusion apparatus consisted of 2 metal cylinders 41 and 45 mm, respectively, in diameter, and 3 m long, with temperature difference of 55 and 37°. Under these conditions the enrichment was proportional to the temperature difference.

708

THE SEPARATION OF ISOTOPES OF CARBON. M. de Hemptinne and P. Capron. Acad. roy. Belg. Classe sci., Mem. 19, No. 4, 1-44 (1942). Chem. Zentr. I, 1855-6 (1943). C.A. 38, 4509_3.

The concentration of C^{13} in CH_4 by means of the Hertz diffusion method is described. Use of a series of 84 one-stage Hg diffusion pumps resulted in a yield of 40 cc CH_4 with 25% C^{13} in 10 hours at an optimal pressure of 2 mm; the maximum C^{13} concentration reached was about 50%.

709

THE (THERMAL DIFFUSION) SEPARATING TUBE EFFECT. George Stetter. Oesterr. Chem. Ztg. 45, 130-4 (1942). C.A. 38, 4846_2.

He-Xe mixtures can be separated in a few minutes, and even isotopes can be treated, but with more difficulty, for the specific gravity of the components are not very different.

710

EXCHANGE REACTION BETWEEN SOLID AND DISSOLVED PHASES. R. Daudel. Compt. rend. 217, 239-40(1943). C.A. 38, 4856_3.

Radioactive isotopes are employed as tracers in the study of the rate of exchange between solutions and solids containing a common ion. In the case of $Ag_4As_2O_5$ and $Na_2As_2O_4$ solution only an extremely slow interchange is observed, presumably due to the different compounds of the anions in solution and in the solid.

711

THE SEPARATION OF THE O ISOTOPES BY THE DISTILLATION OF WATER. H. G. Thode, S. R. Smith, and F. O. Walkling. Can. J. Res. 22B, 127-36(1944). C.A. 38, 5142_3.

Three 25 ft columns packed with "Haydite" aggregate have been operated in cascade for 120 days to concentrate the O isotopes by distillation of water. 150 ml of water enriched 6.5-fold in O^{18} and 2.7-fold in O^{17} were obtained. The results show that these columns can be expanded to several feet in diameter for large-scale production of O^{18} without much loss in efficiency. The vapor pressure of H_2O^{17} was found to be within experimental error equal to the algebraic or geometric mean of the vapor pressures of H_2O^{16} and H_2O^{18}.

712

SEPARATION OF ISOTOPES BY HIGH-FREQUENCY ELECTRIC FIELDS. Julien Martelly. Compt. rend. 215, 106-8(1942). C.A. 38, 5142_7.

A beam of positive ions passes through 2 systems of crossed condensers, across which the high-frequency field is imposed. Separation is effected by filtering out ions having different velocities. As an example it is stated that the 2 isotopes of Hg can be separated by a hole in the receiving screen having a radius of 1mm, and an electric field having a frequency of 2 megacycles.

713

MASS SPECTROMETER AND GASEOUS-THERMAL-DIFFUSION ISOTOPE SEPARATOR. J. E. Taylor. Rev. Sci. Inst. 15, 1-8(1944). C.A. 38, 5726_4.

The mass spectrometer is like that of Nier but with changes. The thermal-diffusion separator is a six unit separator 7 feet high. It yields concentrations of C^{13} up to 20%. The concentration was observed as a function of time and the equilibrium concentration compared with theory for several pressures.

714

THE SEPARATION OF THE OXYGEN ISOTOPES BY DISTILLATION, AND THE VAPOR PRESSURE OF H_2O^{17}. H. G. Thode, S. R. Smith and F. O. Walkling. Jan. 3, 1944, 10p. (MC-36).

Three 25 foot packed columns were operated in cascade for 120 days to produce 150 ml of water enriched 6.5 fold in O^{18} and 2.7 fold in O^{17}. The vapor pressure of H_2O^{17} has been calculated and found to be equal, within experimental limits, to the algebraic or geometric mean of the vapor pressures of H_2O^{16} and H_2O^{18}.

715

THE SEPARATION OF THE OXYGEN ISOTOPES BY THE DISTILLATION OF TECHNICAL LIQUID OXYGEN. H. G. Thode and S. R. Smith. March 1944, 6p. (MC-45).

The difference reported by Klar and Krauss in the vapor pressures of $O^{16}O^{16}$ and $O^{16}O^{18}$ is too high. The distillation of liquid oxygen as a method for separation of oxygen isotopes has been reinvestigated and the ratio of the vapor pressures ($O^{16}O^{16}/O^{16}O^{18}$) has been determined by the Rayleigh method to be 1.0065 at the B.P. of liquid oxygen.

716

EFFICIENCY OF THE THERMODIFFUSION METHOD FOR SEPARATION OF ISOTOPES. A. N. Murin. Compt. rend. acad. sci. U.R.S.S. 42, 386-7(1944). C.A. 39, 1093_2.

Application of the derived equations to the problem of isolating deuterium shows that diffusion of D_2 in gaseous H_2 is about 1000 times as efficient thermally as diffusion of D_2O in liquid H_2O.

717

A MASS SPECTROMETER AND THE MEASUREMENT OF ISOTOPE EXCHANGE FACTORS. H. G. Thode, R. L. Graham, and J. A. Ziegler. Can. J. Res. 23B, 40-7(1945). C.A. 39, 1806_7.

A 180° mass spectrometer for the measurement of isotope abundance is described. The equilibrium constants for $N^{15}H^3_{(gas)} + N^{14}H_4^+{}_{(soln.)} \rightleftharpoons N^{14}H_{3\,(gas)} + N^{15}H_4^+{}_{(soln.)}$ and $S^{34}O_{2\,(gas)} + HS^{32}O_3^-{}_{(soln.)} \rightleftharpoons S^{32}O_{2\,(gas)} + HS^{34}O_3^-{}_{(soln.)}$ were found to be about 60% higher than those previously reported from fractionation-column experiments. However, the low values previously reported can be accounted for on the basis of Cohen's theory of packed columns.

718

REACTION MECHANISM FOR EXCHANGE REACTIONS IN LIQUID H_2S. DETERMINING THE COMBINING POWER OF H. A. Tananger. Tids. Kjemi. Bergvesen Met. 3, 44-8 (1943). C.A. 39, 2438_4.

The rate of exchange of $PhCH_2OH$ and D_2S was studied.

719

SEPARATION OF ARTIFICIAL RADIOACTIVE ISOTOPES AND ISOMERS. Kurt Starke. Z. Physik 42, 184-91(1941). C.A. 39, 3199_5.

A review.

720

ELECTROLYSIS AT CONSTANT LEVEL OF A MIXTURE OF LIGHT AND HEAVY WATER. Jean Savard. J. phys. radium (8) 5, 85-9(1944). C.A. 39, 3209_5.

Equations are developed to give the limit of enrichment of heavy water by electrolysis with several cells in series. The level of water in each cell is held constant by adding fresh solution to the first cell and permitting a flow of solution from one cell to the succeeding one. The enrichment obtained in the last cell increases with the number of cells used. However, the amount of electrical current required to attain the limit increases very rapidly with the number of cells.

721

ENRICHMENT OF N^{15} BY THE CHEMICAL EXCHANGE PROCEDURE. Klaus Clusius and E. Becker. Z. physik. Chem. 193, 64-76(1943). C.A. 39, 3729_1.

A discussion of the theory of the chemical exchange process for N enrichment is given. Details and performance data are given for a two-stage apparatus. The most recent experiment lasting 38 days, gave products containing 2.7% N^{15} for the first stage and 12.5% N^{15} for the second stage.

722

THE SOLUBILITY OF DEUTERIUM IN SOLID NICKEL. A. Sieverts and W. Danz. Z. anorg. allgem. Chem. 247, 131-4(1941). Chem. Zentr. 1941 II, (1942). C.A. 39, 4537_8.

The solubility of D_2 in solid Ni was measured at atmospheric pressure and at temperatures between 200 and 1120° and compared with that of H_2.

723

COMPARATIVE ISOTHERMALS OF WATER AND HEAVY WATER ON POROUS SOLIDS. D. N. Broad and A. G. Foster. J. Chem. Soc. 372-5(1945). C.A. 39, 4786_2.

The adsorption isothermals of H_2O and D_2O were compared at 25° on SiO_2 and Fe_2O_3 gels and on charcoal.

724

KINETICS OF THE ISOTOPIC EXCHANGE REACTION BETWEEN CARBON MONOXIDE AND CARBON DIOXIDE. J. D. Brander and Harold C. Urey. J. Chem. Phys. 13, 351-62(1945). C.A. 39, 5159.

The rate of exchange of C^{13} between CO and CO_2 was studied. It is a surface-catalyzed reaction on quartz, Au, and Ag surfaces. The reaction is independent of pressure and the composition of the gas mixture. The exchange is accelerated by H or H_2O vapor.

725

ISOTOPE ENRICHMENT BY DIFFUSION OF COPPER IN SILVER SULFIDE. A. Klemm. Z. physik. Chem. 193, 29-39

(1943). C.A. 39, 5174_8.

Calculations are made for the isotopic separation and yield to be expected when an element diffuses across a plane boundary into a second solid phase. The theory was experimentally investigated by measurement of the diffusion of Cu into Ag_2S at 450°.

726

EFFICIENCY OF THE ELECTROLYTIC SEPARATION OF CHLORINE ISOTOPES. D. A. Hutchison. J. Chem. Phys. 13, 536-7(1945). C.A. 40, 519_1.

The isotopic separation coefficient α on the electrolysis of aqueous solutions of NaCl was determined at 15°, 20°, 25°, and 40°. The average value of α was 1.0063 for these 4 single-step electrolyses. The average value of α, including the earlier paper, is 1.0061. It does not vary with current density or with temperature (15-40°).

727

KINETICS OF EXCHANGE REACTIONS. III. INFLUENCES OF SOLVENT AND MOLECULAR STRUCTURE. L. J. LeRoux, C. S. Lu, S. Sugden, and R. H. K. Thomson. J. Chem. Soc. 586-8(1945). C.A. 40, 1082_8.

Rate studies were made on the exchange reaction RBr + $Br^* \rightleftharpoons RBr^* + Br^-$ to show effects of structure and solvents. The bromides n-butyl, isopropyl, and tert-butyl, and 2,4-dinitrobromobenzene were caused to react with Br^{*-} in both anhydrous and aqueous acetone and in ethylene glycol diacetate.

728

OAK RIDGE GIVES INDUSTRY A UNIT OPERATION-GAS DIFFUSION. J. F. Hogerton. Chem. & Met. Eng. 52, No. 12, 98-101(1945). C.A. 40, 1359_7.

The K-25 plant at Oak Ridge for Uranium 235 is the first commercial application of gaseous diffusion. Several thousand diffusion stages are employed, as the theoretical separation factor for the Uranium hexafluoride is only 1.0043 in spite of the reduced pressure.

729

COVALENT AFFINITY, OXIDATION-REDUCTION POTENTIAL, AND EXCHANGE REACTIONS. R. Daudel, P. Daudel, and M. Martin. Compt. rend 219, 129-30(1944). C.A. 40, 1707_5.

Experimentally it was found that there was a complete exchange between Br and $SnBr_4$ in 2 minutes and no exchange in the case of CBr_4. There is no exchange between Cl^- and ClO_4^-, Cl^- and ClO_3^-, the corresponding compounds of Br and I, S^{2-} and SO_4^{2-}, SO_3^{2-} and SO_4^{2-}, TeO_3^{2-} and TeO_4^{2-}, AsO_3^{3-} and AsO_4^{3-}, which are irreversible reduction-oxidation systems. There is exchange between Fe^{2+} and Fe^{3+}, Hg_2^{2+} and Hg^{2+}, Cu^+ and Cu^{2+}, Tl^+ and Tl^{3+}, which are reversible.

730

THERMAL DIFFUSION AS ADJUNCT OF ELECTROMAGNETIC PROCESS. M. C. Fox. Chem. & Met. Eng. 52, 102-3(1945). C.A. 40, 1727_6.

The thermal-diffusion plant at Oak Ridge concentrated U-235 from 0.7 to 1.4% in preparation for electromagnetic separation. Light UF_6 is concentrated at the top of the annular space between a steam-heated vertical central pipe and a water-cooled outer pipe.

731

SYMPOSIUM ON ATOMIC ENERGY AND ITS IMPLICATIONS. FIFTY YEARS OF ATOMIC PHYSICS. METHODS AND OBJECTIVES IN THE SEPARATION OF ISOTOPES. Harold C. Urey. Proc. Am. Phil. Soc. 90, No. 1, 30-35 (1946). C.A. 40, 1729_4.

A review.

732

THE DEVELOPMENT OF ATOMIC ENERGY. A. W. Kramer. Power Plant Eng. 49, No. 12, 99-104(1945), 50, No. 1, 87-92(1946). C.A. 40, 2065_9.

Construction of the Pu production plant at Pasco, Wash., is described with consideration of the problems involved. The methods used and the development of the plants at Oak Ridge, Tenn., for large-scale separation of U^{235} from natural U are described.

733

URANIUM-SOURCE OF ATOMIC ENERGY. G. E. Kidd. Petroleum Engr. 17, No. 6, 240-6(1946). C.A. 40, 3049_4.

A review of the engineering aspects of the manufacture of U^{235} and Pu, based on the Smyth report.

734

KINETICS OF IONIC DISCHARGE AND IONIZATION OF ADSORBED DEUTERIUM ATOMS ON A PLATINUM ELECTRODE. K. I. Rozental, P. I. Dolin, and B. V. Ershler. J. Phys. Chem. U.S.S.R. 19, 601-14(1945). C.A. 40, 3323_5.

The effect on the electrolytic separation factor for H and D is discussed.

735

THE STABILITY OF CHELATE COMPOUNDS III. EXCHANGE REACTION OF COPPER CHELATE COMPOUNDS. R. B. Duffield and M. Calvin. J. Am. Chem. Soc. 68, 557-61(1946). C.A. 40, 3672_6.

The reaction selected was the exchange reaction between the chelate and Cu ion, $Cu^{II}Ke_2 + Cu^{++*} \rightarrow Cu^{II*}Ke_2 + Cu^{++}$, the Cu ion being marked by containing a radioactive Cu isotope indicated by the superscribed asterisk. Ke represents one equivilent of chelating substance usually filling two coordination positions of the metal.

736

STRUCTURE OF BENZENE. XIII. HYDROGEN-EXCHANGE REACTION WITH BENZENE DERIVATIVES. PREPARATION OF 1,3,5-TRI, 1,2,4,5-TETRA-, AND PENTADEUTEROBENZENE. A. P. Best and C. L. Wilson. J. Chem. Soc. 239-43(1946). C.A. 40, 4356_6.

$PhNH_2.HCl$ exchanges only the o- + p-positions in the aromatic molecule with D_2O. Equilibrium is attained in 24 hours at 100° with a partition coefficient of 0.844. Methods of deuterating the other positions are given.

737

DIFFUSION OF THE STABLE ISOTOPES OF NICKEL IN COPPER. Wm. A. Johnson. Metals Technol. June 1946; Am. Inst. Mining Met. Engrs., Inst. Metals Div. Tech. Pub. No. 2007, 13 p. C.A. 40, 4578_5.

It has been found that the relative abundance of the several isotopes of Ni is altered by diffusion into Cu, and that the observed changes in isotopic constitution are best explained by assuming that the isotopes diffuse at rates inversely proportional to the square roots of their masses.

738

THE KINETICS OF CATALYTIC HYDROGENATION. A. A. Balandin. Bull. acad. sci. U.R.S.S. Classe sci. chim. 339-58(1945). C.A. 40, 4593_8.

A quantitative treatment assuming two kinds of catalytic active centers leads to reaction-rate equations for cases of hydrogenation, dehydrogenation and deuterium exchange.

739

A HIGH-INTENSITY MASS SPECTROGRAPH FOR EXPERIMENTS ON THE SEPARATION OF ISOTOPES. J. Koch and B. Bendt-Nielson. Kgl. Danske Videnskab. Selskab, Mat. fys. Medd. 21, No. 8, 28(1944). C.A. 40, 4600_7.

Details are presented for the construction and operation of a mass spectrograph of high intensity. It has a resolving power better than 1/238 at an ion current of 10 microampere and an accelerating potential of 50 Kev. Illustrations of the

effectiveness of the apparatus are furnished by the separations of the isotopes of B, Ne, Br, Kr, and Xe. The observed mass-dispersions of the apparatus are found to be smaller than those calculated for it owing to imhomogeneity of the magnetic field.

740

EXCHANGE OF HYDROGEN AND TRITIUM IONS DURING ALKYLATION, CATALYZED BY TRITIUM SULFURIC ACID. T. D. Stewart and D. Harman. J. Am. Chem. Soc. 68, 1135-6 (1946). C.A. 40, 4653_8.

A rapid exchange takes place between 2-isobutene and T_2SO_4.

741

PERFORMANCE OF A HOT-WIRE CLUSIUS AND DICKEL COLUMN. Ralph Simon. Phys. Rev. 69, 596-603(1946). C.A. 40, 4946_4.

The separation factor for A isotopes was measured as a function of the gas pressure in a hot wire type of Clusius and Dickel column.

742

ISOTOPE SEPARATION BY THERMAL DIFFUSION: THE CYCLINDRICAL CASE. W. H. Furry and R. Clark Jones. Phys. Rev. 69, 459-71(1946). C.A. 40, 4946_6.

743

PARTIAL SEPARATION OF THE ISOTOPES OF CHLORINE BY THERMAL DIFFUSION. E. F. Shrader. Phys. Rev. 69, 439-42(1946). C.A. 40, 4952_3.

The Clusius-Dickel isotope separator has been modified to allow larger-scale separation of the isotopes of Cl. The modified separator employs 2 coaxial pyrex glass cylinders. A special design was necessary to allow for the heating and resultant thermal expansion of the inner cylinder.

744

PARTIAL SEPARATION OF THE OXYGEN ISOTOPES BY THERMAL DIFFUSION AND THE DEUTERON BOMBARDMENT OF O^{17}. S. B. Welles. Phys. Rev. 69, 586-9(1946). C.A. 40, 5333_2.

With an 18-m column, O^{18} was enriched from the ordinary concentration of 0.2% to 17% and O^{17} from 0.04% to 0.8%. The former increase was determined by the mass spectrometer, the latter by the increased activity of F^{18} produced in the nuclear reaction O^{17} (d,n) F^{18}.

745

EFFICIENCY OF THE ELECTROLYTIC SEPARATION OF POTASSIUM ISOTOPES. D. A. Hutchison. J. Chem. Phys. 14, 401-8(1946). C.A. 40, 5333_3.

The electrolytic separation coefficient, α, was determined for the K isotope separation in the electrolysis of aqueous solutions of KCl at a flowing-Hg cathode. The electrolytic separation factor for the K isotopes is 1.0054 ± 0.0005 at 15-50°, and is independent of temperature, the fraction electrolyzed, the concentration of the electrolytic solution the current density, and of the amount of back reaction at the cathode. An empirical relation between the electrolytic separation factors of elements thus far investigated and their atomic weights is presented.

746

ENRICHMENT OF THE CARBON ISOTOPE C^{13} BY SEPARATING UNDER HIGH PRESSURE. W. Groth. Chem. Tech. 17, 29-31(1944). C.A. 40, 5639_1.

The apparatus consists of 2 concentric Ni tubes 5.7 m long, 18 and 28 mm outside diameter walls 2 mm thick, with 3 mm between the pipes, electrically heated, with the necessary adjuncts. The C^{13} was condensed in CH_4. The operation is described and the results are discussed mathematically.

747

KINETICS OF THE DISCHARGE OF DEUTERIUM IONS AND IONIZATION OF ADSORBED DEUTERIUM ATOMS ON PLATINIUM ELECTRODE. K. I. Rozental, P. I. Dolin, and B. V. Ershler. Acta Physicochim. U.R.S.S. 21, 213-34 (1946). C.A. 40, 6324_8.

The effect on the electrolytic separation factor is discussed.

748

A CONVENIENT AND EFFECIENT FRACTIONATING COLUMN AND ITS USE IN THE SEPARATION OF THE HEAVY ISOTOPES OF HYDROGEN. I. Dostrovsky and E. D. Hughes. Nature 158, 164-5(1946). C.A. 40, 6339_9.

The column 20 mm by 12 ft, is packed with $^1/_{16}$ inch θ-shaped rings of 100-mesh phosphor bronze gauze, and is inclosed in a vacuum jacket containing multiple concentric Al reflectors. By operating 24 days continuously with 20 l of water, 500 ml was obtained, 200 ppm heavy in D and 350 ppm heavy in O^{18}.

749

STUDY OF EXCHANGE EQUILIBRIA BY USE OF RADIOACTIVE INDICATORS. P. Sue. J. chim. phys. 43, 73-6 (1946). C.A. 41, 22f.

For reactions of the type $RM + (M + M^*)X \rightleftharpoons R(M + M^*) + MX$, the equilibrium constant is shown to be unity. Two methods of calculating the percentage of exchange are given, together with suggestions for a more uniform presentation of data.

750

THE CONCENTRATION OF K^{39} AND K^{41} BY BALANCED ION MIGRATION IN A COUNTERFLOWING ELECTROLYTE. A. Keith Brewer, Samuel L. Madorsky, and J. W. Westhaver. Science 104, 156-7(1946). C.A. 41, 336i.

The solution of KCl is electrolyzed in a fine-grained packing (of sand, glass wool, cotton, glass beads, etc.) of uniform porosity, in order to reduce the rate of remixing below the rate of separation, and to obtain a multiple-stage process. The maximum value obtained for the separation coefficient was 1.0039; the average, 1.0022. Changes of more than 50% in K^{39}/K^{41} were obtained. The apparatus is described and illustrated.

751

EXCHANGE REACTIONS WITH SOLIDS. K. E. Zimens. Arkiv Kemi, Mineral Geol. A21, No. 16, 32 (1946). C.A. 41, 904d. (English translation AERE-Lib/trans-679.)

The kinetics of heterogeneous exchange reactions are considered, and applications to problems of corrosion, reactions of solids, and heterogeneous catalysis are cited. A critical review of the literature is given, with over 40 references. The use of a self-diffusion coefficient is suggested for the study of disorders in crystal lattices.

752

THE FRACTIONATION OF ISOTOPES. A. M. Squires. J. Chem. Education 23, 538-41(1946). C.A. 41, 1151f

A general discussion of methods of separation especially gaseous diffusion (UF_6).

753

ELECTROLYTIC DEUTERIUM. Leif Tronstad. British Patent 580,791, Sept. 19, 1946. C.A. 41, 1160a.

An electrolytic cell for the preparation or concentration of heavy water is described.

754

ELECTROLYTIC PRODUCTION OF HYDROGEN, HEAVY WATER, AND METALS. Leif Tronstad. British Patent 581,908, Oct. 29, 1946. C.A. 41, 1160c.

To separate H_2 and D_2, and to recover completely the D_2 and H_2 evolved in the electrolysis is oxidized by metal oxide or mixtures of metal oxides to water. The D_2 is

oxidized to D_2O. Metals or alloys of high purity and of low C content are produced. Zn, Mn, Ni, Cr, Cu, Pb, Sn or ferrochromium, ferronickel, etc., may be produced in this way. The oxidized H_2 and D_2, as H_2O and D_2O, are returned to the electrolytic cell in which the electrolyte has about the same D_2O content as this water.

755

THE SEPARATION TUBE. V. PREPARATION OF O^{18}. Klaus Clusius and G. Dickel. Z. physik. chem. 193, 274-86(1944). C.A. 41, 1502f.

An 82-meter tube is described with separation factor for O of 10^5. Owing to the reaction $2O^{16}O^{18} = O_2^{16} + O_2^{18}$ at the hot Pt wire, the apparatus produces O^{18}, together with $O^{17}O^{18}$. This mixture reworked in a smaller apparatus gave 250 cc O^{18} containing 99.5% O^{18} and 0.5% O^{17}.

756

MULTISTAGE SEPARATION PROCESSES. Manson Benedict. Am. Inst. Chem. Engrs. 43, No. 2, 41-60(1947). C.A. 41, 1503b.

For isotope separation, it is thought that chemical exchange, gaseous diffusion, and mass diffusion will be preferred for large-scale operations, and thermal diffusion and the gas centrifuge for small-scale operations. In small-scale work, thermal diffusion will have a higher enrichment factor and will be more suitable than the gas centrifuge for separating mixtures of low molecular weight, such as light and heavy methane, or neon and helium. The gas centrifuge has a high enrichment factor and is preferred to thermal diffusion for separating mixtures of heavy gases, such as krypton and xenon, or the xenon isotopes. Basic concepts, mathematical equations, and flow diagrams are given for the various methods.

757

NEW DEVELOPMENTS IN VACUUM ENGINEERING. R. B. Jacobs and H. F. Zuhr. J. App. Phys. 18, 34-48(1947). C.A. 41, 1895b.

The vacuum engineering of the K-25 Gaseous Diffusion Plant and the methods employed there for obtaining vacuum tightness for the separation of U^{235} are described. A resume of vacuum testing methods prior to 1943 is given.

758

PROPOSAL OF A METHOD FOR THE SEPARATION OF He^3 FROM He^4. J. Franck. Phys. Rev. 70, 561(1946). C.A. 41, 1931a.

Superfluidity occurs in He^4, but not in He^3. There should be a considerable enrichment of He^3 in the residue after most of the He^4 has run out of a container on account of its superfluidity.

759

VARIATION IN DEUTERIUM CONCENTRATION IN THE PROCESS OF MELTING ICE. R. V. Teĭs. Compt. rend. acad. sci. U.R.S.S. 53, 529-32(1946). C.A. 41, 2623c.

The D content of the water formed upon melting depended on the stage of the melting, being low at first and increasing as melting continued.

760

CATALYTIC EXCHANGE REACTION OF HYDROGEN BETWEEN TWO DIFFERENT HYDROCARBONS. I. THE EXCHANGE REACTION BETWEEN HEAVY ETHYLENE AND PROPYLENE. M. Koizumi. J. Chem. Soc. Japan 63, 1516-21(1942). C.A. 41, 2974e.

It was confirmed that the exchange reaction takes place between heavy ethylene and propylene in the presence of Ni catalyst.

761

THE CATALYTIC EXCHANGE REACTIONS OF OXYGEN ATOMS BETWEEN GASEOUS OXYGEN AND WATER VAPOR BY IRON OXIDE CATALYST. I. EXPERIMENTAL. N. Morita. J. Chem. Soc. Japan 63, 659-64(1942). C.A. 41, 2974h.

Four catalysts: (1) α-Fe_2O_3, (2) γ-Fe_2O_3, (3) Fe_2O_3 + Bi_2O_3(2:1 by wt.), (4) Bi_2O_3 were prepared. Their catalytic activity was determined in the exchange reactions of O atoms in O and water vapor. (1), (2), and (3) showed about the same activity. The activity of (1) and (2) decreased with repeated use. All 4 catalysts lost their catalytic activity when heated above 800°. The temperature of the exchange reaction is 300 to 700°.

762

CONCENTRATION OF THE ISOTOPES OF MERCURY BY FREE EVAPORATION IN A 10-CELL COUNTERCURRENT REFLUX STILL. A. Keith Brewer and Samuel L. Madorsky. J. Research Natl. Bur. Standards 38, 129-35(1947). C.A. 41, 2985h.

A single-stage molecular still was operated at temperatures from 108.1° to 128°. Isotope enrichment was measured by the change in density of Hg. The change in density per plate decreases with increasing temperature, and is in agreement with results of other investigators using single-stage stills.

763

EXCHANGE REACTIONS BETWEEN ARSENICAL AND THIOARSENICAL DERIVATIVES. INFLUENCE OF SOLVENT. M. Martin, P. Daudel, R. Daudel, and P. Magnier. Compt. rend. 224, 195-6(1947). C.A. 41, 3008c.

By utilizing radioactive arsenic in tracer quantities and soluble and insoluble arsenic, arsenious, arsenite, arsenate, thioarsenite, and thioarsenate compounds in water or liquid-NH_3 solutions, exchange was found to take place when the system contained only thioarsenical ions, but not when it contained an arsenical and a thioarsenical ion, or two arsenical ions. The last group was better able to exchange in liquid NH_3.

764

EXCHANGE REACTION OF OXYGEN ATOMS BETWEEN SULFUR TRIOXIDE AND SULFUR DIOXIDE IN LIQUID PHASE. S. Nakata. J. Chem. Soc. Japan 64, 635-8(1943). C.A. 41, 3349c.

When anhydrous SO_2 gas is dissolved in anhydrous liquid SO_3, exchange of O takes place to a considerable extent at room temperature.

765

THE PHENOMENOLOGY OF TWO PROCEDURES FOR SEPARATING ISOTOPES. A. Klemm. Z. Naturforsch. 1, 252-7 (1946). Naturwissenschaften 32, 69 (1944). C.A. 41, 3364g.

The separation factor, Q, is approximately given by the equation in Q = f in q for diffusion and for migration processes.

766

CONCENTRATION OF ISOTOPES OF POTASSIUM BY THE COUNTERCURRENT ELECTROMIGRATION METHOD. A. Keith Brewer, Samuel L. Madorsky, J. K. Taylor, V. H. Dibeler, P. Bradt, O. L. Parham, Roy J. Britten, and F. G. Reid, Jr. J. Research Natl. Bur. Standards 38, 137-68 (1947). C.A. 41, 3692c.

The method is based on the principle of setting up a flow of electrolyte through a packed column in a direction countercurrent to the migration of the isotopic ions being separated and at a rate intermediate between the velocities of these ions. Under these conditions, the faster-moving ions will make headway against the electrolyte stream while slower ones will be carried back. In a series of experiments, for the concentration of K^{39}, the abundance ratio $N = K^{39}/K^{41}$ was increased from its normal value of 14.2 to maximum of 24 in about 500 hours of operation and a maximum separation coefficient of 0.385×10^{-2} was obtained.

767

CONCENTRATION OF K^{39} BY COUNTERCURRENT ELECTROMIGRATION: SOME THEORETICAL ASPECTS OF THE OPERATION. James W. Westhaver. J. Research Natl. Bur. Standards 38, 169-83(1947). C.A. 41, 3692f.

Equations are derived which describe the operations (A) for the early stages of a run, (B) after infinite time with no production, and (C) after infinite time at fixed production. The formulas under (A) enable evaluation of the elementary separation factor, while those under (B) enable calculation of the maximum separation factor in terms of various channeling factors which determine the length of the theoretical unit cell, h. The formulas under (C) measured by the smallness of h, depict the fractionator as one which is about 100 times more powerful than a modern laboratory distillation column.

768

CONCENTRATION OF ISOTOPES OF CHLORINE BY THE COUNTERCURRENT ELECTROMIGRATION METHOD. Samuel L. Madorsky and Sidney Straus. J. Research Natl. Bur. Standards 38, 185-9(1947). C.A. 41, 3692h.

The isotope Cl^{35} was concentrated in the anode compartment of an electromigration cell with NaCl as the electrolyte. A concentration from the normal value of 75.76% to 80.7% was obtained in 474 hours. A maximum initial separation coefficient of 0.207×10^{-2} was obtained.

769

ENRICHMENT OF HEAVY WATER BY THERMAL DIFFUSION. K. Hirota and O. Kimura. Bull. Chem. Soc. Japan 17, 42-4(1942). C.A. 41, 4347d.

The effect of the addition of inorganic substances on isotopic separation of water in thermal diffusion was studied. H_2SO_4, KCl and Na_2SO_4 were used.

770

CATHODIC PROTIUM-TRITIUM SEPARATION FACTORS. M. L. Eidinoff. J. Am. Chem. Soc. 69, 977(1947). C.A. 41, 4362e.

Protium-tritium separation factors of $13._4$ and $14._7$ were observed. The protium-tritium ratio for the H gas in the electrolysis is slightly more than twice that corresponding to thermodynamic equilibrium of the electrode interface.

771

PROTON-DEUTERON EXCHANGE BETWEEN AMMONIA AND AMMONIATED DIBORANE. A. B. Burg. J. Am. Chem. Soc. 69, 747-50(1947). C.A. 41, 4363b.

The H-D exchange reaction between liquid ND_3 at −78° and $B_2H_6 \cdot 2NH_3$ reaches equilibrium very rapidly. The extent of exchange corresponds only to the N-H links in $B_2H_6 \cdot 2NH_3$ even at temperatures up to 18°.

772

THE CATALYTIC EXCHANGE OF ISOTOPES OF GASEOUS OXYGEN. XI. THE EXCHANGE REACTION OF OXYGEN ATOMS BETWEEN OXYGEN AND STEAM ON THE SURFACE OF SODIUM AND POTASSIUM HYDROXIDES. Y. Osumi and N. Morita. Bull Chem. Soc. Japan 17, 217-20(1942). C.A. 41, 4365e.

Steam from heavy water and the light oxygen gas, obtained electrolytically, were passed together through the catalyzer pipes where a mixture of asbestos and alkali hydroxide was packed. The effluent steam, after being condensed, was weighed, and from the decrease in weight, the exchange percentage of the oxygen atoms was calculated. The activation energy for the exchange reaction was found to be 47 kcal. with NaOH as catalyst and 21 kcal. with KOH. A mechanism is proposed.

773

THE CATALYTIC EXCHANGE OF ISOTOPES OF GASEOUS OXYGEN. XII. THE EXCHANGE REACTION OF OXYGEN AND STEAM OF THE SURFACE OF SODIUM AND POTASSIUM CARBONATES. Y. Osumi, N. Morita, and T. Chitani. Bull. Chem. Soc. Japan 17, 189-96(1942). C.A. 41, 4365g.

Finely granulated NaCl, Na_2SO_4, Na_3PO_4, Na_2CO_3, and K_2CO_3 were placed separately into catalyzer pipes and heated at some definite temperature. Steam of heavy water, together with electrolytic light oxygen was passed through the pipes, and the effluent steam, after being condensed, was weighed. From the decrease in weight exchange percentage of isotopes of oxygen was calculated. Catalytic exchange reaction took place with carbonates only.

774

THE CATALYTIC EXCHANGE OF ISOTOPES OF GASEOUS OXYGEN. XIII. THE EXCHANGE REACTION OF OXYGEN ATOMS BETWEEN OXYGEN AND WATER VAPOR ON THE SURFACE OF VARIOUS CATALYZERS OF IRON OXIDES. N. Morita. Bull. Chem. Soc. Japan 18, 242-7(1943). C.A. 41, 4366a.

Light O_2 and heavy water vapor were passed together over α-Fe_2O_3, γ-Fe_2O_3, $2Fe_2O_3 + Bi_2O_3$, and Bi_2O_3, respectively at various temperatures. From the decrease of the vapor density, the exchange percentage of O-isotopes, was calculated.

775

EXCHANGE REACTION OF HYDROGEN ATOMS IN SOLID ANILINE HYDROCHLORIDE AND ITS DERIVITIES. I. ANILINE HYDROCHLORIDE. N. Okazaki and M. Koidzume. Bull. Chem. Soc. Japan 16, 371-7(1941). C.A. 41, 4463f.

If $PhNH_2.HCl$ with D in the amino group is heated, the 2-, 4-, and 6-positions of the ring exchange H atoms with the amino group.

776

EXCHANGE REACTION OF HYDROGEN ATOMS IN SOLID ANILINE HYDROCHLORIDE AND ITS DERIVATIVES. II. p-TOLUIDINE HYDROCHLORIDE. J. Kuroda and N. Okazaki. Bull. Chem. Soc. Japan 16, 417-22(1941). C.A. 41, 4463h.

If p-toluidine with D in the amino group is heated the D exchanges with 2 or 4 of the H atoms of the ring.

777

ISOTOPE EXCHANGE IN THE HYDROGENATION OF BENZENE WITH DEUTERIUM OVER PLATINIUM AND CHROMIC OXIDE CATALYSTS. A. A. Balandin, Z. V. Kharina, and R. V. Teĭs. Compt. rend. acad sci. U.R.S.S. 53, 715-18(1946). C.A. 41, 4698d.

During the hydrogenation of benzene over a Pt-on-asbestos catalyst and over Cr_2O_3, it was observed that exchange with D occurred.

778

EXCHANGE BETWEEN CHROMIUM IONS AND THE SZILARD EFFECT. Roland Muxart, P. Daudel, R. Daudel, and M. Haissinsky. Nature 159, 538-9(1947). C.A. 41, 4706d.

$Cr(OH)_3$ which had been subjected to the action of slow neutrons was converted into the sulfate. $K_2Cr_2O_7$ was added to this solution so as to obtain equimolecular amounts of Cr^{3+} and $\frac{1}{2}Cr_2O_7^{2-}$. After 15-120 minutes, the chromic salt was precipitated by boiling with NH_4OH and the dichromate precipitated as the Ba salt. As measured by a Geiger-Muller counter, no appreciable exchange was found in neutral or acid medium.

779

EVIDENCE OF AN EXCHANGE REACTION BETWEEN FREE BROMINE AND ANTIMONY BROMIDE. Roland Muxart. Compt. rend 224, 1107-8(1947). C.A. 41, 4729h.

In four experiments $SbBr_3$ dissolved in CS_2 and radio-Br_2 were in contact for less than 1 hour at a temperature of 50°. A complete exchange of atoms resulted.

780

CENTRIFUGE FOR THE SEPARATION OF GASES OF DIFFERENT MOLECULAR WEIGHTS. A. Bramley.

U. S. Patent 2,422,882. June 24, 1947. C.A. 41, 4974e.
Structural and operational details are given.

781

THERMAL DIFFUSION WITH BORON TRIFULORIDE. W. W. Watson, J. O. Buchanan, and F. K. Elder, Jr. Phys. Rev. 71, 887-90(1947). C.A. 41, 4982b.

With BF_3 gas at atmospheric pressure in 7 m of Clusius and Dickel hot-wire columns, with $\Delta T = 400°$, the equilibrium separation factor for $B^{10}F_3/B^{11}F_3$ was 1.32 ± 0.12, reached in slightly over 3 days.

782

CALCULATION OF EQUILIBRIUM CONSTANTS FOR ISOTOPIC EXCHANGE REACTIONS. Jacob Bigeleisen and Maria G. Mayer. J. Chem. Phys. 15, 261-7(1947). C.A. 41, 5009h.

The chemical separation of isotopes is a quantum effect. This permits a direct calculation of the difference in the free energies of two isotopic molecules. Tables and approximation methods are given which permit a rapid calculation of equilibrium constants if the frequency shifts on isotopic substitution are known.

783

ENRICHMENT OF N^{15} IN A TWO-STAGE EXCHANGE PLANT. E. W. Becker and H. Baumgärtel. Z. Naturforsch. 1, 514-17(1946). C.A. 41, 5015g.

With a cascade arrangement of glass columns filled with efficient packing material, the N^{15} content was enriched from 0.36 to 18.2%. For $N^{15}H_3$ (g) + $N^{14}H_4^+$ (soln) $\rightleftharpoons$ $N^{14}H_3$ (g) + $N^{15}H_4^+$ (soln), K = 1.023. More than a kg of NH_4Cl with an average N^{15} content of 9.0% was obtained. Details of the apparatus and operating procedures are given.

784

SEPARATION AND PHYSICS OF ISOTOPES. O. van Paemel. Tech. Wetenschap. Tijdschr. 16, 56-9(1947). C.A. 41, 5374i.

A review.

785

THE DIFFUSION THERMOEFFECT IN MULTICOMPONENT ISOTOPIC GAS MIXTURES. Ludwig Waldmann. Z. Naturforsch. 1, 12-13(1946). C.A. 41, 5765g.

Two gas mixtures of different relative isotope concentration contained in a Clusius-Dickel divided tube were allowed to mix (after the difference in their mean molecular weight had been determined) and the temperature effect was measured.

786

THERMODYNAMIC PROPERTIES OF ISOTOPIC SUBSTANCES. Harold C. Urey. J. Chem. Soc. 562-81(1947). C.A. 41, 5777c.

The thermodynamics of the exchange reaction $aA_1 + bB_2 \rightleftharpoons aA_2 + bB_1$ is considered, where A and B are molecules having one element in common and the subscript 1 or 2 indicates whether a molecule contains the light or heavy isotope of this element. The equilibrium constant (K) is expressed by a ratio of the partition functions (Q) for the exchange reaction between the compound and the separated atoms, i.e., $K = (Q_{2A}/Q_{1A})^a/(Q_{2B}/Q_{1B})^b$. Molecular frequencies are tabulated and tables of the values of (Q_2/Q_1) and K are given for exchange reactions involving isotopes of H, Li, B, C, N, O, Cl, Br, and I.

787

PHYSICAL CHEMICAL DIFFERENCES OF ISOTOPES. K. Schäffer. Angew. Chem. A59, 42-8 (1947). C.A. 41, 5792d.

A comprehensive discussion covering static differences under chemical equilibrium and other physical equilibrium and dynamic differences under the headings of gas reaction velocities in solutions, and differences of reaction velocities on solid surfaces. Considerable theoretical material is presented.

788

THE SEPARATION OF ISOTOPES BY THERMAL DIFFUSION. R. Clark Jones and W. H. Furry. Rev. Mod. Phys. 18, 151-224(1946). C.A. 41, 5792e.

Subjects treated are: fundamental theory of thermal diffusion, theory of functioning of apparatus for separation of isotopes, review and discussion of existing experimental results. Detailed numerical design calculations are given for two multistage plants, one for the concentration of C^{13} in CH_4 and the other for increasing the concentration of He^3 in He.

789

ISOTOPE SEPARATION IN ASCENDING HYDROGEN-DEUTERIUM FLAMES. Klaus Clusius and G. Faber. Z. Naturforsch. 2a, 97-9(1947). C.A. 41, 5792f.

The separation factor F_g in the unburned gas was studied with relation to the primary H content. At 9% H, a value of $F_g = 2.2$ was obtained.

790

CONCENTRATION OF N^{15} BY MEANS OF THE CHEMICAL EXCHANGE METHODS. E. W. Becker and H. Baumgärtel. Angew. Chem. A59, 88-9(1947). C.A. 41, 5792g.

A two-stage system is described where a 60% aq. NH_4NO_3 solution having a normal isotope content of 0.38% N^{15} is brought into countercurrent contact with NH_3 gas generated from the nitrate solution with NaOH. A detailed flow sheet and the construction of a rubber-tube-type pump are shown.

791

DETERMINATION OF INTERMOLECULAR FORCES FROM TRANSPORT PHENOMENA IN GASES. Masao Kotani. Proc. Phys. Math. Soc. Japan 24, 76-95 (1942). C.A. 41, 6095c.

The coefficient of viscosity of a simple gas and the thermal diffusion ratio of the gaseous isotope mixture were calculated as functions of temperature. Results were applied to the isotopic thermal diffusion of CH_4 and Ne.

792

DETERMINATION OF INTERMOLECULAR FORCES FROM TRANSPORT PHENOMENA IN GASES. II. INVESTIGATION OF VISCOSITY AND ISOTOPIC THERMAL DIFFUSION ACCORDING TO THE LENNARD-JONES MODEL. Taro Kihara and Masao Kotani. Proc. Phys. Math. Soc. Japan 25, 602-14 (1943). C.A. 41, 6095c.

By assuming an intermolecular potential of the Lennard-Jones type, the coefficient of viscosity of simple gases and the thermal diffusion ratio of gaseous isotope mixtures were calculated as functions of temperature.

793

SEPARATION OF THE NITROGEN ISOTOPES BY THE EXCHANGE REACTION BETWEEN AMMONIA AND SOLUTIONS OF AMMONIUM NITRATE. Isidor Kirshenbaum, James S. Smith, Thomas Crowell, Jacob Graff, and Robert McKee. J. Chem. Phys. 15, 440-6(1947). C.A. 41, 6116a.

The fractionation factor for the exchange reaction between NH_3 and NH_4NO_3 was determined as a function of the dissolved NH_3 content.

794

METHOD FOR EXTENDING STUDY OF METAL ION-CATION EXCHANGER ISOTOPE FRACTIONATION. Maxwell Leigh Eidinoff. J. Chem. Phys. 15, 527(1947). C.A. 41, 6142h.

Isotope fractionation in cation-cation exchanger equilibrium can be studied more readily by the addition of 5-50

microcuries of radioisotopes to the element. Some excellent pairs are $Be^{7,9}$, $Be^{9,10}$, $Na^{22,23}$, $Na^{23,24}$, $K^{39,41,42}$, $Ca^{40,41,45}$.

795
COMMERCIAL SEPARATION OF ISOTOPES. F. Rumford. Chem. Age (London) 62, 231-4, C.A. 41, 6442e.

796
ENRICHMENT OF C^{13} AND C^{14} BY A COUNTERCURRENT GASEOUS EXCHANGE PROCESS USING THERMAL DIFFUSION. T. I. Taylor and R. B. Berstein. J. Am. Chem. Soc. 69, 2076(1947). C.A. 41, 6465c.

By the use of the exchange reaction $C^{13}O + C^{12}O_2 = C^{12}O + C^{13}O_2$ in conjunction with a thermal diffusion column, and enrichment of both C^{13} and O^{18} was effected.

797
KINETICS OF HYDROGENATION AND OF RELATED REACTIONS. I. MECHANISM OF HYDROGENATION, DEHYDROGENATION, AND DEUTERIUM EXCHANGE. A. A. Balandin. Acta. Physicochim. U.R.S.S. 22, 81-100 (1947). C.A. 41, 6801a.

A quantitative treatment assuming two kinds of catalytic active centers leads to reaction-rate equations for the cases of hydrogenation, dehydrogenation, and deuterium exchange.

798
ENRICHMENT OF THE HEAVY SILVER ISOTOPE BY IONIC MIGRATION IN α-AgI. A. Klemm. Z. Naturforsch. 2a, 9-16(1947). C.A. 41, 6809e.

Solid AgI was electrolyzed at 230° for 20 hr with an anodic current density of 2 amps/cm^2, a C anode, and a Ag cathode. The AgI remaining in the vicinity of the anode after the electrolysis was investigated by the mass spectrograph and the spectrograms were examined with a Zeiss recording photometer. A theoretical justification of this photometric method is derived.

799
ISOTOPIC NITROGEN EXCHANGE BETWEEN NITROGEN PENTOXIDE AND DIOXIDE. R. A. Ogg, Jr. J. Chem. Phys. 15, 613(1947). C.A. 41, 7182h.

The mechanism proposed for the decomposition of N_2O_5 was verified by using positron-active N^{13}.

800
EXCHANGE IN BINARY AND TERNARY SYSTEMS: PERIODATE-IODATE-IODINE. M. Cottin and M. Haissinsky. Compt. rend 224, 1636-8(1947). C.A. 41, 7219e.

By use of radioactive Na, the exchange between $NaIO_4$ and $NaIO_3$ in 0.02 N HNO_3 solution was investigated. Iodine acted as a catalyst, but other reduction-oxidation catalysts such as $Ce(NO_3)_3$ and $KReO_4$ acted more as inhibitors for the reaction. The strong catalytic action of I therefore implies exchange in the systems IO_3^-/I_2 and IO_4^-/I_2.

801
THE CONCENTRATION OF STABLE ISOTOPES BY THE ELECTROMAGNETIC METHOD. A REVIEW. C. P. Keim. Chem. Eng. News, 25, 2624-5(1947). C.A. 41, 7229h.

An elementary review. To date 26 elements and 111 stable isotopes have been concentrated.

802
ISOTOPE SEPARATION FOR THE PURPOSE OF PRODUCTION OF NUCLEAR ENERGY. S. R. de Groot. Nederland. Tijdschr. Nauurk. 13, 113-26(1947). C.A. 41, 7230g.

A review.

803
A NEW METHOD OF SEPARATION OF THE ISOTOPES He^3 AND He^4. J. G. Daunt, R. E. Probst, Herrick L. Johnston, L. T. Aldrich, and A. O. Nier. Phys. Rev. 72, 502-3(1947). C.A. 41, 7243h.

Liquid He II was caused to flow from a bath of He, at a temperature below the λ-point. The arrangement was such that He was transferred in a surface film, with no flow of "bulk" liquid or of vapor. From He in which the ratio He^3/He^4 was 1.20×10^{-6}, the first sample of He transferred by superfluid flow had a ratio of He^3/He^4 of 1.1×10^{-7}, and subsequent samples had ratios of He^3/He^4 less than 5×10^{-8}. The He in the reservoir was enriched in He^3. The apparatus is described.

804
THE THERMAL DIFFUSION CONSTANT OF HELIUM AND THE SEPARATION OF He^3 BY THERMAL DIFFUSION. B. B. McInteer, L. T. Aldrich and A. O. Nier. Phys. Rev. 72, 510-11(1947). C.A. 41, 7246i.

With a thermal diffusion apparatus, He was enriched 860 times in He^3 in 8 days; 52 cc of He enriched 300 times in He^3 was accumulated. The experimental thermal diffusion constant α is 0.059 ± 0.005. Theoretical and experimental values of α are discussed.

805
THE DUAL TEMPERATURE PROCESS FOR ISOTOPIC SEPARATION. [nd] Decl. Feb. 26, 1947. (MDDC-89). ADD 1, 547.

A variation of the chemical exchange method was devised by J. S. Spevack. The procedure, known as the dual temperature process, is essentially an engineering application of the well-known fact that the equilibrium constant for isotopic exchange reactions varies with the temperature.

806
THE HYDROGEN ISOTOPES: THERMODYNAMIC PROPERTIES OF THEIR COMPOUNDS. Sept. 1942. Decl. Nov. 25, 1947. 54p. (MDDC-1496). ADD 1, 808.

A tabulation of the properties of D_2, H_2, the system D_2O-HDO-H_2O, organic molecules with H and with D, halogen acids, hydrogen and deuterium compounds of metals and nonmetals, ammonium salts, and deuterates and hydrates.

807
SEPARATION OF STABLE ISOTOPES. David W. Stewart. Nucleonics 1, No. 2, 18-26(1947). C.A. 42, 453a.

808
A TECHNIQUE FOR THE STUDY OF ISOTOPIC EXCHANGE REACTIONS. M. Haïssinsky and B. Pullman. J. phys. radium 8, 33-5(1947). C.A. 42, 453i.

The difficulties of obtaining reproducible exchange coefficients by measurements on thin layers of equal thickness are discussed. It is shown that the activity detected by a counter increases with the layer thickness until an asymptotic level is attained. Beyond this thickness, further increase in layer thickness does not change the measured activity. Experimental curves for β-radiation are shown for Cu and Pb.

809
THE SEPARATION OF THE ISOTOPES He^3 AND He^4 IN THE LIQUID PHASE. J. G. Daunt, R. E. Probst, and Herrick L. Johnston. J. Chem. Phys. 15, 759-60(1947). C.A. 42, 454i.

A vessel with a ground-glass joint was immersed in liquid He below the λ-point. The He flowed through the ground joint. Ratios for He^3/He^4 of 1.85 and 1.55×10^{-6} were obtained in the vapor from the liquid which did not pass through the capillary opening; ratios of 0.37 and 9.35×10^{-6} were obtained in the vapor from the liquid which passed through the capillary. Evidently He^3 is partially removed by filtration through a capillary opening.

810

ISOTOPIC EXCHANGE IN THE SYSTEMS MnO_2/Mn^{++} AND PbO_2/Pb^{++}. B. Pullman and M. Haïssinsky. J. phys. radium 8, 36-8(1947). C.A. 42, 454c.

Studies were undertaken in order to investigate the reported differences in exchange rates for 2 systems, which are otherwise similar chemically. The rates were such as to indicate a diffusion-controlled process after an initial rapid exchange in both cases.

811

ISOTOPIC EXCHANGE AND THE NATURE OF THE CHEMICAL BOND. A REVIEW. M. Haissinsky and R. Daudel. Bull. soc. chim. France 552-9 (1947). C.A. 42, 1115f.

The various mechanisms of isotopic exchange are discussed and an attempt is made to account for the non-occurrence of exchange in particular cases. An extensive table of attempted exchange reactions is included.

812

EXCHANGE OF CARBON DIOXIDE BETWEEN BARIUM CARBONATE AND THE ATMOSPHERE. W. D. Armstrong and J. Schubert. Science 106, 403-4(1947). C.A. 42, 1124d.

To explain the incorporation in $BaCO_3$ of $C^{12}O_2$ from the atmosphere in exchange for $C^{14}O_2$, the following mechanism is postulated: $C^{12}O_2 + H_2O \rightarrow H_2C^{12}O_3$; $BaC^{14}O_3 + H_2C^{12}O_3 \rightarrow BaC^{12}O_3 + H_2C^{14}O_3$; $H_2C^{14}O_3 \rightarrow H_2O + C^{14}O_2$. No loss of radioactivity by $BaCO_3$ is found to occur in the absence of H_2O vapor or CO_2; $C^{14}O_2$ is released to the atmosphere, when the exchange occurs, in an amount equal to the decrease in radioactivity of the $BaCO_3$.

813

THE ENRICHMENT OF THE HEAVY ISOTOPES OF Li AND K BY ELECTROLYTIC ION MIGRATION IN FUSED CHLORIDES. A. Klemm, H. Hintenberger, and P. Hoernes. Z. Naturforsch 2a, 245-9 (1947). C.A. 42, 1500h.

The mixing proportion $[Li^7]/[Li^6]$ was shifted from 12.3 to 44.3 and that of $[K^{41}]/[K^{39}]$ from 0.0714 to 0.0885 by electrolytic ion migration in fused LiCl with 2 mole % KCl or $PbCl_2$ at a current density of 5 amp/cm^2 in 48 hours. From the quotients of the ion migration velocity, the given enrichment means a separation stage value of 61.5 in Li isotopes and 13.4 in K isotopes. Mass effect $\mu = -0.135$ for Li and $\mu = -0.32$ for K.

814

THE TEMPERATURE VARIATION OF THE THERMAL DIFFUSION FACTOR FOR BINARY MIXTURES OF HYDROGEN, DEUTERIUM AND HELIUM. Byron F. Murphey. Phys. Rev. 72, 834-7(1947). C.A. 42, 1774a.

Experimental values of the thermal diffusion factor, α, were measured by the twin-bulb method for mixtures of H_2 and D_2, H_2 and He, and D_2 and He. The thermal diffusion factor was found to be measurable for a mixture of D_2 and He and appeared to decrease with temperature.

815

He^3 SEPARATION BY A HEAT FLUX IN LIQUID HELIUM II. C. T. Lane, Henry A. Fairbank, L. T. Aldrich, and A. O. Nier. Phys. Rev. 73, 256-7(1948). C.A. 42, 1815b.

By using the internal convection in liquid He produced by a heat flux, a maximum enrichment factor of 130 was obtained for He^3 at 2.01°K. The apparatus is described.

816

THE SEPARATION OF ISOTOPES IN QUANTITY BY ELECTROMAGNETIC MEANS. L. P. Smith, W. E. Parkins and A. T. Forester. Phys. Rev. 72, 989-1002 (1947). C.A. 42, 1815h.

A discussion of the possibilities with various instruments.

817

CALCULATIONS ON COUNTERCURRENT ELECTROMIGRATION. G. Breit and F. L. Friedman. J. Research Natl. Bur. Standards 39, 397-409(1947). C.A. 42, 2184h.

The mathematical problems presented by the countercurrent electrolysis method for isotope separation are treated under the following assumptions: the mobilities and diffusion coefficients have the same values throughout the tube; the electric field is constant along the tube; the cathode is perfectly stirred; the concentrations in the anode are maintained at the normal value; the solution is completely dissociated and the forces acting on ions due to space charge effects are neglected. Solutions are worked out for tubes of finite length and approximations are made for tubes of infinite length.

818

THE CATHODIC PROTIUM-TRITIUM SEPARATION FACTOR. I. APPARATUS; PLATINUM CATHODE-ALKALINE SOLUTION. Maxwell Leight Eidinoff. J. Am. Chem. Soc. 69, 2507-9(1947). C.A. 42, 2512.

Protium-tritium separation factors of 13.4 and 14.7 were obtained in the electrolysis at 20.0° of a 10% NaOH solution at a smooth Pt-foil cathode with a current density of 0.1 amp/cm^2.

819

ISOTOPE SEPARATION. Allen Francis Reid. U. S. Patent 2,435,796, Feb. 10, 1948. C.A. 42, 2522h.

Isotopes of C and O are relatively concentrated by the reaction of CO_2 with H_2CO_3, HCO_3^-, and H_2O under a pressure of 6-50 atmosphere and at temperatures of 20-64°, in the presence of a heterogenous catalyst containing SiO_2, a silicate, C, and Al_2O_3. The CO_2 is fed at the rate of 15 millimoles/cm^2/min. A fluid enriched with the desired isotope is taken off continuously. The process is shown schematically.

820

THE THERMAL DIFFUSION CONSTANT OF NITROGEN. A. K. Mann. Phys. Rev. 73, 412-13(1948). C.A. 42, 2827i.

Some two-bulb thermal diffusion experiments are reported. The temperature was 329°K. Values are reported for the isotopic separation in %, for the thermal diffusion constant α, and for R_T, the ratio of the experimental value of α to that calculated from the elastic-sphere molecular model: Ne^{22}/Ne^{20}, 4.48 ± 0.27, 0.0273 ± 6%, 0.65 ± 6%; A^{36}/A^{40}, 2.24 ± 0.22, 0.0164 ± 10%, 0.35 ± 10%; $(N^{14}N^{15})/N_2^{14}$, 1.41 ± 0.14, 0.0051 ± 10%, 0.33 ± 10%.

821

DIFFUSION TUBE AT HIGH PRESSURES AND IN A RADICAL ELECTRIC FIELD. II. PHENOMENA OF TURBULENCE. E. W. Becker. Z. Naturforsch. 2A, 447-54(1947). C.A. 42, 2828a.

Operation at 1 to 23 atmospheres and at varying rates of flow shows that the efficiency of separating N_2/CO_2 mixtures is not worked by dependent on the turbulence obtained in the system.

822

THE EFFECT OF CERTAIN COLUMN VARIABLES ON THERMAL DIFFUSION. H. G. Drickamer, V. J. O'Brien, J. C. Bresee, and C. E. Ockert. J. Chem. Phys. 16, 122-8(1948). C.A. 42, 2829g.

Tests were made on two thermal diffusion columns with different annular spacing. The results indicate that the dependence of the separation is on temperature and annular spacing.

823

PREPARATION OF STABLE TRACERS. H. G. Thode. Proc. Conf. Nuclear Chem., Chem. Inst. Can.

127-33 (1947). C.A. 42, 3254d.

The various methods of preparing N^{15}, C^{13}, O^{18}, S^{34}, and S^{36} are reviewed, and the choice of isotope, the quantities available, and the cost are discussed. The chemical exchange method can be used successfully for separating the isotopes of H, C, N, O, and S. The rate of production by this method is higher than that of other methods, and enrichments can be obtained suitable for most isotope exchange and tracer work.

824

THE SEPARATION TUBE. VI. ISOLATION OF THE MIXED MOLECULE $N^{14}N^{15}$. Klaus Clusius and E. W. Becker. Z. Naturforsch. 2a 154-9(1947). C.A. 42, 3259d.

The starting material was enriched NH_4NO_3 (1.8-3.0% N^{15}). The separated product from the 82-meter separation tube consisted of 1.5 l of N_2 with molecular weight of 29.015 and 1.0 l of molecular weight 28.5, corresponding to a yield of 61% of the starting material. The equilibrium $2N^{14}N^{15} = N_2^{14} + N_2^{15}$ was not established on the hot wire.

825

A NEW ISOTOPIC EFFECT IN LIQUID HELIUM. J. G. Daunt, R. E. Probst, and Herrick L. Johnston. Phys. Rev. 73, 638(1948). C.A. 42, 3633h.

The apparatus consists of an inverted U-tube with a ground glass plug that prevents the flow of vapor but permits the flow of liquid through the super-surface film. When He with an initial concentration of $He^3/He^4 = 0.000024$ was condensed in one arm at 1.57°K, the liquid flowed through the superconductive film until equilibrium was established, with the level in the first side 2.1 mm above that in the second side of the U-tube.

826

THE EXCHANGE REACTION BETWEEN THE TWO OXIDATION STATES OF THALLIUM IN PERCHLORIC ACID SOLUTIONS. Garman Harbottle and R. W. Dobson. J. Am. Chem. Soc. 70, 880(1948). C.A. 42, 3665b.

With $Tl^{204,206}$ the dependence of the rate of exchange on the concentration of thallous and thallic perchlorates, on acid concentration, and on the temperature was determined by varying thallic perchlorate from 0.0006 to 0.003f.

827

EXCHANGE REACTION BETWEEN THALLIUM (I) AND THALLIUM (III) IONS IN PERCHLORIC AND NITRIC ACID SOLUTIONS. R. J. Prestwood and A. C. Wahl. J. Am. Chem. Soc. 70, 880-1(1948). C.A. 42, 3665d.

By using $Tl^{204,206}$ part prepared by the Tl(d,p) reaction and part prepared by the Tl(n,γ) reaction, the rate of exchange reaction between Tl(I) and Tl(III) in aqueous solutions of perchloric and nitric acid was measured.

828

EXCHANGE REACTION BETWEEN FERRIC AND FERROUS IONS IN PERCHLORIC ACID USING A DIFFUSION SEPARATION METHOD. L. Van Alten and C. N. Rice. J. Am. Chem. Soc. 70, 883-4(1948). C.A. 42, 3665f.

Electronic exchange between ferric and ferrous ions in 3M perchloric acid with radioferric ion as indicator was measured over periods up to 9 days. The total iron concentration was 0.023M, and the concentration ratio of ferric to ferrous ions was close to 0.25. A half time for exchange of 18.5 ± 2.5 days was determined.

829

SEPARATION OF THE OXYGEN ISOTOPES BY THERMAL DIFFUSION. I. Lauder. Trans. Faraday Soc. 43, 620-30 (1947). C.A. 42, 3666c.

The construction of a 1-stage and a 4-stage apparatus for the separation of the O isotopes by thermal diffusion is described. Factors such as carrier gas, separation-tube diameter, temperature gradient, and working pressure, are chosen so as to achieve a maximum separation in a minimum of time of the O isotopes by thermal diffusion.

830

IMPROVED PREPARATION OF DEUTERIUM ORGANIC COMPOUNDS BY EXCHANGE. K. Clusius and H. Knopf. Z. Naturforsch. 2B, 169-73 (1947). C.A. 42, 4026f.

Use of the mass action law and rectification of mixtures produced is used to obtain compounds of high D content from exchange reactions with heavy water. Preparations of CD_3CO_2D and MeOD are described.

831

SOME CATALYTIC HYDROGEN EXCHANGE REACTIONS OF HYDROCARBONS. A. Aman, L. Farkas, and A. Farkas. J. Am. Chem. Soc. 70, 727-32(1948). C.A. 42, 4035c.

The following exchange reactions of H (D) atoms in Pd and Ni catalysts at pressures of 20-700 mm and in the temperature range of 80-170° were investigated by both circulatory and static methods: water and ethylene, water and butene, water and butane, butene and butane, and butane and ethylene.

832

THE NON-EXCHANGE OF RADIOACTIVE COBALT BETWEEN HEXAMMINO COBALTIC AND COBALTOUS CHLORIDES. K. J. McCallum and S. A. Hoshowsky. J. Chem. Phys. 16, 254-5(1948). C.A. 42, 4054b.

The exchange between hexammino cobaltic ion containing radioactive $Co^{60^{3+}}$ and ordinary Co^{2+} ion was examined in solutions ranging from M HCl to 10M NH_3; the apparent exchange is zero (within the experimental error).

833

ELECTROMAGNETIC SEPARATION OF BROMINE AND CHLORINE ISOTOPES. L. G. Chelius and C. P. Keim. Phys. Rev. 73, 813(1948). C.A. 42, 4054c.

Stable isotopes are usually separated in the calutron by collecting a beam of singly ionized chemically uncombined atoms such as Ag^+ or Sn^+. Br was collected with $NaBr^+$ particles. This method simplifies the separation of isotopes which are gaseous at room temperature and which are not chemically inert. Cl was separated, by collecting $CuCl^+$ particles in the mass 98 and mass 102 positions.

834

THE APPROACH TO EQUILIBRIUM IN FRACTIONATION. W. Bartky and A. J. Dempster. Rev. Mod. Phys. 20, 123-7(1948). (ANL-4032). C.A. 42, 4428i.

Instead of treating the gradual approach of a fractionating plate column to an equilibrium condition by a single differential equation in which the concentrations are considered to vary continuously, in many cases the simultaneous differential equations that govern the change of concentration at each plate can be solved directly. The solutions of these equations take an especially simple form when the equilibrium constant differs from unity by a small amount and the number of plates is not too great. Enrichment of 10% or less in the abundance of many isotopes may be treated in this manner.

835

SOME PRELIMINARY INVESTIGATIONS BY MEANS OF RADIOACTIVE Zn^{65}. Ch. Haenny and P. Mivelaz. Helv. Chim. Acta 31, 633-42(1948). C.A. 42, 4451i.

The preparation obtained by high-energy protons according to the scheme: $Cu^{65} + {}_1H^1 \rightarrow {}_{30}Zn^{65} + {}_0n^1$ has a half life of 250 days and can consequently be used for studies of the properties of Zn ions. In this manner it was shown that the exchange reaction between metallic Zn and dissolved Zn at pH ± 5 ceases before an exchange equilibrium is reached, at pH ± 5 ceases before an exchange equilibrium

is reached, owing to formation of a film of oxide or of basic Zn salt on the metal.

836

RATE OF EXCHANGE OF CELLULOSE WITH HEAVY WATER. V. J. Frilette, J. Hanle, and H. Mark. J. Am. Chem. Soc. 70, 1107-13(1948). C.A. 42, 4823g.

Cellulose exchanges rapidly with D_2O. However, even after one week not all the hydroxyls were exchanged. This largely seems to be due to non-accessibility.

837

ISOTOPE CONCENTRATION BY ION MIGRATION IN WATER SOLUTION, MELTED, AND SOLID PHASE. T. Vestermark. Tek. Tid. 78, 160-2(1948). C.A. 42, 4844b.

A review based on 12 references.

838

PREPARATION AND MEASUREMENT OF ISOTOPES AND SOME OF THEIR MEDICAL ASPECTS: THERMAL DIFFUSION AND OTHER PHYSICAL METHODS OF ISOTOPE SEPARATION. W. W. Watson. U. S. Naval Med. Bull. (Suppl.) 28-41(1948). C.A. 42, 4844e.

Centrifugation, the electromagnetic process, and thermal diffusion methods cannot compete with the chemical exchange method of isotopic separation. Production of C^{13} by thermal diffusion with CH_4 is a possible exception.

839

CHEMICAL METHODS OF ISOTOPE SEPARATION. Allen Francis Reid. U. S. Naval Med. Bull. (Suppl.) 205-8(1948). C.A. 42, 4845c.

840

DISTRIBUTION OF He^3 BETWEEN LIQUID AND VAPOR He^4. Henry A. Fairbank, C. T. Lane, L. T. Aldrich, and A. O. Nier. Phys. Rev. 73, 729-32 (1948). C.A. 42, 4845e.

From 5.2 °K to the λ-point, the ratio He^3/He^4 in the vapor divided by He^3/He^4 in the liquid increases as the temperature decreases. Below the λ-point this ratio sharply decreases to zero since the vapor contains no detectable amount of He^3. A method of isotope separation is proposed.

841

SOLUTIONS OF He^3 IN He^4. F. London and O. K. Rice. Phys. Rev. 73, 1188-93 (1948). C.A. 42, 4845g.

Thermodynamic theory is applied to recent data on the equilibrium concentration of He^3 in the liquid and vapor phases of He^4.

842

SOME EXCHANGE EXPERIMENTS INVOLVING HEXACYANOFERRATE (II) AND HEXACYANOFERRATE (III) IONS. Roy C. Thompson. J. Am. Chem. Soc. 70, 1045-6 (1948). C.A. 42, 5367i.

An exchange of electrons between $Fe(CN)_6^{4-}$ and $Fe(CN)_6^{3-}$ in neutral solution, 1.0M HCl, and 0.05M NaOH occurs within the time interval required for separation of the ions. No exchange of Fe atoms was observed between any of the following pairs of ions: Fe^{3+} and $Fe(CN)_6^{3-}$, Fe^{3+} and $Fe(CN)_6^{4-}$, Fe^{2+} and $Fe(CN)_6^{3-}$, and Fe^{2+} and $Fe(CN)_6^{4-}$. The rapid electronic exchange between $Fe(CN)_6^{4-}$ and $Fe(CN)_6^{3-}$ is not surprising, since exchange has been observed in all cases in which pairs of ions differing only in electronic charge have been studied.

843

THE PHENOMENA OF SEPARATION PROCESSES. A. Klemm. Z. Physik 123, (Nos. 1-2), 10-27(1944). C.A. 42, 5747e.

Single-phase, one-dimensional separation processes in a gravitational field, in a temperature gradient, in a steady diffusion current, and in an electric current are phenomenologically the same. The cause of unmixing is an applied force or potential. The inherent limitations of each process are considered. The separation of ions in an electric field is limited the least; however, the use of a countercurrent principle for the other processes avoids their limitations.

844

RECOIL-ACTIVATED AND THERMAL-EXCHANGE REACTIONS BETWEEN SULFUR-35 AND CARBON DISULFIDE. Raymond R. Edwards, Frances B. Nesbett and A. K. Solomon. J. Am. Chem. Soc. 70, 1670 (1948). C.A. 42, 6232e.

Sulfide ion in aqueous solution exchanges with CS_2 as a separate phase through the formation of CS_3^{2-}.

845

CONCENTRATION OF N^{15} IN A GASEOUS EXCHANGE COLUMN. T. I. Taylor and William Spindel. J. Chem. Phys. 16, 635(1948). C.A. 42, 6638d.

By using the exchange reaction $N^{15}O + N^{14}O_2 \rightleftharpoons N^{14}O + N^{15}O^2$ in a thermal diffusion column 0.9 cm inside diameter and 200 cm long, with a 40-1 reservoir, filament temperature 500°, at 0.5 atomic pressure, a ratio of 3.00 ± 0.10 was obtained in about 5 days between the N^{15} abundance at the bottom of the column and that at the top. With pressures of 0.25 and 1.0 atoms the ratios were 2.70 and 1.72, respectively.

846

EXCHANGE BETWEEN A SHEET OF COPPER MARKED BY RADIOACTIVE COPPER AND A SOLUTION OF COPPER IONS. M. Quintin, P. Sue, and M. Bizouard. Compt. rend. 226, 1723-5(1948). C.A. 42, 6648i.

Radioactive Cu^{64}, prepared by irradiation with deuterons, was melted in a vacuum, to obtain Cu of homogeneous specific activity. Specimens were prepared from this material by cold-rolling followed by washing with either alcohol, ether, benzene, H_2O, or HNO_3. One sample was prepared by electrolytic polishing and another by electrolytic deposition on Pt from a solution of the radioactive Cu. The exchange between these samples and solutions of $CuSO_4$ was studied.

847

HYDROGEN EXCHANGE ON OXIDIC CONTACT CATALYSTS. A. Eucken and E. Wicke. Z. Naturforsch. 2a, 163-6(1947). C.A. 42, 7148d.

The dehydration of alcohols on oxidic contact catalysts (bauxite and γ-Al_2O_3) is further considered in the light of the previously developed theory. According to this concept, surface OH groups of the contact substance are catalytically active, and this activity is based on an exchange of H particles according to the "principle of least structure change."

848

THE EXCHANGE REACTION BETWEEN METHANE AND DEUTERIOMETHANES ON SILICA-ALUMINA CRACKING CATALYSTS. G. Parravano, E. F. Hammel, and H. S. Taylor. J. Am. Chem. Soc. 70, 2269-70(1948). C.A. 42, 7148f.

The studies show that the exchange reaction between CH_4 and deuteriomethanes on SiO_2-Al_2O_3 cracking catalysts occurs measurably at temperatures of 345° and higher.

849

FRACTIONAL DISTILLATION AND ITS APPLICATION IN THE CONCENTRATION OF THE HEAVY ISOTOPES OF OXYGEN AND HYDROGEN. I. Dostrovsky, E. D. Hughes,

and D. R. Llewellyn. Nature 161, 858-9(1948). C.A. 42, 7158g.

A previously described fractionation column was enlarged to show possibilities of such columns in isotopic work and in close fractionation of mixtures. A 30-ft metal column 3 in. in diameter was used with appropriate safety devices and automatic controls. Results show it may be of value in the production of pure deuterium oxide.

850

FUNDAMENTALS OF ISOTOPE SEPARATION. Karl Cohen. Nucleonics 2, No. 6, 3-9(1948). C.A. 42, 7158h.

A review on a theory of cascades, which provides a method for calculating the number of separating elements required, the optimum separative power, the efficiency, and the production capacity of an isotope-separation plant.

851

MEASUREMENT OF THE STABILITY OF THIOSULFATE COMPLEXES BY ISOTOPE EXCHANGE. Genevieve Scoffier. Compt. rend. 227, 63-4 (1948). C.A. 42, 7649f.

Exchange was measured after 10-12 minutes in HCl solution between $K_3[As(S_2O_3)_3]$ and $As_2{}^*O_3$; $K_3[Sb(S_2O_3)_3]$ and Bi^*Cl_3; $Na_2[Cu(S_2O_3)_2]$ and Cu^*SO_4. The degrees of exchange were found to be 50-72%, about 83%, 95%, 95%, and 30%, respectively.

852

HYDROGEN EXCHANGE OF PHENOLS AND PHENOL ETHERS WITH DEUTEROALCOHOL. P. F. Tryon, W. G. Brown, and M. S. Kharasch. J. Am. Chem. Soc. 70, 2003-5 (1948). C.A. 42, 7725c.

Exchange data for various phenols with EtOD are given.

853

SEPARATION OF ISOTOPES BY THERMAL DIFFUSION. O. Wolczek. Wiadomości Chem. 1, No. 7/9, 21-5(1947). C.A. 42, 8078e.

A review.

854

COUNTERCURRENT GASEOUS EXCHANGE METHOD FOR THE SEPARATION OF ISOTOPES. R. B. Berstein and T. I. Taylor. J. Chem. Phys. 16, 903-15(1948). C.A. 42, 8079b.

A method is described for isotope enrichment by countercurrent gaseous exchange in a thermal diffusion column. The theory is derived for two cases of interest: diffusion limited and reaction-rate limited. Experiments are described in which C^{13} was concentrated by the exchange reaction $C^{12}O_2 + C^{13}O \rightleftharpoons C^{13}O_2 + C^{12}O$. The observed dependence of the over-all separation upon the operational variables is consistent with the theory.

855

THE CONCENTRATION OF HELIUM^3. Alan Andrew and W. R. Smythe. Phys. Rev. 74, 496-7 (1948). C.A. 42, 8079f.

In using a first stage of 4 Clusius-Dickel columns of the concentric type connected in parallel, and a second stage of 29 Hertz pumps connected in series, a sample of 30 cc at 10 mm was obtained which had the analysis He^3, 0.5%; He^4, 59.5%; H, 40.0%. It should be possible to produce 50% He^3 in about a year by this process.

856

CONCENTRATION OF He^3 BY EVAPORATION OF LIQUID HELIUM AT TEMPERATURES BELOW THE λ-POINT. B. V. Rollin and J. Hatton. Phys. Rev. 74, 508 (1948). C.A. 42, 8080a.

With He containing 0.15% He^3, it was found at very low temperatures and appreciable heat inflow that He^3 tends to concentrate in the vapor rather than the residual liquid.

857

THE PRODUCTION OF ELECTROMOTIVE FORCES BY CENTRIFUGING ELECTROLYTES AND ITS APPLICATION TO THE SEPARATION OF ISOTOPES. R. Salcedo. Anales real soc. espan. fis. y quim., Ser. A, 44, 251-68(1948). C.A. 42, 8546a.

The possibilities with known centrifuges are reviewed. Largely mathematical.

858

THE SELF-DIFFUSION COEFFICIENT OF NITROGEN. E. B. Winn. Phys. Rev. 74, 698-9(1948). C.A. 42, 8558d.

The ratio of diffusion of N containing 7.4 atomic % N^{15} into ordinary N was determined.

859

ISOTOPE EFFECT IN THE THERMAL CRACKING OF PROPANE-1-C^{13}. D. P. Stevenson, C. D. Wagner, O. Beeck, and J. W. Otvos. J. Chem. Phys. 16, 993-4(1948). C.A. 42, 8627a.

It was recently found that the dissociation probabilities of the C^{12}-C^{12} and the C^{12}-C^{13} bonds of the molecular-ions formed from EtC^{13}-H_3 by electron impact differ by ~20%. In the pyrolysis of $EtC^{13}H_3$ it was found that there is an 8% more frequent rupture of the C^{12}-C^{12} bonds than of C^{12}-C^{13} bonds. This effect should not be neglected in quantity tracer experiments with C isotopes where reaction rates are involved.

860

CONCENTRATION OF ISOTOPES THROUGH ELECTROLYTIC TRANSFER IN AQUEOUS SOLUTIONS. A. Klemm. Z. Naturforsch, 3a, 127-8(1948). C.A. 42, 8633d.

861

EVIDENCE FOR AN EXCHANGE REACTION OF BROMINE BETWEEN FREE BROMINE AND THE TETRABROMIDE OF SELENIUM. Saint Priest, Sautreau, R. Muxart, P. Daudel, and R. Daudel. Experientia 3, 239(1947). C.A. 42, 8633d.

A complete exchange of bromine between $SeBr_4$ and Br_2^* as well as between $SeBr_4^*$ and Br_2 is observed in CS_2 at 45°.

862

CONCENTRATION OF COPPER 63 BY THE COUNTERCURRENT ELECTROMIGRATION METHOD. Samuel L. Madrosky and Sidney Straus. J. Research Natl. Bur. Standards 41, 41-4(1948). C.A. 42, 8633g.

Concentration of Cu^{63} by the countercurrent electromigration method is described. The electromigration cell was operated with cupric sulfate as the electrolyte for periods of about 400 to 500 hr. A definite, though small, concentration of Cu^{63} in the cathode compartment of the cell was obtained. The terminal separation coefficient was about one-third as large as that found for Cl under similar conditions.

863

A STUDY OF THE EXCHANGE OF NICKEL IN CERTAIN COMPLEX COMPOUNDS USING RADIOACTIVE NICKEL. J. E. Johnson and N. F. Hall. J. Am. Chem. Soc. 70, 2344-8(1948). C.A. 42, 8693h.

In general, exchange of the central atom in a complex ion or compound proceeds rapidly only when the bonds present approach ionic rather than covalent character. It was expected that exchange studies would show no exchange of simple nickel ions with 4-coordinated Ni compounds for which strong covalent bonds are indicated by magnetic susceptibility, x-ray examination and demonstration of

geometrical isomers. The Ni exchange of ten Ni coordination compounds was studied, with Ni^{63} as the tracer. In the main the results, which are discussed in detail, show a satisfactory correlation with predictions of bond type based on other criteria.

864

ANALOGIES BETWEEN GASEOUS DIFFUSION AND FRACTIONAL DISTILLATION. J. Shacter and G. A. Garrett. Apr. 7, 1948. Decl. May 7, 1948. 19p. (AECD-1940). ADD 2, 297p.

It is shown that the mathematical treatment of a gaseous diffusion cascade where all stages are identical is equivalent to the treatment of a fractional distillation column. The stage separation factor is analogous to the relative volatility in fractional distillation. Steady-state equations are derived which apply to the general topic of fractionation. Some concepts relating to idealized and practical systems are discussed.

865

APPROACH TO EQUILIBRIUM BY A THERMAL DIFFUSION COLUMN. PART I. COLUMN CLOSED AT BOTH ENDS. H. M. Moseley and N. Rosen. [nd.] 11p. Decl. Aug. 25, 1948. (AECD-2236). NSA 1, 1134.

Calculations have been carried out for the separation factors of the thermal diffusion column approaching equilibrium for the case in which the column is closed at both ends and the concentration of the isotope to be enriched is small.

866

MASS SPECTROMETRIC AND INFRARED STUDY OF RATES OF DEUTERIUM EXCHANGE, ISOMERIZATION, AND HYDROGENATION OF THE n-BUTENES. V. H. Dibeler and T. I. Taylor. J. Chem. Phys. 16, 1008-9(1948). C.A. 43, 24f.

867

THERMODYNAMIC FUNCTIONS FOR TRITIUM AND TRITIUM HYDRIDE. THE EQUILIBRIUM OF TRITIUM AND HYDROGEN WITH TRITIUM HYDRIDE. THE DISSOCIATION OF TRITIUM AND TRITIUM HYDRIDE. W. M. Jones. J. Chem. Phys. 16, 1077-81(1948). C.A. 43, 476b.

The equilibrium constant for the formation of TH from H and T is calculated at frequent intervals 50-2500°K.

868

CONCENTRATION OF He^3 BY THERMAL DIFFUSION. B. B. McInteer, L. T. Aldrich and A. O. Nier. Phys. Rev. 74, 946-8(1948). C.A. 43, 489d.

A thermal-diffusion plant for the enrichment of He was constructed consisting of cylindrical columns followed by a hot-wire column. Under continuous operating conditions it was possible to produce with the expenditure of 16.6 kw, 14 standard cc He per day having a He^3/He^4 ratio of 0.0021 when well He was used as a source of gas.

869

MOLECULAR DISTILLATION PROCESS AND APPARATUS FOR THE SEPARATION OF ISOTOPES AND LIQUID MIXTURES CONTAINING ISOTOPES. A. K. Brewer and S. L. Madorsky. U. S. Patent 2,446,997, Aug. 17, 1948. C.A. 43, 500e.

The theory and possible practical embodiments of the countercurrent reflux molecular still previously described by the authors are discussed in some detail, especially as applied to the separation of isotopes.

870

INACTIVE ISOTOPES, THEIR SEPARATION AND APPLICATIONS. G. Dickel. FIAT Rev. Ger. Sci. 1939-46; Phys. Chem., 7-17(1948). C.A. 43, 1639f.

A review.

871

ISOTOPE EXCHANGE EQUILIBRIA. H. Suess. Phys. Chem. 19-24(1948). FIAT Rev. Ger. Sci. 1939-46. C.A. 43, 1639f.

A review with 74 references.

872

COMPILATION OF THERMAL PROPERTIES OF HYDROGEN IN ITS VARIOUS ISOTOPIC AND ORTHO-PARA MODIFICATIONS. H. W. Woolley, R. B. Scott, and F. G. Brickwedde. J. Research Natl. Bur. Standards 41, 379-475 (1948). C.A. 43, 2057c.

The available thermal data for H_2, HD, and D_2 in solid, liquid, and gaseous states up to 600°K are assembled. 181 references.

873

SEPARATION OF UNWEIGHABLE AMOUNTS OF SUBSTANCES [ISOTOPES] AND USE OF THE PRODUCT OBTAINED. O. Erbacher. FIAT Rev. Ger. Sci. 1939-46. Inorg. Chem. Pt. I, 113-20(1948). C.A. 43, 2083h.

A review with 29 references.

874

SEPARATION OF ISOTOPES. G. Dickel. FIAT Rev. Ger. Sci. 1939-46. Inorg. Chem. Pt. I. 121-3(1948). C.A. 43, 2083i.

A review with 34 references.

875

AN EFFECT OF ISOTOPE MASS ON THE RATE OF A REACTION INVOLVING THE CARBON-CARBON BOND. P. E. Yankwich and M. Calvin. J. Chem. Phys. 17, 109-10 (1949). C.A. 43, 2862d.

The relative rates of rupture of the C^{12}-C^{14} and C^{12}-C^{12} bond are determined from the decarboxylation of singly labeled malonic and bromomalonic acid. The primary competition for the reaction is between functional groups of the same molecule which differ only in the labeled atom. The C^{12}-C^{12} bond ruptured 1.12 times as frequently as the C^{12}-C^{14} bond in malonic acid and 1.4 times as frequently in bromomalonic acid. These effects are considerably larger than any isotope effects observed in chemical equilibrium.

876

ISOTOPE DISPLACEMENT IN THE CASE OF CADMIUM BY ION MIGRATION IN MOLTEN CADMIUM CHLORIDE. A. Klemm, H. Hintenberger, and W. Seelman-Eggbert. Z. Naturforsch 3a, 172-6(1948). C.A. 43, 2862f.

At the boundary between LiCl and $CdCl_2$, the isotopic composition of Cd is depleted relative to the light isotope. The current density used was 5.5 amp/cm^2, the temperature was 630°, the separation distance was 13 cm and the time of the experiment was 50 hours. The separation factor for the best fraction, 47 mg $CdCl_2$, was 1.046 referred to the naturally occurring Cd mixture for a mass difference of 1%, or 1.5 for the ratio Cd^{106}/Cd^{116}.

877

CONDENSATION OF PURE He^3 AND ITS VAPOR PRESSURES BETWEEN 1.2° AND ITS CRITICAL POINT. S. G. Sydoriak, E. R. Grilly, and E. F. Hammel. Phys. Rev. 75, 303-5, (1949). C.A. 43, 3679d.

Vapor pressures of liquid He^3 are reported at intervals between 1.21-3.3 °K. The boiling point is 3.2_0 °K.

878

THE He^3-He^4 EQUILIBRIUM BELOW THE λ-POINT. C. T. Lane, Henry A. Fairbank, L. T. Aldrich, and Alfred O. Nier. Phys. Rev. 75, 46-50 (1949). C.A. 43, 3679e.

Values of He^3/He^4 in the vapor divided by He^3/He^4 in the liquid of 44 to 97 were obtained.

879

SEPARATION OF ISOTOPES IN SMALL QUANTITIES. W. Walcher. FIAT Rev. Ger. Sci. 1939-46, Nuclear Physics and Cosmic Rays – Part 2, p.94-107(1948). C.A. 43, 3701e.

A review.

880

EXCHANGE REACTIONS IN THE URANYL-URANOUS SYSTEM. R. H. Betts. Can. J. Research 26B, 702-10 (1948). C.A. 43, 3708e.

The rate of interchange of U atoms between quadrivalent uranous ion and UO_2^{++} in H_2SO_4 solutions has been measured with U^{233} as tracer. Exchange occurs most readily under the influence of light (from a W lamp). The effects of pH, temperature and U^{IV} and U^{VI} concentrations have been evaluated. Correlation is made between the electrochemical behavior of the system and the exchange rates.

881

SEPARATION OF LITHIUM ISOTOPES. W. Whaling and J. E. Evans. Phys. Rev. 73, 648(1948). C.A. 43, 4093f.

882

COMPARISON OF THE FLOW OF ISOTOPICALLY PURE LIQUID HELIUM^3 AND HELIUM^4. Darrell W. Osborne, Bernard Weinstock, and Bernard M. Abraham. Phys. Rev. 75, 988 (1949). C.A. 43, 4130a.

The mass rates of flow of liquid He^3 and of liquid He^4 through a 7 x 10^{-5} cm annulus were determined at 1.05-3.02 and 2-4 °K, respectively.

883

CONCENTRATION OF ISOTOPES OF MERCURY IN COUNTERCURRENT MOLECULAR STILLS. Samuel L. Madorsky, Paul Bradt, and Sidney Straus. J. Research Natl. Bur. Standards 41, 205-10(1948). C.A. 43, 4130h.

Concentration of Hg^{204} in long countercurrent molecular distillation columns having cups of less than 1 ml capacity gave poor results as compared with a 10-cell still column with large cups, because as a result of small hold-ups in the cells a liquid of high surface tension does not reflux regularly.

884

THERORY OF ISOTOPE SEPARATION IN GEOLOGICAL PROCESSES. W. H. Furry. Phys. Rev. 73, 1264(1948). C.A. 43, 4192g.

885

VAPOR-PRESSURE DETERMINATION OF HEAVY WATER. I. E. Puddington. Can. J. Research, 27B, 1-5(1949). C.A. 43, 4532f.

The concentration of D_2O in H_2O can be determined from vapor pressure measurements.

886

THE EXCHANGE REACTION BETWEEN BROMINE AND BROMO-TRICHLOROMETHANE. A. A. Miller and J. E. Willard. J. Chem. Phys. 17, 168-75(1949). C.A. 43, 4548d.

Thermal exchange of the Br in CCl_3Br with radioactive Br_2 was measured 100°-135° in liquid CCl_3Br, 135°-170° in CCl_4 solution, and 150°-220° in the gas phase. The activation energy is approximately 29 kcal/mole in each phase. Analysis of the results suggests that the "cage" effect may appreciably lower the quantum yield of the photochemical reaction in the liquid phase. Mechanisms are discussed.

887

THE KINETICS OF THE VAPOR PHASE EXCHANGE OF RADIOACTIVE BROMINE BETWEEN TRICHLOROBROMOMETHANE AND BROMINE. N. Davidson and J. H. Sullivan. J. Chem. Phys. 17, 176-81(1949). C.A. 43, 4548g.

The exchange was investigated in the range 420-455°K and rate constants determined. The exchange reaction $Br_2(g) + AgBr^* \rightleftharpoons Br_2^*(g) + AgBr$ readily goes to completion and is the basis for a convenient semimicro method for the preparation of radioactive elementary Br.

888

VARIATIONS IN ABUNDANCES OF ISOTOPES IN NATURE. H. G. Thode. Research 2, 155-61(1949). C.A. 43, 4553g.

A review.

889

ISOTOPE EXCHANGE OF IODINE BETWEEN POTASSIUM IODIDE AND POTASSIUM IODATE IN AQUEOUS SOLUTION. K. B. Zaborenko, M. B. Neĭman, and V. I. Samsonova. Doklady Akad. Nauk S.S.S.R, 64, 541-4(1949). C.A. 43, 4565i.

The exchange $KI^* + KIO_3 \rightleftharpoons KI + KI^*O_3$, where I* designates a mixture of long-lived radioactive isotopes was observed, contrary to previous negative results, in experiments in sealed tubes at temperatures of 100-300°.

890

AN ISOTOPE EFFECT IN PHOTOSYNTHESIS. J. W. Weigl and M. Calvin. J. Chem. Phys. 17, 210(1949). C.A. 43, 4730c.

During photosynthesis of barley seedings, it was found that the plants utilized $C^{12}O_2$ faster than $C^{14}O_2$.

891

A METHOD OF ESTIMATING AND MINIMIZING THE ERROR OF MEASUREMENT OF THE RATE OF A RADIOACTIVE EXCHANGE REACTION. N. Davidson and J. H. Sullivan. J. Am. Chem. Soc. 71, 739-40(1949). C.A. 43, 4951h.

Graphical and analytical methods are proposed: (1) for establishing the error arising from the radio-assay in the rate constant; (2) for an exchange reaction as a function of the extent of exchange; and (3) for selecting the optimum degree of exchange to minimize this error.

892

THE GALVANIC SEPARATION OF METALS THAT ARE SUBJECT TO SECONDARY REACTION WITH THE ELECTROLYTE; SUCH AS THE ALKALI METALS: THE SEPARATION OF ISOTOPES. A. Del Vecchio. Italian Patent 420,822, Sept. 18, 1946. C.A. 43, 4963e.

Upon the electrolyte containing the metal to be separated is layered an immiscible liquid of a lower density which is not electrolytically dissociable. When electrodes are inserted in this liquid and the electrolyte and a potential difference of sufficient magnitude is applied, the metallic ions traverse the neutral liquid and are deposited at the electrode. To distinguish this process from electrophoresis, it has been named galvanophoresis. This method is particularly suitable for the separation of the alkali metals, and offers the possibility of separating isotopes since the galvanophoresis, working against gravity, will leave behind the heavier isotope.

893

THERMAL-EXCHANGE EXPERIMENTS WITH RADIOACTIVE CHROMIUM. H. E. Menker and C. S. Garner. J. Am. Chem. Soc. 71, 371-2(1949). C.A. 43, 4967b.

Appreciable exchange was observed for Cr(III) and $Cr(CN)_6^{3-}$ in low concentration of $HClO_4$ or AcOH and for hexaaquochromium (III) and dichromate ions in 0.05 f $HClO_4$ at 25° and 45°. The half time for exchange of this latter was 60 ± 6 days at 45° and >430 days at 25°.

894

THERMAL-EXCHANGE EXPERIMENTS WITH RADIOACTIVE ZINC. L. Leventhal and C. S. Garner. J. Am. Chem. Soc. 71, 371(1949). C.A. 43, 4967c.

Complete exchange or radioactive Zn was found between dipyridine Zn acetate and the following Zn complex compounds at 25° after exchange times as short as 30 sec:

Zn acetylacetone, Zn acetylacetone ethylenediimine, Zn benzoylacetone ammoniate, Zn nicotinylacetone, and dipyridine Zn thiocyanate. The acetylacetone experiment was also run at 0° with no apparent difference. If the rapid exchange was not induced, these compounds would not be suitable for Szilard-Chalmers separations in pyridine solution.

895

INVESTIGATION OF SOME CHEMICAL REACTION MECHANISMS WITH THE AID OF ISOTOPE EXCHANGE. A. I. Brodskiĭ. Izvest. Akad. Nauk. S.S.S.R., Otdel. Khim. Nauk. 3-12(1949). C.A. 43, 5011c.

As compared with the N-H, O-H, S-H, and Cl-H bonds, exchange of the H atom in a C-H bond with D_2O is difficult, owing to the absence of electrons not involved in bonding. Data are given for various C-H bond containing compounds largely at 170°. A detailed account is contained in C.A.

896

THE SEPARATION OF THE OXYGEN ISOTOPES BY THERMAL DIFFUSION. R. H. Davies. Trans. Faraday Soc. 45, 145-8(1949). C.A. 43, 5299a.

The results of Lauder for the separation of oxygen isotopes in a thermal diffusion column are extended to take account of O^{17}. Values for the separation factor (ratio of concentration of O^{18} at bottom to concentration at top of column) were established in 3 ways to be 4.256, 5.64, and 4.61.

897

ISOTOPE EFFECT IN THE RUPTURE OF CARBON-CARBON BONDS IN PROPANE-1-C^{13}. Jacob Bigeleisen. J. Chem. Phys. 17, 344-5 (1949) C.A. 43, 5299c.

Experiments have shown a significant isotope effect in the rupture of carbon-carbon bonds in propane-1-C^{13} by electron impact. The ratios $k_1/2k_2$ and $k_1/2k_3$ $C^{12}H_3C^{12}H_2C^{12}H_3 \xrightarrow{k_1} C^{12}H_3 + C^{12}H_3C^{12}H_2$; $C^{12}H_3C^{12}H_2\text{-}C^{13}H_3 \xrightarrow{k_2} C^{13}H_3 + C^{12}H_3C^{12}H_2$; $C^{12}H_3C^{12}H_2C^{13}H_3 \xrightarrow{k_3} C^{12}H_3 + C^{13}H_3C^{12}H_2$ were calculated by means of an approximate equation derived by the application of the statistical-mechanical treatment of isotopic molecules to the statistical treatment of absolute rates.

898

EXCHANGE REACTIONS AND ELECTROLYTIC DISSOCIATION IN NONAQUEOUS SOLVENTS. C. C. Evans and S. Sugden. J. Chem. Soc. 270-3(1949). C.A. 43, 6055b.

The bimolecular velocity constant for the exchange reaction between LiBr and alkyl bromides in anhydrous acetone varies with the dilution. The similiar reaction between NaI and alkyl iodides in MeOH snows no effect of dilution.

899

RULES ON THE CONDITION OF ISOTOPE EXCHANGE EQUILIBRIA. H. Suess and H. Jensen. Naturwissenschaften 32, 372-4(1944). C.A. 43, 6078a.

Waldmann's rule, which asserts that at equilibrium the heavy isotope is enriched in the liquid if the ions have more internal degrees of freedom than the gas molecules, is discussed in some detail.

900

ION MIGRATION IN A COUNTERFLOWING ELECTROLYTE AS A BASIS FOR AN ELECTROCHEMICAL EXCHANGE METHOD. H. Martin. Z. Naturforsch. 4a, 28-37 (1949). C.A. 43, 6091f.

An electrolyte flows through an electrolytic cell at such a rate that the net transport of one ion is zero. The application of this process to isotope separation is discussed theoretically.

901

INFINITELY LONG SEPARATION TUBE WITH END-VOLUMES. A. Klemm. Z. Naturforsch 3a, 211-16(1948). C.A. 43, 6508a.

The space-time-concentration relationships of rare isotopes in an infinitely long separation tube, with end-volumes, are calculated theoretically.

902

EXCHANGE REACTIONS OF Co^{++}, Co^{+++}, AND THEIR HEXAMMINO COMPLEXES. S. A. Hoshowsky, O. G. Holmes and K. J. McCallum. Can. J. Research 27B, 258-65(1949). C.A. 43, 6508e.

The exchange between $CoCl_2$ and $[Co(NH_3)_6]Cl_3$ in neutral solution, using Co^{60}, took place only to a small extent in 6 days at 50° while no exchange between Co^{+++} and $Co^{60}(NH_3)_6^{+++}$ in either H_2SO_4 or $HClO_4$ for periods up to 5 hours at 0° or up to 1.5 hours at 20°. A complete exchange between $(Co^{60})^{++}$ and Co^{+++} was obtained in 5 minutes although whether the exchange took place in the solution or catalytically during the separation of Co^{+++} from Co^{++} was not established. There was 6% exchange between $Co^{60}(NH_3)_6^{+++}$ and $Co(NH_3)_6^{++}$ after 17 days at 25°. The dissociation of $Co(NH_3)_6^{+++}$ is one limiting factor in the exchange between Co^{++} and $Co(NH_3)_6^{+++}$.

903

EXCHANGE REACTION BETWEEN THE TWO OXIDATION STATES OF CERIUM IN NITRIC ACID SOLUTIONS. J. W. Gryder and R. W. Dobson. J. Am. Chem. Soc. 71, 1894-5 (1949). C.A. 43, 6532g.

Ce^{144} was purified by the procedure described by Newton. In diffusion separation exchange was complete within 2 hours, but the separation factor was poor. Et_2O extracted from HNO_3 solution no significant amount of cerous ion, while the extraction of ceric nitrate was essentially complete. From the data presented the calculated experimental energy of activation was 13.4 ± 0.7 kcal. It is concluded that the reaction is first order with respect to both cerous and ceric concentrations.

904

ISOTOPE EXCHANGE AND MECHANISMS OF HETEROCYCLIC SUBSTITUTION. I. HYDROGEN EXCHANGE AND MECHANISMS OF ELECTROPHILIC SUBSTITUTION. S. K. Hsu, C. K. Ingold, C. G. Raisin, E. De Salas and C. L. Wilson. J. chim. phys. 45, 232-6(1948). C.A. 43, 6876d.

Hydrogen isotope exchange may proceed by bimolecular or unimolecular mechanisms of electrophilic substitution, and in prototropic systems a bimolecular mechanism involving rearrangement of the unsaturated system is also available.

905

ISOTOPE EXCHANGE AND MECHANISMS OF HETEROCYCLIC SUBSTITUTION. II. HALOGEN EXCHANGE AND MECHANISMS OF NUCLEOPHILIC SUBSTITUTION. P. B. D. De la Mare, B. D. England, L. Fowden, E. D. Hughes, and C. K. Ingold. J. chim. phys. 45, 236-41 (1948). C.A. 43, 6876e.

Halogen isotope exchange may take place by bimolecular or unimolecular mechanisms of nucleophilic substitution, and in anionotropic systems the apparent alternative of bimolecular nucleophilic substitution with rearrangement is not additionally available.

906

EXCHANGE BETWEEN METALS AND THEIR IONS IN SOLUTION. I. PRELIMINARY EXPERIMENTS. M. Haissinsky, M. Cottin, and B. Varjabedian. J. chim. phys. 45, 212-23(1948). C.A. 43, 6890f.

Experiments with tagged atoms indicate that the dependence on time is log x = a log t + log b, where x is the quantity of metal exchanged in g/atoms and a and b are constants. Values for k, E, and Z are determined between 17 and 94° for the rate of exchange between $Au/AuCl_3$, $Cu/CuBr_2$, $Cu/Cu(NO_3)_2$, $Bi/Bi(NO_3)_3$, $Bi/BiCl_3$, $Sb/SbCl_3$, $Mn/MnSO_4$, $Pb/PbCl_2$, $Pb/Pb(NO_3)_2$, $La/La(NO_3)_3$, and $Te/TeCl_4$. E depends on the nature of the anion and is of the order of 7 to 8 kcal for nitrates and 3 to 5.5 kg/cal for chlorides.

907

RELATIONS BETWEEN EXCHANGE PHENOMENA AND ELECTROCHEMICAL PHENOMENA. M. Haïssinsky. J. chim. phys. 45, 224-31(1948). C.A. 43, 6891b.

There is apparently no correlation of the initial rate of exchange between tagged metals and solutions of their salts and the electrochemical potential of the metals. It is postulated that the exchange reaction $M = M^{n+}$ is very rapid, practically reversible, and independent of the nature of the metal or of the state of the surface. The observed differences in the rates are supposed to be due to different tendencies of the metallic surfaces to develop in contact with the solution. The rate of M/M^{n+} exchange is compared to that of other exchange reactions involving electronic changes.

908

KINETIC STUDIES OF ISOTOPIC EXCHANGE REACTIONS WITH SOME REMARKS ON THEIR RELEVANCE IN CLASSIFICATION OF TYPES OF CHEMICAL BONDING. M. D. Kamen, J. W. Kennedy, and O. E. Myers. J. chim. phys. 45, 199-204(1948). C.A. 43, 6894d.

Examples are cited to show that it is not a general rule that electrovalent linkages lend themselves to rapid exchange and covalent linkages do not. Experiments were tried to correlate reaction velocity constants for systems far from equilibrium with the same constants at equilibrium.

909

ENGINEERING DEVELOPMENTS IN THE GASEOUS DIFFUSION PROCESS. M. Benedict and C. Williams, eds. New York, McGraw-Hill Book Co. 1949. 129p. (National Nuclear Energy Series, Division II, Volume 16). C.A. 43, 7273c.

910

"HEAT FLUSH" METHOD OF He^3 SEPARATION. Charles A. Reynolds, Henry A. Fairbank, C. T. Lane, B. B. McInteer, and A. O. Nier. Phys. Rev. 76, 64-6(1949). C.A. 43, 7283b.

A further experimental study was made of the efficiency of separation of He^3 from mixtures of He^3 and He^4 in a method making use of the "internal convection" process in superfluid liquid He. The method is capable of removing all the He^3 in mixtures with an original He^3/He^4 abundance of 0.01% in about 5 minutes with a power input of 13 milliwatts.

911

THE SEPARATION OF STABLE ISOTOPES. G. Parravano. Chimica e industria 30, 296-301(1948). C.A. 43, 7319d.

A review with 37 references.

912

ISOTOPE EFFECT IN THE DECARBOXYLATION OF LABELLED MALONIC ACIDS. Jacob Bigeleisen. J. Chem. Phys. 17, 425-6(1949). C.A. 43, 7333a.

Using a previously developed theory the author calculates the relative rates of rupture of the C^{12}-C^{12} and C^{12}-C^{14} bonds in the decarboxylation of labelled malonic acids. The calculated isotope effect is considerably less than the experimental one.

913

BIBLIOGRAPHY OF RESEARCH ON HEAVY HYDROGEN COMPOUNDS. Alice H. Kimball. New York, McGraw-Hill Book Co., Inc., (1949) 365p. (National Nuclear Energy Series III, Volume 4C). C.A. 43, 7351b.

A bibliography of published research on deuterium and its compounds for the period 1932-1945. The references are arranged alphabetically according to the name of the leading author and co-authors are cross-indexed. A subject index and a compound index are included. 2,189 references.

914

RAISING THE CONCENTRATION OF HEAVY WATER. Norsk Hydro-Electrisk Kvaelstofaktieselskab. British Patent 620,837. Mar. 31, 1949. C.A. 43, 7359a.

Air, N, or the H and O produced in the electrolysis cells is circulated through the first row of cells to increase the evaporation. This water after condensation is fed to the next row of cells.

915

THE EXCHANGE OF Ag^+ IONS BETWEEN AQUEOUS SOLUTIONS AND SURFACES OF METALLIC SILVER. C. C. Coffin and I. I. Tingley. J. Chem. Phys. 17, 502-3 (1949). C.A. 43, 7791b.

The exchange of Ag ions between solutions of $AgNO_3$ and surfaces of metallic Ag is being studied with Ag^{110}. On the basis of measured areas, etched and polished surfaces of annealed Ag foil exchange with 0.1N $AgNO_3$ solutions to depths of about 10 and 100 atomic layers, respectively.

916

THE INTERACTION OF METHANE AND METHANE-d_4 ON NICKEL AND THE STATE OF THE CATALYST SURFACE. M. M. Wright and H. S. Taylor. Can. J. Research 27B, 303-17(1949). C.A. 43, 7802g.

Mass-spectrometer studies of the exchange reaction and the reaction of H with catalyst surface residues support the concept of dissociative adsorption.

917

ISOTOPIC EXCHANGE REACTIONS AND THE ELECTRONIC STRUCTURE OF AROMATIC HYDROCARBON DERIVATIVES. B. Pullman, P. Rumpf, and F. Kieffer. J. chim. phys. 45, 150-61(1948). C.A. 43, 7809g.

This review covers the use of D and radioactive halogen in exchange reactions, the theory and application of "molecular diagrams," certain techniques for measuring exchange, and the interrelationships of these topics.

918

ISOTOPIC EXCHANGE OF PHOSPHORUS BETWEEN H_3PO_2, H_3PO_3, AND H_3PO_4. V. D. Ionin, A. F. Lukovnikov, M. B. Neĭman, and A. N. Nesmeyanov. Doklady Akad. Nauk S.S.S.R. 67, 463-6(1949). C.A. 43, 7815a.

In equilibrium mixtures $NaH_2P^{32}O_4 + NaH_2PO_2$, heated 80 hours in a closed vessel, no isotopic exchange was detected by radioactivity measurements up to 280°, at which temperature all the $H_2PO_2^-$ was oxidized to $H_2PO_4^-$. A similar negative result was found with $H_3P^{32}O_4 + H_3PO_3$ up to 280°, where H_3PO_3 disappears.

919

HYDROGEN-EXCHANGE REACTIONS OF THE BUTANES IN SULFURIC ACID. O. Beeck, J. W. Otvos, D. P. Stevenson, and C. D. Wagner. J. Chem. Phys. 17, 418-9(1949). C.A. 43, 7897c.

Neither the primary nor the secondary H atoms of butane undergo measurable reaction in 96.2% H_2SO_4 in 3 hours at 25°. Isobutane exchanges primary H atoms with 91.5 to 93.8% H_2SO_4. Tertiary H of isobutane does not exchange readily in 96.2 to 98.3% H_2SO_4 at 25° and several hours contact time. In spite of the absence of exchange of tertiary H atoms and acid, isobutane molecules undergo direct intermolecule exchange of their tertiary H atoms at 25° in the presence of H_2SO_4.

920

HYDROGEN-EXCHANGE REACTIONS OF PARAFFIN IN THE PRESENCE OF ALUMINUM CHLORIDE-ALUMINA CATALYST. C. D. Wagner, O. Beeck, J. W. Otvos, and D. P. Stevenson. J. Chem. Phys. 17, 419-20(1949). C.A. 43, 7897e.

This is a condensed summary of the results of a comprehensive research program on the reactions of hydrocarbons in the presence of $AlCl_3$ using tracer techniques.

921

EXCHANGE REACTIONS BETWEEN CERIUM (III) AND CERIUM (IV) AND BETWEEN IRON (II) AND IRON (III). B. J. Linnenbom and A. C. Wahl. J. Am. Chem. Soc. 71, 2589-90(1949). C.A. 43, 8272a.

The exchange Ce (III) – Ce (IV) in $HClO_4$ or H_2SO_4 is not measurably slow, complete exchange having been observed within the separation time. An electric migration method was used for partial separation, followed by determination of the enrichment factor. For Fe (II – Fe (III) in $HClO_4$, with a sintered glass diffusion disk for separation, exchange occurred in the ½ hours diffusion time.

922

THE FORMULA OF THE URANYL ION. Howard W. Crandall. J. Chem. Phys. 17, 602-6(1949). C.A. 43, 8764c.

The exchange of O between uranyl ion and water was studied with O^{18} as a tracer. The results indicate the formula of the uranyl ion is UO_2^{++}.

923

MEASUREMENTS CONCERNING THE VAPOR-LIQUID EQUILIBRIUMS OF SOLUTIONS OF HELIUM^3 IN HELIUM^4 BELOW 2.19°K. K. W. Taconis; J. J. M. Beenakker, Alfred O. Nier, and L. T. Aldrich. Phys. Rev. 75, 1966 (1949). C.A. 43, 8775a.

Isotherms were obtained at 1.2, 1.75, 1.9, and 2.0°K. The assumption that He^3 is soluble in the normal fluid fraction of He (II) is verified.

924

EXCHANGE BETWEEN COBALTOUS ION AND COBALTIC HYDROXIDE IN THE PRESENCE AND ABSENCE OF HYDROGEN PEROXIDE. D. B. Broughton, R. L. Wentworth, and M. E. Farnsworth. J. Am. Chem. Soc. 71, 2346-7(1949). C.A. 43, 8820i.

Studies with radioactive Co show that there is practically no exchange between cobaltous ion and cobaltic hydroxide in water within 24 hours. H_2O_2 does not affect the system.

925

OXYGEN EXCHANGE WITH OXIDES. J. A. Allen and I. Lauder. Nature 164, 142-3(1949). C.A. 43, 8821h.

Preliminary results are reported for the exchange between O_2 and CuO, Co_3O_4, CoO, and NiO, obtained by the use of O_2 containing 1.4% O^{18}. The temperature-percentage exchange relation at 4 hours reaction time was investigated over the range 400-1000° for each of the 4 oxides. The rate of the exchange, and the effect of pressure were investigated at 700° and 800° for Co_3O_4 only.

926

THE ISOTOPE EFFECT IN THE DECOMPOSITION OF OXALIC ACID. J. G. Lindsay, D. E. McElcheran, and H. G. Thode. J. Chem. Phys. 17, 589(1949). C.A. 43, 8859e.

The isotopic effects in decomposition of oxalic acid into CO, CO_2, and H_2O in concentrated H_2SO_4 have been followed by determining the variations in the natural C^{13} to appear in CO_2 rather than CO. A higher rate of decomposition of oxalic acid molecules containing only C^{12} atoms over those containing C^{13} atoms was found. The fact that C^{13} is favored in the CO_2 seems to indicate a preferential splitting of the C^{12}-O^{16} bond over that of the C^{13}-O^{16} bond.

927

ISOTOPE SEPARATION BY UREY'S METHOD. R. Muylle. L'Industrie Chemique Belge 13, 17-23(1948) NSA 3, 390.

This is an outline of the theoretical basis of the isotope separation methods as developed by Urey and his co-workers. The principle is shown of the computation of the equilibrium constant of an exchange reaction by using methods of statistical mechanics. A mathematical analysis of the behavior of a rectifying column is made. Examples are given of isotope separations by Urey's method.

928

GAS-CENTRIFUGES. ENRICHMENT OF ISOTOPES OF XENON, KRYPTON, AND SELENIUM WITH THE CENTRIFUGAL PROCESS. K. Beyerle, W. Groth, P. Harteck, H. J. D. Jensen, G. Beggerow, V. Faltings, A. Suhr, and E. Nann. Chem. Ing. Tech. 21, 331-4(1949) C.A. 44, 3h.

The report covers theoretical principles, construction of a gas centrifuge, and experimental results. Increased separation was accomplished by stabilizing the rotor contents through H_2 addition up to as much as 90% H_2. Structural details are presented.

929

ON THE ELECTROLYTIC SEPARATION OF HYDROGEN ISOTOPES AT HIGH CURRENT DESITIES. Tsing-Lien Chang and Tsin-Hua Wang. J. Chinese Chem. Soc. 16, 59-64(1949). C.A. 44, 53b.

Dilute solutions of D_2O containing NaOH are electrolyzed at room temperature with smooth Pt wire as a cathode. At current density between 1 and 13 amp./sq. cm., the separation factor is approximately 6.5; this confirms the Eyring-Glasstone-Laidler theory of overvoltage.

930

HYDROGEN-DEUTERIUM EXCHANGE IN MIXTURES OF METHANE, HYDROGEN, AND OXYGEN. J. Wijnen, A. van Tiggelen. Bull. soc. chim. belges. 57, 446-66(1948). C.A. 44, 414f.

At 476-515° in a pyrex tube no exchange between CH_4 and D_2 took place until O_2 was added.

931

EXCHANGE REACTION BETWEEN PHOSPHORUS AND PHOSPHORUS TRICHLORIDE. Roland Muxart, Odilon Chalvet, and Pascaline Daudel. J. chim. phys. 46, 373-4 (1949). C.A. 44, 471f.

Slow exchange occurs in CS_2 solution between P_4 and PCl_3 (4% in a few minutes, 30% in a few days.

932

THE DEPENDENCE OF THE THERMAL DIFFUSION FACTOR ON TEMPERATURE. K. E. Grew. Proc. Phys. Soc(London) 62A, 655-61(1949) C.A. 44, 887e.

The thermal-diffusion factor for isotopic mixtures was calculated from values of the collision integrals which refer to molecules exerting an inverse 13th-power repulsion with an inverse 7th-power attraction-the (13, 7) model. The theoretical results are compared with experimental ones for the inert gas mixtures.

933

THE RELATIVE REACTION VELOCITIES OF ISOTOPIC MOLECULES. Jacob Bigeleisen. J. Chem. Phys. 17, 675-8(1949). C.A. 44, 910e.

The rate constants for competitive reactions of isotopic molecules are considered from the theory of "absolute rates" and the collision theory. Formulas are derived for the ratio of the rate constants and the difference in the activation energies for reactions of isotopic molecules.

934

APPLICATIONS OF RADIOACTIVE CHLORINE TO THE STUDY OF THE MECHANISMS OF REACTIONS INVOLVING CHANGES IN THE OXIDATION STATE OF CHLORINE. H.

Taube, and H. W. Dodgen. J. Am. Chem. Soc. 71, 3330-6(1949). C.A. 44, 912d.

The exchange of Cl between ClO^- and ClO_2^- in base is very slow. The exchange of Cl_2 with chlorate ion in acid at room temperature and at elevated temperatures is very slow.

935

THE EXCHANGE OF CYANIDE WITH NITRILES L. S. Tsi and M. D. Kamen. J. Chem. Phys. 17, 585-6(1949). C.A. 44, 1013i.

The exchange of the nitrile C in $HOCH_2CH_2CN$ with the C in the cyanide ion of MeCN, PhCN, and $(CH_2CN)_2$ was investigated under various conditions. The reality of such an exchange is questioned.

936

NONEXCHANGE OF SULFUR BETWEEN CARBON DISULFIDE AND HYDROGEN SULFIDE IN BENZENE SOLUTION. D. L. Douglas, R. A. Cooley, and D. M. Yost. J. Am. Chem. Soc. 71, 3237-8(1949). C.A. 44, 1309f.

In view of the recent work of Edwards, et al. it is reported that there is no exchange (greater than the experimental error, 1%) between H_2S^{35} and CS_2 in C_6H_6 after 95 hours at 120°.

937

SEPARATION TUBE. VII. ENRICHMENT OF THE HEAVY XENON ISOTOPE. REMARKS ON THE SEPARATION OF MIXTURES OF MANY COMPONENTS. Klaus Clusius. Helv. Phys. Acta 22, 473-8(1949) C.A. 44, 1823c.

The thermal diffusion tube used was 27 m. long and contained 14 liters of Xe of normal isotopic composition at a pressure of 0.5 atmosphere. Mass-spectrometric analyses gave the abundance in the separated gas in % of various isotopes. The atomic weight of the mixture was changes from 131.31 to 134.32. It is suggested that separation of complex mixture such as this one could be improved if gases of proper mass and cross section were added. Typical examples include HI and DI for the separation of Xe, HBr and DBr for Kr, and HCl and DCl for A.

938

EXCHANGE BETWEEN METALS AND THEIR IONS IN SOLUTIONS. II. MERCURY. M. Haissinsky and M. Cottin. J. Chim. Phys. 46, 476-9(1949). C.A. 44, 2338e.

Metallic Hg, tagged with 52-day Hg^{203}, is agitated with solutions of Hg salts. The Hg in the solution is recovered by reduction with formic acid, and the activity is determined. The amount of Hg in the 2 phases is the same. For 0.1M $Hg(NO_3)_2$ at pH 1.7, 20.0% exchange occurs in 10 minutes.

939

THE EXCHANGE REACTION THE HYDROGEN HALIDES AND THE HALOGENS IN THE GASEOUS STATE. H. W. Dodgen and W. F. Libby. J. Chem. Phys. 17, 951-7(1949). C.A. 44, 2340i

HF and F gases do not undergo an exchange reaction at room temperature; heating to 200° for a matter of an hour or so in a brass vessel is necessary to accomplish exchange. A rapid exchange reaction in the dark at room temperature was observed to occur between Cl and HCl in the gaseous state. The mechanisms of the exchanges are discussed.

940

THERMODYNAMIC FUNCTIONS FOR TRITIUM DEUTERIDE. THE DISSOCIATION OF TRITIUM DEUTERIDE. EQUILIBRIA AMONG THE ISOTOPIC HYDROGEN MOLECULES. W. M. Jones. J. Chem. Phys. 17, 1062-4(1949). C.A. 44, 2362g.

The heat capacity, entropy, internal energy, and free energy are calculated to 2500°K for TD, the dissociation of TD is considered, and equilibria of the isotopic hydrogens among themselves are calculated.

941

THE SEPARATION OF CLOSELY BOILING MIXTURES. H. E. Watson. Ind. Chemist 25, 503-6(1949). C.A. 44, 2801e.

Test data are presented for 14 types of fractionating column packings made of 36-mesh gauze. A column 4 feet high containing 250 disks showed promise for the separation of H_2O^{18} from water, giving a maximum difference of density of 40 p.p.m. between head and pot samples. A 45 foot column is being tested.

942

EXCHANGE OF CARBON DIOXIDE BETWEEN BARIUM CARBONATE AND CARBON DIOXIDE GAS. G. Samos. Science 110, 663-5(1949). C.A. 44, 2832a.

$BaCO_3$ containing C^{14} was exposed to an atmosphere of inactive CO_2 at relative humidity from 3 to 75%. Exposure for 2 ¼ hours gave 1.3 to 3.5% decrease in activity of $BaCO_3$. Samples of different thickness showed the same percentage decrease in activity, which indicates that exchange took place throughout the sample. The exchange depended on the size of the crystals; the larger the particles the less the exchange. Samples heated in air at 140° lost 2.5 to 3.0% activity but were stabilized against exchange losses by the heating.

943

HYDROGEN EXCHANGE REACTIONS OF PHENOL ETHERS IN ACETIC ACID SOLUTION. PROMOTIVE AND INHIBITORY EFFECTS OF STERIC ORIGIN. W. G. Brown, K. E. Wilzbach, and W. H. Urry. Can. J. Research 27b, 398-407(1949). C.A. 44, 2945d.

Analysis of AcOD for D is performed by addition of a MeMgI solution to the phenol ether in AcOD, combustion of the methane produced, and detection of the density of the water thus formed. Results are given for various ethers reacting at 90° in the presence of traces of H_2SO_4.

944

SEPARATING COMPONENTS OF A GAS OR LIQUID MIXTURE AND ENRICHING AND SEPARATING ISOTOPES. W. A. Wahl. Swedish Patent 126,166, Sept. 20, 1949. C.A. 44, 3312f.

Process and apparatus are described based on thermodiffusion and convection methods.

945

EXCHANGE OF OXYGEN^{18} BETWEEN OXIDES AND GASEOUS OXYGEN. G. Houghton and E. R. S. Winter. Nature 164, 1130-1(1949). C.A. 44, 3340a.

The data for MgO indicate a first-order reaction. Provided a similar heat treatment is used, the calculated reactive surface areas of the oxide are of the same order as those calculated from low-temperature N isotherms by the Brunauer method.

946

ISOTOPIC EXCHANGE OF IRON. I. C. Haenny and G. Rochat. Helv. Chim. Acta 32, 2441-4 (1949). C.A. 44, 3340b.

With Fe^{59} no exchange was found between the Fe in Fe^{3+} and $[Fe(CN)_6]^{3-}$, or between Fe^{3+} and $[Fe(CN)_6]^{4-}$. Between Fe^{3+} and $[Fe(C_2O_4)_3]^{3-}$ and between $[Fe(CN)_6]^{4-}$ and $[Fe(CN)_6]^{3-}$ exchange takes place.

947

ISOTOPIC EXCHANGE OF IRON. II. C. Haenny and E. Wikler. Helv. Chim. Acta 32, 2444-52(1949). C.A. 44, 3340b.

No exchange is found between Fe^{3+} and Fe in methemoglobin. About 3% exchange between Fe^{3+} and $[Fe(CN)_6]^{3-}$ takes place after several days in sunlight or in the presence of I_2. Exchange between $[Fe(CN)_6]^{4-}$ and

$[Fe(CN)_6]^{3-}$ is complete in 10 minutes while the exchange between Fe^{3+} and $[Fe(C_2O_4)_3]^{3-}$ is 98% complete in one second. No exchange takes place between $[Fe(CN)_6]^{3-}$ and $[Fe(C_2O_4)_3]^{3-}$ in 10 minutes while exchange between Fe^{3+} and $Fe(CNS)_3$ is rapid.

948

CARBON[13] ISOTOPE EFFECT IN THE DECARBOXYLATION OF MALONIC ACID. Jacob Bigeleisen and L. Friedman. J. Chem. Phys. 17, 998-9(1949). C.A. 44, 3340f.

The ratio of $C^{13}O_2$ to $C^{12}O_2$ in the decomposition products from malonic acid was determined by means of the mass-spectrometer. The results are compared with the calculations of Bigeleisen (C.A. 43, 7333a) and the data of Yankwich and Calvin (C.A. 43, 2862d).

949

THE ELECTROMAGNETIC CONCENTRATION OF Be^{10}. C. P. Keim, H. W. Savage, and Boyd Weaver. Phys. Rev. 77, 414(1950). C.A. 44, 3373a.

Be^9 contains about 2 ppm of Be^{10}. The Be^{10} was enriched by factors of 870-1200.

950

APPARATUS FOR ISOTOPE SEPARATION BY THERMAL DIFFUSION. W. W. Watson, L. Onsager and A. Zucker. Rev. Sci. Instruments 20, 924-7(1949). C.A. 44, 3804h.

The unit is compact and of metal construction. By operating with Ne at 3 atmosphere pressure and using 12 m of column, 7 l of gas with a Ne^{22} content of 93.4% was produced in 260 hours.

951

INFLUENCE OF STRUCTURAL FACTORS ON CONJUGATION PHENOMENA. I. MOBILITY OF HYDROGEN ATOMS IN VARIOUS CYCLIC KETONES. A. N. Nesmeyanov. D. N. Kursanov, A. K. Pecheskaya, and Z. N. Parnes. Izvest. Akad. Nauk S.S.S.R. Otdel Khim, Nauk 592-7(1949). C.A. 44, 3917e.

Exchange studies between various cyclic ketones and D_2O above 100° are reported.

952

INFLUENCE OF STRUCTURAL FACTORS ON CONJUGATION PHENOMENA. II. MOBILITY OF HYDROGEN ATOMS IN ACETYLACETONE AND ITS COBALT AND ALUMINUM SALTS. A. N. Nesmeyanov, D. N. Kursanov, T. A. Smolina, and Z. N. Parnes. Izvest. Akad. Nauk S.S.S.R., Otdel Khim. Nauk, 598-600(1949). C.A. 44, 3917f.

Acetylacetone exchanged 2H atoms with D_2O at 17° in 70 hours while the Co and Al salts did not.

953

EXCHANGE IN COBALT CHELATE COMPOUNDS. B. West. Nature 165, 122-3 (1950). C.A. 44, 4299g.

Exchange by an ionic mechanism between Co^{2+} and Co chelate compounds exhibiting high paramagnetism was shown by mixing equimolal, with respect to Co, solutions of chelate and $CoSO_4$, which contained Co^{60}, separating, then measuring the activity of the chelate extract. Salicylaldehyde and guaiacol derivatives showed exchange. No exchange was found in the ethylenediamine complex, which is strongly diamagnetic. The unexpected activity of the chelate layer obtained with the salicylaldoxime complex was attributed to the possibility of the formation of an exchangeable compound.

954

ISOTOPIC EXCHANGE OF PHOSPHORUS BETWEEN THE PHOSPHATE ION AND ESTERS OF PHOSPHORIC ACID. A. F. Lukovnikov, V. P. Medvedev, M. V. Neiman, An. N. Nesmeyanov and I. S. Shaverdina. Doklady Akad. Nauk S.S.S.P. 70, 43-5, (1950). C.A. 44, 4315i. (Eng. trans. see reference No. 1116).

No exchange was found upon heating 20-30 hours at 100-300° in sealed tubes dioxane solutions of equivalent amounts of $(MeC_6H_4)_3PO_4 + H_3PO_4$; Bu_3PO_4, $(iso\text{-}Bu)_3PO_4$, $(C_6H_{13})_3PO_4$, and Et_3PO_4, respectively with Na_2HPO_4.

955

ELECTRONIC EXCHANGE AND OXIDATION-REDUCTION REACTIONS IN INORGANIC SYSTEMS. J. W. Gryder. Trans. N. Y. Acad. Sci. 12, 18-21(1949). C.A. 44, 4317h.

Exchange reactions are reviewed briefly. The rate of exchange is most dependent on the nature of the species involved, the free energy change of the reaction, the charge product of the reacting ions, and the electric properties of the solution.

956

FORMATE-CARBONATE EXCHANGE REACTION REVEALED BY LABELED CARBON. D. G. Grant and H. S. Turner. Nature 165, 153-4(1950). C.A. 44, 4761a.

When 0.1M solutions of Na_2CO_3 and $HC^{13}OONa$ were heated in a bomb for several hours, the C^{13} content of the Na_2CO_3 increased from 1.06 to 2.62 atom %. When a solution containing 50 mg each of HCOONa and $Na_2C^{14}O_3$ was heated for 4 hours the activity of the $BaCO_3$ precipitated from the solution decreased from 4.13×10^{-10} to 2.80×10^{-10} curies/mg. Under the same conditions there was a negligible exchange between $CH_3C^{13}OONa$ and Na_2CO_3. The yield of HCOONa was 98-100%. The mechanism of the exchange reaction may involve an equilibrium with oxalate ion.

957

ISOTOPIC EXCHANGE REACTIONS OF GASEOUS ETHYL BROMIDE WITH Br, HBr AND DBr. J. B. Peri and F. Daniels. J. Am. Chem. Soc. 72, 424-31(1950). C.A. 44, 4762a.

Bromine reacts with ethyl bromide below 350° to give the dibromide. Direct exchange of radioactive bromine into ethyl bromide occurs only through reaction with the products of the reaction. The bromine of hydrogen bromide exchanges with ethyl bromide from 180-310° with an activation energy of 31.5 ± 1.0 kcal/mole. The deuterium of deuterium bromide exchanges with all five hydrogens of ethyl bromide between 258 and 306° with an activation energy of 40 ± 4 kcal/mole. The exchange of bromine and deuterium were studied simultaneously, also, using deuterium bromide containing radioactive bromine. A mechanism for the exchange reactions is proposed which involves free radicals produced on the walls.

958

OXYGEN ISOTOPE EXCHANGE IN THE ELECTRIC DISCHARGE. W. E. Roake and M. Dole. J. Am. Chem. Soc. 72, 36-40(1950). C.A. 44, 4771d.

No evidence for the exchange of O isotopes between O and H_2O vapor was discovered on passing the two through an electric discharge cell at low pressures and at -40° in the presence of a parallel magnetic field. However, a significant exchange was found to exist when O and CO_2 were the gases in the cell. The relation of these results to the problem of the enhanced O^{18} content of the atmosphere is discussed and a theory for the latter is given which seems to be quantitatively possible.

959

SEPARATION TUBE. VIII. ENRICHMENT OF CARBON[13] IN METHANE. Klaus Clusius and G. Dickel. Helv. Phys. Acta 23, 103-7(1950). C.A. 44, 4797f.

The final product has a molecule weight of 16.211 and composition in % of: $C^{12}H_4$, 82.1; $C^{13}H_4$, 17.0; $C^{12}H_3D$, 0.9. It is suggested that CO would be more suitable for preparation of C^{13} by the thermal-diffusion method. The enriched CO would contain C^{13}, O^{17}, and O^{18}. The reaction: $CO + 3H_2 = H_2O + CH_4$ would then transfer the O isotopes of H_2O and C^{13} to CH_4. If electrolytic H were used, the resulting CH_4 would contain very small amounts of D.

960

COMPARISON OF THE STRENGTH OF VERY WEAK ACIDS. A. I. Shatenshtein. Doklady Akad. Nauk S.S.S.R. 60, 1029-31(1950). C.A. 44, 5194d.

The mobility of the H atom in hydrocarbons is evaluated by the rate of its exchange with D in the solvent. Generally, this exchange is either absent or insignificant with D_2O or with deuterioalcohol, even in the presence of alkali, but is significant with liquid ND_3 as solvent, particularly in the presence of dissolved NH_2K which creates a strongly alkaline medium. Results are given with first order rate constants for a large number of compounds in D_2O or deuterioalcohol, liquid NH_3 and liquid ND_3. Compounds studied include indene, acetophenone, fluorene, m-dinitrobenzene, p-nitrotoluene, α-picoline, quinaldine, triphenylmethane, acenaphthene, naphthalene, HCO_2Na, AcONa, diphenylmethane, MeOH, Ph_2NH, and p-$MeC_6H_4NH_2$ at various temperatures.

961

RESULTS OF LOW-TEMPERATURE RESEARCH. VIII. RECTIFICATION OF H_2-HD-D_2 MIXTURES FOR THE PREPARATION OF DEUTERIUM HYDRIDE, DEUTERIUM, AND HEAVY WATER. Klaus Clusius and Kurt Starke. Z. Naturforsch, 4a, 549-59(1949). C.A. 44, 5194i.

The proposal is made to prepare D_2 or HD by dropping liquid D-free H_2 through ordinary H_2 cooled to the dew point. The heavier components are carried downward by the liquid, which can be fractionated to give pure D_2. The efficiency of the process can be improved by establishing equilibrium in the liquid through catalysis. Separation factors were calculated.

962

THE EXCHANGE RATE OF SULFUR DIOXIDE WITH CONCENTRATED SULFURIC ACID. T. H. Norris. J. Am. Chem. Soc. 72, 1220-3 (1950). C.A. 44, 5197d.

With radioactive S^{35} the exchange reaction between SO_2 and H_2SO_4 (97.2%), $SO_2 + H_2S^*O_4 \rightleftharpoons S^*O_2 + H_2SO_4$, was investigated over the range from room temperature to 211°. The observed half-times for exchange are: at room temperature, greater than 27 years; at 101°, about 1.6 years; at 211°, about 7.5 years. The temperature coefficient of the rate is, at 165°, about 1.8 per 10°, corresponding to an apparent activation energy of 22.0 kcal. mole.

963

CARBON ISOTOPE EFFECT ON REACTION RATES. K. S. Pitzer. J. Chem. Phys. 17, 1341-2(1949). C.A. 44, 5198g.

The calculation of the C isotope effect in the decarboxylation of malonic acid as described by Bigeleisen is modified on the basis of a somewhat different model. The resulting calculated ratio of rates of breaking of C^{12}-C^{12} to C^{12}-C^{14} bonds is 1.14 as compared with Bigeleisen's 1.04.

964

ABUNDANCE OF N^{15} IN THE NITROGEN OCCLUDED IN RADIOACTIVE MINERALS. Wm. C. White and Herman Yagoda. Science 111, 307-8 (1950). C.A. 44, 5223h.

In uranites, pitchblendes, and samarskites the abundance of N^{15} in N varies between 0.532 ± 0.005 and 0.614 ± 0.012 (nearly proportional to the geologic age of the mineral) as compared with a normal abundance of 0.376%. No adequate explanation exists.

965

COMPLEMENTARY KINETIC STUDY OF THE REACTION $H_2 + D_2 = 2HD$ CAUSED BY α-PARTICLES. W. Mund and M. Van Meersche. Bull, soc. chim. belges. 57, 88-110(1948). C.A. 44, 5225b.

Previous work (C.A. 42, 5777c) was repeated with a smaller reaction vessel and improved precision in the analysis.

966

THE EFFECT ON REACTION RATES CAUSED BY THE SUBSTITUTION ON C^{14} FOR C^{12}. W. H. Stevens and R. W. Attree. J. Chem. Phys. 18, 574(1950). C.A. 44, 5688h.

No isotope effect on the reaction velocity in the Cannizzaro reaction with PhCHO or in the benzoin condensation with PhCHO was found within the error of the sample preparation and counting error (±1.5%). In the benzilic acid rearrangement with monocarbonyl-labeled benzil the ratio of $Ph_2C^{14}OHCO_2H$ to $Ph_2COHC^{14}O_2H$ was 1.11 ± 0.01.

967

SOME RECENT WORK ON THE SEPARATION AND USE OF STABLE ISOTOPES. I. Lauder. J. Proc. Roy. Soc. N. S. Wales 82, 183-95(1948). C.A. 44, 5715b.

A review with 54 references.

968

THE NATURAL DISTRIBUTION OF CARBON[13] AND OXYGEN[18] AND THE REDISTRIBUTION OF THE ISOTOPES IN THE SOLUTION EQUILIBRIUM: HYDROCYANIC ACID-GIACIAL ACETIC ACID. E. W. Becker and W. Vogell. Z. Naturforsch 5a, 174-5(1950). (Translation AEC File No. NP-2235). 4p. C.A. 44, 6240i.

Results indicate that $C^{13} = (1.12_4 \pm 0.005)\%$ and $O^{18} = (0.205_9 \pm 0.003)\%$. The shift in isotopic abundance caused by the equilibrium HCN_{gas}/HCN_{soln} (CH_3COOH) has been investigated. The C^{13} is found to be enriched by approximately 0.2% in the liquid phase. This indicates that the hydrocyanic acid dissolved in the glacial acetic acid can be only slightly dissociated.

969

EXCHANGE STUDIES BETWEEN SODIUM TRIMETAPHOSPHATE AND SODIUM HEXAMETAPHOSPHATE, USING RADIOACTIVE PHOSPHORUS. R. C. Vogel and H. Podall. J. Am. Chem. Soc. 72, 1420(1950). C.A. 44, 6244b.

No exchange of P was observed between labeled $(NaPO_3)_3$ or $(NaPO_3)_3$ and NaH_2PO_4 mixtures and unlabeled $(NaPO_3)_6$ at the end of 25 hours at O and 25°.

970

EXPERIMENTAL EVIDENCE FOR THE QUASI-UNIMOLECULAR DISSOCIATION OF NITROGEN PENTOXIDE. R. A. Ogg, Jr., W. S. Richardson and M. K. Wilson. J. Chem. Phys. 18, 573(1950). C.A. 44, 6245c.

Intensity measurements of suitable infrared absorption bands were used to determine the concentrations of compounds involved in rate studied with N_2O_5. The equilibrium $N_2^{14}O_5 + N^{15}O_2 \rightleftharpoons N_2^{15}O_5 + N^{14}O_2$ is established very rapidly.

971

THE APPLICATION OF BRONSTED'S METHOD OF ISOTOPE SEPARATION TO THE STUDY OF THE NATURAL RADIOACTIVITY OF POTASSIUM. G. Hevesy. Acta. Chem. Scand. 3, 1263-8(1949). C.A. 44, 6287_1.

The heavy isotopes of K were enriched in the residues from distillation of metallic K.

972

EFFICIENCY OF THE ELECTROLYTIC SEPARATION OF NITROGEN ISOTOPES. D. A. Hutchison. Phys. Rev. 75, 1303(1949). C.A. 44, 6295f.

The electrolytic separation factor, α, has been determined for the nitrogen isotope separation in the electrolysis of aqueous solutions of ammonium chloride at a flowing mercury cathode. The electrolytic separation factor was found to be 1.008 ± 0.001 for the temperature interval of 30°-70°. A plot of α's for the elements thus far investigated against their atomic weights yields a smooth curve which approaches zero slope at about mass 25 and extends to mass 40.

973

SEPARATION OF ARGON^{36} BY THERMAL DIFFUSION. James O. Buchanan. Phys. Rev. 75, 1332 (1949). C.A. 44, 6296b.

974

CONCENTRATION INCREASE ON HEAVY THALLIUM ISOTOPE BY ELECTROLYTIC MIGRATION IN MOLTEN THALLIUM CHLORIDE. A. Klemm, H. Hintenberger, and W. Seelman-Eggbert. Z. Naturforsch, 3a, 622-4(1948). C.A. 44, 6299a.

By electrolysis for 7.9 days at a current density of 6 amp/cm^2 of a melt of TlCl and $ZnCl_2$ it was possible to concentrate Tl^{205} to a relative concentration of 2.81 ± 0.3 for Tl^{205}/Tl^{203}, corresponding to a separation factor of 1.147.

975

ELECTROLYTIC SEPARATION FACTOR OF TRITIUM. J. Horiuchi and T. Nakamura. J. Chem. Phys. 18, 395-6(1950). C.A. 44, 6299b.

For the electrochemical mechanism ($H_2^+ \rightarrow H_2$) the calculated value for a Hg electrode is 5.8. Revised values for the calculated separation factors of D are 6.8 (Ni electrode), 7.2 (Pt electrode), 3.8 (Hg electrode, electrochemical mechanism).

976

CHEMICAL-EXCHANGE REACTIONS: ENRICHMENT OF SULFUR^{34}. Klaus Clusius and Hans Haimerl. Z. Naturforsch, 39, 611-16(1948). C.A. 44, 6709b.

The exchange reaction between $HS^{34}O_3^-(l)$ and $S^{32}O_2(g)$ to give $S^{34}O_2(g) + HS^{32}O_3^-(l)$, in a 20-m-long column led to enrichment of 10.2% S^{34} and 1.5% S^{33} as compared with the natural concentrations of 4.18% and 0.74%, respectively. The apparatus is described.

977

PHYSICAL AND CHEMICAL ADSORPTION STUDIES ON CATALYSTS. P. H. Emmett and J. T. Kummer. J. Chim. Phys. 47, 67-73(1950). C.A. 44, 6711i.

The theory for the multilayer adsorption of gases on solids still appears to yield reliable values for the surface area of porous and finely-divided solids though the assumptions of the theory are of doubtful validity. N_2^{28} and N_2^{30} react rapidly to form N_2^{29} over iron catalysts at 450 to 500° contrary to previous conclusions.

978

THE KINETICS OF THE α-PARTICLE INDUCED EXCHANGE REACTION BETWEEN HYDROGEN AND DEUTERIUM. W. Mund and M. Van Meersche. Bull, classe sci. Acad. roy. Belg. 36, 47-62(1950). C.A. 44, 6728h.

The rate of exchange between H and D in a vessel containing a source of α-particles is calculated and agrees with experimental results.

979

ISOTOPE ENRICHMENT IN ULTRACENTRIFUGES WITH HYDROGEN STABILIZATION. W. Groth and P. Harteck. Z. Elektrochem. 54, 129-32(1950). C.A. 44, 6739g.

Isotope enrichment in gaseous compounds by means of an ultracentrifuge to which H is added is discussed. Reference is made to experiments, for which no data are given, with Kr, Xe, H_2Se, and GeH_4. Without H the enrichment obtained was always less than that to be expected from theory, but when the gas mixture contains up to 90% H the theoretically expected enrichments were obtained. The advantages of adding H are: (1) suppression of convection currents and turbulence; (2) facilitating the determination of the degree of enrichment; (3) increasing the enrichment of a single stage.

980

EXCHANGE REACTION OF CARBONATE ION WITH CARBONATOTETRAMMINE COBALTIC ION. G. M. Harris. J. Chem. Phys. 18, 764-5(1950). C.A. 44, 6757d.

In a solution approximately 0.03M in $[Co(NH_3)_4CO_3]NO_3$ and 0.01M in Na_2CO_3 containing a small amount of C^{14}, isotopic exchange occurred at 20° in the dark with a half life of 7 hrs. The reaction showed 1st-order characteristics.

981

A MULTI-COLUMN COUNTERCURRENT MOLECULAR STILL. S. L. Madorsky. Rev. Sci. Inst. 21, 760-3 (1950). (AECD-2674). C.A. 44, 7096c.

A still, based on refluxing by gravity feeds and circulation of the liquid by means of magnetic pumps, is described. Each column consists of a concentric evaporator having surface of 300 cm^2 surrounded by water-cooled condenser, and the still comprises 19 practical plates or 13 theoretical plates. A magnetic pump, designed to operate in a vacuum is described.

982

THE EXCHANGE OF WATER BETWEEN AQUEOUS CHROMIC ION AND SOLVENT. J. P. Hunt and H. Taube. J. Chem. Phys. 18, 757-8(1950). C.A. 44, 7125h.

A solution of 1.47M $Cr(ClO_4)_3$ and 0.13M $HClO_4$ in ordinary water was mixed at 25° with water containing O^{18}. Aliquots were removed at intervals; a portion of the water was removed by distillation and equilibrated with CO_2; the isotopic composition of the CO_2 was then determined with a mass spectrometer. The calculated initial holdback of water per Cr^{3+} ion is 6.2 ± 0.2; preference of the ion for H_2O^{18} over H_2O^{16} reduces this value by 0.1-0.2. The coordination number of Cr^{3+} for H_2O is therefore 6. The half-life of the exchange reaction between the hydrated ion and solution is approximately 40 hr.

983

THE EXCHANGE OF WATER BETWEEN Co^{+++}aq. AND THE SOLVENT AND BETWEEN Co^{++}aq. AND THE SOLVENT. H. L. Friedman, H. Taube, and J. P. Hunt. J. Chem. Phys. 18, 759-60(1950). C.A. 44, 7126a.

At 0 ± 4° exchange with both Co^{3+} and Co^{2+} ions was complete by the time of the 1st sampling (approximately 2 minutes). Since it is known that Co^{2+}_{aq} exchanges water rapidly with the solvent, the apparent high exchange rate for the Co^{3+}_{aq} ion can be accounted for by assuming a rapid electronic exchange between Co^{2+} and Co^{3+}.

984

EFFECT OF THE HETEROGENEITY OF CATALYSTS ON CHEMISORPTION AND CHEMICAL KINETICS. Hugh S. Taylor. J. chim. phys. 47, 1225(1950). C.A. 44, 7132h.

Surface heterogeneity for the adsorption of H_2 on ZnO, must be taken into consideration in interpreting the temperature coefficient of the catalytic reaction of H_2 and D_2. In experiments on the exchange between CH_4 and CD_4 (C.A. 43, 7802f) it is shown that fragments CH_3, CH_2, CH, C, CD, CD_2, and CD_3 exist on the surface of the Ni catalyst. The exchange of N_2^{28} and N_2^{30} form N_2^{29} occurs rapidly at the

temperature of NH_3 synthesis over Fe and Re if the metals are produced by passing pure dry H_2 through the bed of metallic oxide for a sufficient time to effect substantially complete reduction. However, surfaces of these metals, incapable of causing the reaction between N_2^{28} and N_2^{30}, still cause exchange between H_2 and D_2, H_2O and D_2O, and NH_3 and ND_3. This confirms the heterogeneous nature of the catalyst surfaces.

985

THE HYDROGEN EXCHANGE OF ALKALI AMIDES AND HYDROXIDE WITH DEUTERIUM GAS. Y. Claeys, J. Dayton, and W. K. Wilmarth. J. Chem. Phys. 18, 759(1950). C.A. 44, 7130e.

Solutions of KNH_2 in NH_3 exchange completely with D_2 at -50°; a 0.001M solution has a half-life of less than 1 minute for the exchange in solution. Exchange in the system D_2-H_2O-KOH is not affected by light or increase in glass surface. The reaction is 1st order with respect to both D_2 and OH^- and has a high temperature coefficient.

986

FERROUS-FERRIC ELECTRON TRANSFER REACTION IN PERCHLORIC ACID SOLUTION. H. A. Kierstead. J. Chem. Phys. 18, 756(1950). C.A. 44, 7154b.

$Fe(ClO_4)_3$ solution was mixed with a solution of $Fe(ClO_4)_2$. The Fe^{2+} and Fe^{3+} ions were partially separated by diffusion through a sintered-glass disk and separation factors were determined by measuring the ultraviolet absorption and by radioactive-counting techniques.

987

DIFFERENTIAL EQUATION OF THE CLUSIUS COLUMN FOR SEPARATION OF ISOTOPES. S. D. Majumdar. Science and Culture 15, 329(1950). C.A. 44, 7603b.

The equation for the operation of the Clusius and Dickel column was simplified by transformation to linear form. The solution for the case where the column is closed at the upper end and connected to a reservoir of infinite capacity at the lower end is given.

988

SOME PROPERTIES OF SOLUTIONS OF HELIUM^3 IN HELIUM^4. B. N. Esel'son and B. G. Lazarev. Doklady Akad. Nauk S.S.S.R. 72, 265-7 (1950). C.A. 44, 7604c.

Natural He was enriched in He^3 by a factor of about 10^3 by use of the thermomechanical effect, then further by a factor of about 200 by distillation. The maximum concentration of He^3 in He^4 was 1.5%.

989

THE GAS PHASE EXCHANGE REACTION BETWEEN HBr AND Br_2. H. Jacobson. J. Chem. Phys. 18, 994(1950) [AECU-862] C.A. 44, 7628d.

The exchange reaction between gaseous HBr and Br_2 is known to be rapid, being reported as almost complete within 2 min at room temperature with approximately equivalent amounts of reactants at a total pressure of about 100 mm.

990

ISOTOPES IN THE STUDY OF CHEMICAL REACTIONS. H. R. V. Arnstein and R. Bentley. Nucleonics 6, No. 6, 11-27(1950). C.A. 44, 7664e.

A review with 70 references.

991

THE EQUILIBRIUM H_2 + HDO = HD + H_2O AND OTHER EQUILIBRIA IN THE SYSTEM H_2-D_2-H_2O. Hans E. Suess. Z. Naturforsch. 4a, 328-32(1949). C.A. 44, 8206f.

The distribution constant, V = (D/H) in water/(D/H) in hydrogen, was measured between 80 and 200° and over a range of D concentration in the water from 4 to 60%. V was independent of the D concentration within experimental precision (1%).

992

CURRENT METHODS FOR SEPARATION OF ISOTOPES. W. Groth. Z. Elektrochem. 54, 5-12(1950). C.A. 44, 8245b.

993

THE EXCHANGE BETWEEN Br_2^* AND $HgBr_2$ IN CARBON DISULFIDE SOLUTION. D. L. Douglas, R. A. Cooley, and D. M. Yost. J. Am. Chem. Soc. 71, 3238(1949). C.A. 44, 8262a.

The results of 6 experiments show that the exchange of Br^{82} atoms between Br_2^* and $HgBr_2$ is complete within at least 2.5 minutes at somewhat less than 0°.

994

THE HISTORY OF THE TRAIL [CANADA] SMELTERY. R. Lepse. Tids. Kjemi, Bervesen Met. 7, 22-5(1947); Chem. Zentr. (Russian Zone Ed. II, 1227(1948)). C.A. 44, 8295i.

This plant works up Cu, Pb, Zn, and Sn ores in large quantities and also produces phosphate fertilizer, S, H_2SO_4, etc. Since the beginning of the war it has also produced HNO_3, NH_4NO_3 and D_2O.

995

THE EXCHANGE REACTION OF HYDROXYLAMINE AND GASEOUS NITROGEN. B. A. Pethica, E. R. Roberts, and E. R. S. Winter. J. Chem. Phys. 18, 996(1950). C.A. 44, 8414f.

NH_2OH-HCl was exposed for 24 hrs. at room temperature to a N atmosphere containing 10% N^{15}. The NH_2OH was then reduced to NH_3 and converted to N_2 by oxidation with NaBrO. No exchange was detected.

996

THE ELECTRON-TRANSFER EXCHANGE REACTION OF FERRICYANIDE AND FERROCYANIDE IONS. J. W. Cobble and A. W. Adamson. J. Am. Chem. Soc. 72, 2276-8(1950). C.A. 44, 8747f.

Separations were made by diffusion electrophoresis and ion exchange to avoid induced exchange that might be brought on by precipitation. Separation times were 4 minutes to 17 hours. Radioactive iron, Fe^{55-59}, was used as an indicator of exchange. Complete exchange was found.

997

THE KINETICS OF ISOTOPIC EXCHANGE REACTIONS. T. H. Norris. J. Phys. & Colloid Chem. 54, 777-83(1950). C.A. 44, 8750f.

A discussion of the theory of the kinetics of exchange reactions is presented.

998

THE EXCHANGE REACTION BETWEEN ANHYDROUS DEUTERIUM CHLORIDE AND PHENOL. H. Hart. J. Am. Chem. Phys. 72, 2900-4(1950). C.A. 44, 8750g.

Anhydrous DCl exchanges rapidly with PhOH, equilibrium being established in several minutes at 50°. The exchange involves not only the OH hydrogen, but the H atoms of the 2, 4, and 6 positions as well. Possible mechanisms for the reaction, and the difference in rate between anhydrous and aqueous exchange were discussed.

999

THE ELECTRON TRANSFER (EXCHANGE) BETWEEN COBALTOUS AND COBALTIC AMINE COMPLEXES. W. B. Lewis, C. D. Coryell, and J. W. Irvine, Jr. J. Chem. Soc. 1949 (Suppl. Issue No. 2) S 386-92. C.A. 44, 8752c.

The rates of the electron-transfer process between the trisethylenediamine complexes of di and tervalent Co, between the corresponding hexammino complexes and the cross reaction between Co complexes of ammonia and ethylenediamine are followed using Co^{60} tracer.

1000

ELECTROMAGNETIC ENRICHMENT OF IRON^{58} AND CONCURRENT IMPROVERISHMENT OF IRON^{54} CONTENT IN IRON. C. P. Keim, H. W. Savage, and Boyd Weaver. Science 112, 47(1950). C.A. 44, 8792e.

Fe enriched in Fe^{58} and impoverished in Fe^{54} has been produced electromagnetically in the calutrons. The best collection of Fe^{58} to date is given in a table along with the analysis of two Fe^{58} shipments used to produce Fe^{58} low in Fe^{55} by neutron irradiation.

1001

THE EXCHANGE REACTIONS OF SOLID OXIDES. I. THE EXCHANGE OF OXYGEN ISOTOPES BETWEEN GASEOUS OXYGEN AND CERTAIN METALLIC OXIDES. E. R. S. Winter. J. Chem. Soc. 1170-5, (1950). C.A. 44, 9220a.

The exchange of O^{18} between O_2 and γ-Al_2O_3, ZnO, ThO_2, and TiO_2 was investigated at 360-600°. The initial reaction is rapid, and is followed by a slow reaction.

1002

THE EXCHANGE REACTIONS OF SOLID OXIDES. II. THE EXCHANGE OF OXYGEN BETWEEN WATER VAPOR AND CERTAIN METALLIC OXIDES. E. Whalley and E. R. S. Winter. J. Chem. Soc. 1175-7(1950). C.A. 44, 9220c.

Preliminary results are reported on the exchange of O^{18} between H_2O^{18} vapor and γ-Al_2O_3, ThO_2, and TiO_2. As in the exchange of O_2 with these substances there is an initial rapid reaction followed by a slow exchange.

1003

DISSOCIATION AND EXCHANGE EQUILIBRIA OF THE TRITIUM HALIDES. J. Bigeleisen. J. Chem. Phys. 18, 481-5(1950). C.A. 44, 9267d.

The ratios of the partition functions of the T halides to their respective H halides have been calculated. These are combined to give the exchange equilibria between the six pairs of T and H halides. The exchange equilibria with H_2O are calculated.

1004

THE SEPARATION OF LITHIUM ISOTOPES BY ION EXCHANGE AND OF NEON ISOTOPES BY LOW TEMPERATURE ADSORPTION COLUMNS. E. Glueckauf, K. H. Barker, and G. P. Kitt. Discussions Faraday Soc. No. 7, 199-213(1949). C.A. 44, 9771f.

The separation of Li isotopes was studied with N AcOLi on Zeo-Karb H.I. with a diffusion coefficient of about 10^{-6} cm^2/sec and a grain size of 0.015 mm diameter at a flow rate of 0.0004 ml/sec. The isotopic ratio was determined after slow neutron bombardment. The separation of Ne isotopes on charcoal at -196° was also studied to test predictions by the theory. The method is not adapted to isotope separation in bulk when the separation factor is small. The chromatographic method is likely to be superior where the quantities are exceedingly small and where the separation factor is comparatively large such as in the separation of He^3 from enriched He.

1005

EXCHANGE OF MERCURY (I) AND MERCURY (II) IONS. Edward L. King. J. Am. Chem. Soc. 71, 3553-4(1949). C.A. 44, 9780g.

Exchange was rapid except in the case where a slurry of Hg(I) compound was used, which caused a slower exchange.

1006

THE ISOTOPIC CHEMISTRY OF CARBONATES AND A PALEO-TEMPERATURE SCALE. J. M. McCrea. J. Chem. Phys. 18, 849-57(1950). C.A. 44, 10395d.

The temperature variation of the fractionation of O in exchange reactions between dissolved carbonate and water and between calcite and water are calculated on theoretical grounds, and checked experimentally. In the course of the experiments it was necessary to investigate several methods of decomposing $CaCO_3$ to CO_2 for mass-spectrometer analysis. A method was developed for growing $CaCO_3$ from solution with the same isotopic composition as the carbonate shells of organisms produced at the same temperature from water of the same isotopic composition.

1007

A TEST OF IDEAL SOLUTION LAWS FOR H_2, HD, AND D_2. VAPOR PRESSURES AND CRITICAL CONSTANTS OF THE INDIVIDUAL COMPONENTS. R. D. Arnold and H. J. Hoge. J. Chem. Phys. 18, 1295(1950). C.A. 44, 10461a.

Dew-point pressures of several mixtures of H_2, HD, and D_2 were observed at various temperatures. Observed pressures are approximately 3% above those calculated for ideal mixtures from the vapor-pressure data of Woolley, et al. Vapor pressures and critical constants of pure H_2 (equilibrium ortho-para mixtures), HD, and D_2 (equilibrium mixtures) were also determined. Values for the gases, in order, are P_c 12.77, 14.64, 16.28 atmospheres; T_c 33.00, 35.91, 32.28°K; V_c 65.5, 62-8, 60.3 cc./mole.

1008

THE APPROXIMATE RATE OF EXCHANGE BETWEEN IODINE ATOMS AND MOLECULES. R. M. Noyes and J. Zimmerman. J. Chem. Phys. 18, 656-8(1950). C.A. 44, 10522f.

The rate constant for the exchange reaction of I atoms with I_2 molecules in hexane at 25° has been established by an indirect method. The rate constant is approximately 1.3 $\times 10^{-13}$ (atom/ml.)$^{-1}$ sec^{-1} or 8×10^{10} (mole/ml)$^{-1}$ sec.$^{-1}$. The energy of activation for the exchange is probably between 2 and 3 kcal.

1009

THE SEPARATION OF ISOTOPES. Tchang-Fong Hoang. Rev. questions sci. 11, 378-88(1950). C.A. 44, 10525a.

A review.

1010

ON THE SEPARABILITY OF ISOTOPES IN SOLUTION. Proceedings of the German Bunsen-Society for Applied Physical Chemistry; Meeting Oct. 7-10, 1948 in Stuttyart. H. Martin. Angen. Chem. 61, 297-305(1949). NSA 4, 1188.

This paper describes a separation principle which is fundamentally similar to the chemical separation procedure of Urey, but differs from it in the following aspects: (1) The particle flow is produced by an electric field. (2) Particle flow and counterflow take place without partial separation in a homogeneous one-phase system (solution). The method is applicable only if at least one partner in the exchange equilibrium considered is an ion (e.g.: $[OH_2D]^+ + H_2O \rightleftharpoons [OH_3^+ + HOD]$). In the direction of the field a fluid current is maintained, such that there is no net transfer of the mixture component to be separated. The author claims that the electrochemical separation method makes it possible to utilize very small deviations of the equilibrium constants from unity.

1011

THE SEPARATION TUBE WITH HIGH PRESSURE AND A RADIAL ELECTRIC FIELD. E. W. Becker. Angew. Chem. 61, 306(1949). NSA 4, 1189.

The separation tube of Clusius and Dickel was used at pressures up to 26 atm. It was found that the turbulence occurring at such high pressures increased the sharpness of separation by a factor of 20 while decreasing the separation yield by only 20-30%. Furthermore, by introducing a radial electric field it was possible to change the amount of turbulence and thus the separation efficiency.

1012

INVESTIGATION OF VARIOUS METHODS OF SEPARATING LITHIUM ISOTOPES. E. Yatabe and D. F. Stedman. Oct. 26, 1948. 26p. (C-69-48S). NSA 4, 2015.

The purpose of this investigation has been to make a preliminary study of various methods of separating Li^7 and Li^6 in order to suggest a program for further research. After considerable investigation of the published literature on the general principles and methods of isotope separations and of the physical and chemical properties of lithium and its compounds, several methods were considered most suitable for the successful separation of Li^6 and Li^7. These methods are listed as follows: (1) distillation of lithium and its compounds, (2) liquid phase partition coefficients of lithium and its compounds, (3) chromatographic methods, (4) electro-migration methods, (5) combined chromatographic and electro-migration methods. A discussion of each method is included.

1013

A COUNTERCURRENT SOLID-GAS FRACTIONATION PROCESS. Allen Francis Reid. Jan. 7, 1948. Decl. Feb. 10, 1950. 16p. (AECD-2801; CUD-17). NSA 4, 2293.

An apparatus has been constructed for the purpose of separating mixtures of materials in the solid phase by taking advantage of the differences in the rates of sublimation and condensation of the components. The apparatus consists of a horizontally-mounted helical pyrex coil which rotates slowly on its horizontal axis and is alternately cooled and heated. Several runs were made with mixtures of benzene and cyclohexane. Results obtained with separation of carbon isotopes using mesitylene and of oxygen isotopes using water were satisfactory and compatible with preliminary theoretical calculations. The equipment is described in some detail, and an analysis of the process in regard to some of its possible applications is included.

1014

THERMAL DIFFUSION: A BIBLIOGRAPHY. Feb. 10, 1950. 32p. (AERE-Inf/Bib-59). NSA 4, 3480.

This bibliography contains a comprehensive collection of references (322) to the process of thermal diffusion in fluids, its theory, its experimental investigation, and its application to the separation of isotopes.

1015

SEPARATION TUBE METHOD AND CHEMICAL EXCHANGE PROCESS FOR THE SEPARATION OF ISOTOPES. E. W. Becker. Angew. Chem. 62, 121-5(1950) NSA 4, 4319.

Paper presented to the German Bursen Society for Physical Chemistry, forty-eight general meeting held at Wiesbaden, Oct. 13-16, 1949.

1016

THE USE OF DIXON GAUZE RINGS IN ISOTOPE SEPARATION EXPERIMENTS. R. W. McIlary and G. P. Kitt. May 1949. 17p. (AERE-C/R-356). NSA 4, 4641.

Nine determinations have been made of the enrichment of S^{32} in a 12-in. column with gauze ring packing, by means of the exchange reaction between sulfur dioxide gas and aqueous bisulfite ions. It is concluded that the packing is about one tenth as efficient in this use as in distillation, but compares favorably with Fenske rings. The relationship between flow rate and enrichment is discussed and an estimate made of the size of column necessary to proceed further with this investigation.

1017

THE THERMODYNAMIC EFFICIENCY IN ISOTOPE SEPARATION PROCESSES. G. Dickel. Naturwissenschaften 37, 164-5(1950). C.A. 45, 10e.

The efficiency of separation tubes was calculated. Comparison of experimental with calculated data gave a variation from 0.09 to 0.68 for different gas mixtures.

1018

EXCHANGE REACTION BETWEEN BROMIDE AND THE TETRABROMIDES OF CARBON, SILICON, AND TIN. Y. A. Fialkov and Y. P. Nazarenko. Doklady Akad. Nauk. S.S.S.R. 73, 727-30(1950). C.A. 45, 27d.

On heating, in a sealed tube, with Br_2 containing some radioactive Br isotope, liquid CBr_4 exchanges Br to the extent of 10% at 100° in 3 hours; no significant exchange occurs at room temperature. No exchange whatever was found in 4 hours with $SiBr_4$ either at 20 or at 100°. With $SnBr_4$, the isotope exchange was complete in 1 hr. even at 20°. The contrast between CBr_4 and $SiBr_4$ is even more striking in exchange experiments with $AlBr_3$ containing some radioactive Br.

1019

ISOTOPE EXCHANGE OF HYDROGEN BOUND TO SILICON. A. I. Brodskiĭ and I. G. Khaskin. Doklady Akad. Nauk S.S.S.R. 74, 299-301 (1950). C.A. 45, 423i.

$HSiEt_3$, $HSiPh_3$, and $HSi(OEt)_3$, heated with D_2O or with EtOD for up to 335 hrs. to over 100° showed either no, or only a semblance of, H-D exchange, attributed to mechanical occlusion of D_2O rather than to actual exchange. This negative result, observed also in the presence of H_2SO_4, KOH, AcONa, and $KHSO_4$, parallels Stewart and Harman's analogous negative observation on the corresponding C compounds. Because of the $Si^+ - H^-$ polarization of the Si-H bond, exchange could take place only by a nucleophilic mechanism which is improbable on account of the low stability of the H^- ion.

1020

SLOW EXCHANGE OF HYDROGEN IN AMMONIUM SALT SOLUTIONS. A. I. Brodskiĭ and L. V. Sulima. Doklady Akad. Nauk S.S.S.R. 74, 513-15(1950). C.A. 45, 424a.

Hydrogen-deuterium exchange between NH_4^+ and D_2O is very slow, for the same reason for which it is extremely difficult or absent in C—H or Si—H bonds, namely because of the unavailability of a free electron pair; on the other hand NH_3 with its available electron pair, exchanges H for D practically instantaneously. Whatever exchange does take place with the NH_4^+ ion is due to the hydrolysis $NH_4^+ + H_2O \rightarrow NH_3 + H_3O^+$, producing some amount of the rapidly exchanging free NH_3. This point of view was confirmed by exchange experiments between NH_4NO_3, $(NH_4)_2SO_4$, or NH_4Cl, with D_2O in aqueous solution, in the absence or in the presence of an excess of the corresponding free acid which, by decreasing the hydrolysis, decreases the degree of exchange attained within a given length of time.

1021

ISOTOPIC SEPARATION DUE TO SETTLING IN THE ATMOSPHERE. J. H. McQueen. Phys. Rev. 80, 100-1(1950). C.A. 45, 473g.

Air samples taken 40-60 km above the earth were analyzed for N^{14} and N^{15}. Compared with low-altitude air

isotopic separation of 0.3% to 3.9 ± 0.4% were found. The isotopic separation found is less than the calculated value owing to stirring in the atmosphere, particularly up to 40 km.

1022

TRANSPORT PROPERTIES OF DENSE MEDIA. I. THERMAL DIFFUSION IN ISOTOPIC MIXTURES OF GASES. W. L. Robb and H. G. Drickamer. J. Chem. Phys. 18, 1380-2(1950). C.A. 45, 918d.

Based on Meixner's thermodynamics for irreversible processes (Z. physik. Chem. 53B, 235(1943)) and the work of Haase (Z. Physik 127, 1(1949)) an equation for the thermal diffusion ratio α, which can be evaluated from the equation of state, is presented. Using van der Waals' equations, α's are calculated in the critical region and compared with data for ethane-xenon. The equation reproduces all the essential features of the experimental results. Calculations made for a mixture of isotopes indicate that the effect of pressure on α cannot be attributed to selective clustering.

1023

OXYGEN AND NITROGEN ISOTOPE EFFECTS IN THE DECOMPOSITION OF AMMONIUM NITRATE. L. Friedman and Jacob Bigeleisen. J. Chem. Phys. 18, 1325-31(1950). C.A. 45, 1411e.

The isotopic composition of the products of the controlled thermal decomposition of NH_4NO_3 was studied. Small amounts of water are necessary to initiate the decomposition $N^{15}H_4NO_3$ yields exclusively $N^{15}N^{14}O$. O and N isotope effects accompanying the decomposition was studied with material of "natural" isotopic composition. Satisfactory agreement is found between the experimental results and theoretical calculations. A method for the isotopic analysis of nitrates for O^{18} is outlined.

1024

EXCHANGE STUDIES WITH COMPLEX IONS. I. THE EXCHANGE OF RADIOCYANIDE WITH CERTAIN HEAVY-METAL COMPLEX CYANIDES. A. W. Adamson, J. P. Welker, and M. Volpe. J. Am. Chem. Soc. 72, 4030-6(1950). C.A. 45, 1452d.

The exchange of radio-cyanide with the following complexes was studied at pH about 10: $K_2Ni(CN)_4$, $K_2Pd(CN)_4$, $K_2Hg(CN)_4$, $K_3Mn(CN)_6$, $K_3Cr(CN)_6$, $K_3FeK(CN)_6$, $K_3Co(CN)_6$, $K_4Mo(CN)_8$. Exchange was observed to be immeasurably rapid with the di-and tetracyanides, fast but measurable in the case of $K_3Mn(CN)_6$, and negligible for the other complexes. The exchange of $K_4Mo(CN)_8$ and possibly of $K_3Cr(CN)_6$ was induced at pH 2—4. This pattern of exchange data supports the viewpoint that over-all thermodynamic instability constants are misleading in predicting exchange. The postulate of decreasing exchange rate with increasing coordination number is in qualitative agreement with the results.

1025

CONCENTRATION OF THE HEAVY NITROGEN ISOTOPE. I. Asao Sugimoto, R. Nakane, R. Shibata, T. Watanabe, S. Motonaga, and S. Isomura. Repts. Sci. Research Inst. (Japan) 26, 1-6(1950). C.A. 45, 1827d.

By operating Urey's apparatus (the primary condenser not used) continuously for 630 hrs. and using Al wire rings for stuffing, N^{15} was concentrated, according to $N^{15}H_3(g) + N^{14}H_4 + (l) \rightleftharpoons N^{14}H_3\ (g) + N^{15}H_4^+\ (l)$, to 3.1-5.8% in $(NH_4)_2SO_4$ from the 2nd condenser and to 1.6-5% in NH_4NO_3 from the 3rd condenser.

1026

MEASUREMENTS OF EXCHANGE CURRENTS ON AMALGAM ELECTRODES WITH THE AID OF RADIOACTIVE INDICATORS. N. B. Miller and V.A. Pleskov. Doklady Akad. Nauk S.S.S.R. 74, 323-5 (1950). C.A. 45, 1848b.

The kinetics of the exchange of ions between an amalgam electrode and aqueous solution were investigated by tagging the metal dissolved in the Hg with its radioactive isotopes and following the increase of the radioactivity of the solution. Results are given with Bi amalgam vs. $BiCl_3$ solution, Zn amalgam vs. $ZnSO_4$ and $ZnCl_2$ solution, and Pb amalgam vs. $Pb(NO_3)_2$ solution. Exchange rates were high but measurable. The highest exchange rate found was of the order of 0.1 amp/sq. cm. Stirring rates of 150-350 r.p.m. gave results independent of rate of stirring.

1027

ELECTRON EXCHANGE BETWEEN MANGANATE AND PERMANGANATE IONS BY SOLVENT EXTRACTION. Howard C. Hornig, Geo. L. Zimmerman, and W. F. Libby. J. Am. Chem. Soc. 72, 3809-9. C.A. 45, 1850g.

The manganate-permanganate exchange in 3.5 and 4 M KOH at temperatures between -14° and 0° is too rapid to measure.

1028

THE KINETICS OF ISOTOPE EXCHANGE REACTIONS. L. Waldmann. Z. Naturforsch. 5a, 399-400(1950). C.A. 45, 1851a.

The problem of statistical distribution of isotopes in a compound containing an element present in 2 isotopic forms is discussed for the case of a thermal diffusion tower.

1029

OXYGEN EXCHANGE BETWEEN NITRATES AND WATER. R. Klein and R. A. Friedel. J. Am. Chem. Soc. 72, 3810-11(1950). C.A. 45, 1851b.

HNO_3 in 40% solution undergoes O exchange with H_2O with a half-life of about 30 min at 30°. No exchange occurs between H_2O and cellulose nitrate in 1N H_2SO_4 either at 23 or 100°. Since no exchange between NO_3^- and H_2O occurs in neutral or alkaline solution O exchange may involve interaction of NO_3^- and H_3O^+.

1030

OXYGEN EXCHANGE BETWEEN OXIDE CATALYSTS AND WATER VAPOR. S. M. Karpacheva and A. M. Rozen. Doklady Akad. Nauk. S.S.S.R. 75, 55-8(1950). C.A. 45, 1855b.

Rates of exchange of O^{18} between metal oxides MO and H_2O vapor were determined both in the forward direction, $MO^{16} + H_2O^{18} \rightarrow MO^{18} + H_2O^{16}$, and in the reverse direction by measurements of the O^{18} content in the initial and the reacted H_2O. On a Cr_2O_3 10% + Al_2O_3 90% contact, on active Al_2O_3, on MnO_2, and on granulated CuO, the exchange is characterized by a sharp slowing down with progressing saturation, resulting in a quasi-equilibrium and practical cessation of further exchange at a considerable distance from the true equilibrium distribution of O^{18} between the oxide and the vapor.

1031

METHOD AND APPARATUS FOR SEPARATING ISOTOPES. G. Simmons, Jr. U. S. Patent 2,533,966, Dec. 12, 1950. C.A. 45, 1878d.

The method used and the apparatus necessary for the separation of isotopes employs the action of magnetic and electrostatic fields on ionized particles of the isotopic element to produce motion of the charged particles in predetermined direction. The apparatus effects the separation of isotopes in a continuous manner and large enough quantities to be considered commercially.

1032

HYDROGEN, HEAVY WATER, AND METALS. L. Tronstad and J. Brun. Norwegian Patent 77,176 July 24, 1950. C.A. 45, 1889c.

Water is electrolyzed in stages to give H which contains D and heavy water which is concentrated in the electrolyte; a metal oxide is then reduced with the H-D mixture so obtained, whereby is formed the metal together with water which also contains heavy water; the latter is returned to the electrolytic cell in order to increase still further the concentration of the heavy water.

1033

HYDROGEN AND HEAVY WATER. Jomar Brun. Norwegian Patent 77,177 July 24, 1950. C.A. 45, 1890b.

A modification of the main patent is described in which the reduced metal is treated with steam at a high temperature to reconvert it to the oxide for reuse in the process. The metal used is preferably Fe, and the process is continuous.

1034

ISOTOPIC COMPOSITION OF THE OXYGEN OF CARBONATES AND ITS TEMPERATURE DEPENDENCE. R. V. Teĭs. Doklady Akad. Nauk. S.S.S.R. 72, 73-6(1950). C.A. 45, 2275d.

H_2CO_3 liberated by HCl from a mineral (calcite, dolomite, limestone) was changed to water over a Ni catalyst with H_2. The density of the water was determined by the method of determination of flotation temperature of a quartz float in relation to standard water. Difference in density between test water and standard depended only on O_2. Data are given of isotopic composition of O_2 of carbonates with temperatures of formation not over 25°, 180-300°, and over 300°.

1035

CATALYTIC ISOTOPIC EXCHANGE REACTION OF HYDROGEN BETWEEN DIFFERENT OLEFINIC HYDROCARBONS. I. M. Koizumi. J. Inst. Polytech. Osaka Univ. 1, 19-28(1950) C.A. 45, 2297e.

The exchange between heavy ethylene and light propylene and butylenes was studied.

1036

ELECTRON TRANSFER BETWEEN FERROUS AND FERRIC IONS IN PERCHLORIC ACID. R. H. Betts, H.S.A. Gilmour, and Rita K. Leigh. J. Am. Chem. Soc. 72, 4978-80(1950) C.A. 45, 2317a.

The electron transfer between Fe^{2+} and Fe^{3+} ions in 0.44 -3.0M $HClO_4$ was complete within 1 hour.

1037

CONCENTRATION OF A^{36} AND A^{38} AND STUDY OF THE $A^{36}(d,p)A^{37}$ REACTIONS AND THE BETA ACTIVITY OF A^{39}. A. Zucker and W. W. Watson. Phys. Rev. 80, 966-9(1950). C.A. 45, 2326g.

The concentration of A^{36} up to 95.9% by the thermal diffusion method is described.

1038

DISTRIBUTION OF OXYGEN ISOTOPES IN THE LITHOSPHERE. P. Baertschi. Helv. Phys. Acta 23, 536-7(1950). C.A. 45, 2332a.

The isotopic O content of the O insilicates was determined as previously. The materials studied included granite, basalt, lava, sandstone. Comparison of their O^{18} content with that of Hawaiian sea water showed that the latter contains about 0.7% less O^{18}. This effect is thought to come from exchange equilibrium between the total O content of sedimentary silicates and the O of the hydrosphere. Silicates of meteoric origin show the terrestrial abundance of O^{18} with 0.1-0.7% more than lava.

1039

THERMODYNAMIC PROPERTIES OF ISOTOPIC COMPOUNDS OF SULFUR. A. P. Tudge and H. G. Thode. Can. J. Research 28B, 567-78(1950). C.A. 45, 2335d.

The method of statistical mechanics is used to calculate partition-function ratios for a number of inorganic S compounds. These results are used to evaluate the equilibrium constants for a number of exchange reactions involving S. Considerable fractionation of S isotopes may occur in laboratory and natural processes. Experimental results on the distribution ratio of S^{32}/S^{34} in nature are summarized. Sulfates as a group are enriched, whereas H_2S is depleted in S^{34}. This agrees with the thermodynamic calculations. The S cycle in nature is discussed in relation to the isotopic exchange reactions.

1040

THE EXCHANGE REACTION BETWEEN FERROUS AND FERRIC IONS IN PERCHLORIC ACID SOLUTIONS. R. W. Dodson. J. Am. Chem. Soc. 72, 3315-16 (1950). C.A. 45, 2353h.

The electron-transfer exchange reaction between ferrous and ferric ions was studied by use of Fe^{55} tracer. A quantitative chemical separation was devised that led to only a small induced exchange. Catalysis by traces of chloride is not important in determining rate. The change of half time with iron concentration shows that the reaction is second order, presumably first order in ferric and in ferrous iron, in which case the rate constant in 0.4 formal $HClO_4$ is 16 $mole^{-1}/l/sec^{-1}$ at 23°.

1041

THE EXCHANGE OF ISOTOPIC IONS IN CATION EXCHANGERS. Lennart W. Holm and Torbjörn Westermark. Acta Chem. Scand. 4, 968-9(1950). C.A. 45, 2741i.

A rapid exchange of Ag ions was found between ions on a resin and their isotopic ions in the surrounding solution in both batch and column experiments.

1042

PROTON EXCHANGE BETWEEN AMMONIA AND AMMONIUM ION IN LIQUID AMMONIA. C. J. Nyman, S. Fung, and H. W. Dodgen. J. Am. Chem. Soc. 72, 1033-4(1950). C.A. 45, 2753c.

NH_4NO_3 containing 14% N^{15} was converted into NH_4Cl by allowing NH_3 to distil from a NaOH solution of the salt into HCl. NH_4Cl (0.2g.) was dissolved in 10 cc. NH_3 during 6 min. and the NH_3 evaporated as rapidly as possible (about 7 min.). The percentage N^{15} decreased from 13.77 to 0.52. The results indicate complete exchange.

1043

ISOTOPIC EXCHANGE REACTION OF CHLOROFORM-d WITH BROMOFORM. G. P. Semeluk and R. B. Bernstein. J. Am. Chem. Soc. 72, 4830-1(1950). C.A. 45, 2756g.

The deuterium exchange reaction $CCl_3D + CBr_3H = CCl_3H + CBr_3D$ was studied in the liquid phase at 30 and 105°. The effects of $BuNH_2$ and piperidine on the rate of exchange were determined.

1044

HYDROGEN-DEUTERIUM EXCHANGE ACTIVITY OF SILICA-ALUMINA CATALYSTS. V.C.F. Holm and R. W. Blue. Ind. Eng. Chem. 43, 501-5(1951). C.A. 45, 2759e.

Catalysts in the range O to 7.5% SiO_2 were most active. The H-D exchange and H transfer involve different mechanisms and require different characteristics in a catalyst. Catalysts pretreated at 800° instead of 400° were 1000 times more active in the H-D exchange.

1045

CONCENTRATION AND APPLICATION OF N^{15}. Asao Sugimoto. Science (Japan) 19, 245-52(1949). C.A. 45, 2792i.

A review with 25 references is presented.

1046

EXCHANGE OF SULFUR BETWEEN COLLOIDAL SULFUR

AND SULFATE AND THIOSULFATE IONS. Roland Muxart, B. Boscardin, P. Daudel, and P. Wenger. J. chim. phys. 47, 606-9(1950). C.A. 45, 2792i.

The reaction was studied with 87.1-day S^{35} in the presence of either sulfate or thiosulfate ions at room temperature and at values of pH between 3.4 and 14. No exchange was observed in 18 hrs. The results were verified with radioactive ions and stable colloidal sulfur.

1047

EXCHANGE OF THE CENTRAL ATOM OF ARSENIC AND ANTIMONY TRIHALIDES. R. Muxart and R. Daudel. J. chim. phys. 47, 610-13 (1950). C.A. 45, 2793d.

Complete exchange was found in 10 minutes between RCl_3 and R^*Br_3, where R* was 26.8 hour As^{76} or 2.8 day Sb^{122}.

1048

THE EXCHANGE REACTION BETWEEN ALUMINUM CHLORIDE AND CARBON TETRACHLORIDE. C. H. Wallace and J. E. Willard. J. Am. Chem. Soc. 72, 5275-81(1950). C.A. 45, 2805f.

The Cl in solid $AlCl_3$ exchanges readily with that in liquid CCl_4. The exchange with CCl_4 and also with CCl_3 occurs rapidly even at the melting point of the compounds if the $AlCl_3$ has not been exposed to moisture. Partial hydroxylation of the $AlCl_3$ by exposure to moisture completely inhibits the exchange at low temperatures and decreases the rate at higher temperatures. Except at elevated temperatures exchange is incomplete; hence recrystallization of the $AlCl_3$ particles is very slow. Whereas complete exchange occurs at 100° in 2 hrs. at ratios of $AlCl_3$ to CCl_4 greater than 10^{-3} m/l, relatively little or no exchange occurs at lower ratios. This observation suggests that exchange can occur only when an $AlCl_3$ surface is present. Mixtures of gaseous $AlCl_3$ and CCl_4 can be maintained at 140° for 9 hours with no exchange.

1049

SEPARATION OF GAS MIXTURES BY MASS DIFFUSION. I. M. Benedict and A. Boas. Chem. Eng. Progress 47, 51-62(1951). C.A. 45, 3202g.

Separation of the components of a gas mixture by mass diffusion is effected by taking advantage of different rates of diffusion of its components into steam or another separating agent. Two types of apparatus which can be used in this separation method are discussed, a mass diffusion stage or a mass diffusion column. Specific examples are given of the design of a cascade of columns and a cascade of stages to produce 100g/day of C^{13}, 90% pure, by mass diffusion of CH_4 into steam. The column type of process is shown to be more efficient.

1050

SWEEP DIFFUSION GAS SEPARATION PROCESS. PART I. M. T. Cichelli, W. D. Weatherford, Jr., and J. R. Bowman. Chem. Eng. Progress 47, 63-74(1951). C.A. 45, 3203d.

A gas separation process is described which has been given the name "sweep diffusion." In the sweep-diffusion process a readily condensable vapor is made to diffuse through a mixture of gases toward a condensing surface. This flowing vapor carries or "sweeps" toward the condensing surface those components of the gas which have lower rates of diffusion through the vapor. The bare essentials of a continuous, single-stage sweep-diffusion unit are shown.

1051

THERMAL DIFFUSION OF GASES AT LOW TEMPERATURES. A van Itterbeek and A. de Troyer. Physica 16, 329-32(1950). C.A. 45, 3213i.

Data for separation of non-isotopic mixtures are given.

1052

ISOTOPE EXCHANGE BETWEEN PROPYL BROMIDE IN ALCOHOLIC SOLUTION. V. B. Miller, M. B. Neiman, and Y. M. Shapovalov. Doklady Acad. Nauk S.S.S.R. 75, 419-22(1950). C.A. 45, 3227c.

The exchange reaction between initially inactive PrBr and tagged NaBr*, where Br* = almost pure radioactive Br^{82} The ratio of the activities of PrBr and NaBr, tends to the limit 0.5, i.e. equal distribution at equilibrium. The activation energy E = 18.0 kcal/mole. The experimental E is in agreement with the activated-complex theory, and a mechanism is proposed.

1053

EXCHANGE BETWEEN SOME OXIDES AND LIQUID WATER, ALCOHOL, AND GASEOUS OXYGEN. S. M. Karpacheva and A. M. Rozen. Doklady Akad. Nauk S.S.S.R. 75, 239-43(1950). C.A. 45, 3228h.

Using O^{18} effective forward and back exchange between liquid H_2O and metal oxides MO, at room temperature, were observed with a $Cr_2O_3 \cdot Al_2O_3$ catalyst, active Al_2O_3, active ZnO and SiO_2 gel; the rates of exchange are lower than with H_2O vapor at higher temperatures. Similar exchange was also observed between the tagged oxides and liquid EtOH or AcOH; this is taken to indicate solvate formation with these oxides even at room temperature. Back exchange between a tagged oxide and gaseous O_2 was observed, with MnO_2 at as low as 70-80°, $CaCO_3$ at 350°; V_2O_5 at 450°, with natural dunite at 800°, and with CuO at 800°.

1054

SEPARATION TUBE IX. PREPARATION OF PURE HEAVY NITROGEN^{15}. Klaus Clusius. Helv. Chim. Acta 33, 2134-51 (1950). C.A. 45, 3256f.

Pure N^{15} cannot be prepared in the usual thermal diffusion column because of the resulting equilibrium among N_2^{14}, N_2^{15}, and $N^{14}N^{15}$. This difficulty was overcome by inserting an electric discharge in the gas stream, and thus dissociating the molecules into atomic N. The theory of this effect as applied to the diffusion column is described. The separation obtained does not agree with the theory developed by minimizing the entropy of the gas mixture. With a column of 3.8 meter length, the product contained 99.8% N^{15}.

1055

ISOTOPIC EXCHANGE OF PHOSPHORUS IN THE SYSTEMS H_3PO_2-H_3PO_3 AND KH_2PO_2-KH_2PO_3 AND THE TAUTOMERISM OF HYPOPHOSPHOROUS ACID. A. I. Brodskii, D. N. Strazhesko and L. L. Chervyatsova. Doklady Akad. Nauk S.S.S.R. 75, 823-5 (1950). C.A. 45, 3280f.

No exchange takes place in either of these systems in aqueous solution in several hours at room temperature or 70°. Exchange is also absent in the presence of I or I^- ion.

1056

SEPARATION OF GAS MIXTURES BY MASS DIFFUSION. II. M. Benedict and A. Boas. Chem. Eng. Progress 47, 111-22(1951). C.A. 45, 3659b.

The separation of isotopic mixtures by a cascade of mass-diffusion stages and the extraction of H_2 from gas mixtures by each type of mass diffusion are discussed.

1057

SWEEP DIFFUSION GAS SEPARATION PROCESS. PART II. M. T. Cichelli, W. D. Weatherford, Jr. and J. R. Bowman. Chem. Eng. Progress 47, 123-33(1951). C.A. 45, 3659c.

The sweep diffusion apparatus described previously (C.A. 45, 3203d) was used to concentrate C^{13} using CH_4 with heptane as the sweep gas.

1058

EXCHANGE REACTION BETWEEN HYDROGEN AND LITHIUM HYDRIDE, PREPARATION OF LITHIUM HYDRIDE-t AND LITHIUM ALUMINUM HYDRIDE-t,. K. E. Wilzbach and L. Kaplan. J. Chem. Soc. 72, 5795-6 (1950). C.A. 45, 3694g.

The exchange reaction of H_2 gas with solid LiT was studied between 25° and 200°. The rate was controlled by a diffusion process within the solid. The equilibrium constant at 200° is 3.7. $LiAlT_4$ has been used to prepare. T-labelled compounds; e.g. ethanol-1-t was obtained in 80% yield by reduction of EtOAc.

1059

EXCHANGE OF URANIUM IONS IN SOLUTION. E. Rona. J. Am. Chem. Soc. 72, 4339-43(1950). C.A. 45, 3694i.

Exchange reactions between U(IV) and U(VI) in HCl solutions were studied. The reaction is of the 1st order with respect to the U(VI), 2nd order with respect to the U(IV), and minus 3rd order with respect to the H^+ concentration. The rates of exchange did not change with added inert salt, with Cl^- concentration or with illumination.

1060

THE EFFECT OF ISOTOPIC SUBSTITUTION ON MASS SPECTRA OF MOLECULES. O. A. Schaeffer. J. Chem. Phys. 18, 1501-5(1950). (AECU-974). C.A. 45, 3707a.

A general method for calculating the effect of isotopic substitution on mass spectra is presented. The method is applied to the diatomic molecules $N^{14}N^{14}$, $N^{14}N^{15}$, $N^{15}N^{15}$, and $C^{12}O^{16}$, $C^{13}O^{16}$. The predicted values compare favorably with previously observed results; however, experimental errors obscure a sharp test of the predictions for these cases. New experimental values are presented for the ratios $C^{13+}/C^{13}O_2^{16+}$ and $C^{12+}/C^{12}O_2^{16+}$ from carbon dioxide and are compared with predictions. Good agreement is found between ratios extrapolated to high ion accelerating voltage and the predicted ones.

1061

AN ELECTROMAGNETIC ISOTOPE SEPARATOR. I. Bergström, S. Thulin, N. Svartholm and K. Siegbahn. Arkiv Fysik 1, 281-92(1949). C.A. 45, 3738h.

An isotope separator designed to separate experimental quantities of the isotopes of all elements in a reasonable time is described. The apparatus utilizes a magnetic type ion source and is provided with a vacuum lock to permit rapid sample changes to be made.

1062

ISOTOPE EFFECTS IN THE DECARBOXYLATION OF DIBASIC ACIDS. A. A. Bothner-By, L. Friedman, and Jacob Bigeleisen. Brookhaven Conf. Rept., (BNL-C-8) Chem. Conf. No. 4, 39-48(1950). C.A. 45, 3807a.

Mass-spectrographic analyses of the ratio C^{13}/C^{12} in the C released from malonic acid and Ba adipate on decarboxylation are used to indicate the mechanisms of the reactions. Isotopic fractionation in the decarboxylation of $CH_2(CO_2H)_2$ indicates that rupture of a C–C bond is the rate-determining step. In the pyrolysis of Ba adipate, no significant isotope effect is obtained on substitution of C^{13} for C^{12} in the CO_2H group.

1063

APPARATUS FOR CONCENTRATION OF HELIUM^3 BY THERMAL DIFFUSION. O. F. Schuette, Jr., A. Zucker, and W. W. Watson. Rev. Sci. Instruments 21, 1016-18 (1950). C.A. 45, 4099d.

Constructional details of a multistage thermal diffusion column are given. Operational details and performance for He^3 concentration are discussed.

1064

SPECTROPHOTOMETRIC AND RADIOCHEMICAL INVESTIGATION OF THE INTERACTION BETWEEN DIFFERENT OXIDATION STATES OF AN ELEMENT. J. Whitney, C. I. Browne, H. McConnell, and N. Davidson. Brookhaven Conf. Rept., (BNL-C-8). Isotopic Exchange Reactions and Chem. Kinetics, Chem. Conf. No. 2, 196-204 (1948). C.A. 45, 4140a.

The relation between the interaction absorption in systems containing an element in 2 different oxidation states and the exchange of radioactive atoms between the 2 states was studied. Sn^{2+} and Sn^{4+} both 0.1f in 9N HCl has a half time of 7 minutes at room temperature. Some discussion on the Sb^{3+} - Sb^{5+}, Tl^+ - Tl^{3+}, and Fe^{2+} - Fe^{3+} exchanges are included.

1065

CARBON^{14} ISOTOPE EFFECT IN AN INORGANIC EQUILIBRIUM. D. R. Stranks and G. M. Harris. J. Chem. Phys. 19, 257-8(1951). C.A. 45, 4166b.

The isotopic exchange reaction between $[Co(NH_3)_4CO_3]^+$ and CO_3^{2-} was studied with tracer amounts of C^{14}. After isotope equilibration at pH 9-10, CO_3^{2-} was precipitated as $BaCO_3$ and counted. The complex ion was decomposed with H_2SO_4. The CO_2 was absorbed, precipitated as $BaCO_3$, and counted. The equilibrium constant for the reaction C^{12} (complex) + $C^{14}O_3^{2-} \rightleftharpoons C^{14}$ (complex) + $C^{12}O_3^{2-}$ was approximately 0.89.

1066

METAL EXCHANGE REACTIONS OF SOME CHROMIUM, ZINC, AND VANADIUM COMPLEXES. C. S. Garner, Brookhaven Conf. Report BNL-C-8, Isotopic Exchange Reactions and Chem. Kinetics, Chem. Conf. No. 2, 94-105 (1948). C.A. 45, 4166c.

No exchange was observed between Cr^{3+} and $Cr_2O_7^{2-}$ in H_2SO_4 solution. $*Cr(H_2O)_6^{3+}$ and $Cr_2O_7^{2-}$ in 0.5 formal $HClO_4$ exchanged with a half time of 430 days at 25°. $Cr(H_2O)_6^{3+}$ and $Cr(CN)_6^{3-}$ exchanged 71% in 72 hours at room temperature. Cr^{3+} and $Cr(CN)_6^{3-}$ exchanged 12% in 96 hours in HOAc solution. $CrCl_3$ and $Cr(OAc)_3$ in HCl-HOAc solution exchanged 3-8% in 15 minutes. Dipyridine Zn acetate exchanged completely at 25° with numerous other Zn complexes. $VO(ClO_4)_2$ and $V(OH)_4ClO_4$ exchanged rapidly in $HClO_4$ and HCl solution.

1067

EXCHANGE BETWEEN Co^{2+}, Co^{3+} AND THEIR HEXAMMINO-COMPLEXES. K. J. McCallum. Brookhaven Conf. Rept. (BNL-C-8) Isotopic Exchange Reactions and Chem. Kinetics, Chem. Conf. No. 2, 120-30(1948). C.A. 45, 4166f.

No exchange occurred between Co^{2+} and $Co(NH_3)_6^{3+}$ both 0.1M at 25° in 1 day; around 1% in 6 days. Exchange between Co^{2+} and Co^{3+} sulfates was complete in ½ to 1 minute. Exchange between $Co(NH_3)_6^{2+}$ and $Co(NH_3)_6^{3+}$ chlorides in 3.6M to 9.5M NH_4OH was about 6% complete in 17 days at 25°.

1068

COMPLEX IONS OF ETHYLENEDIAMINE-TETRAACETIC ACID (H_4Y). F. A. Long, S. S. Jones and M. Burke. Brookhaven Conf. Report BNL-C-8, Isotopic Exchange Reactions and Chemical Kinetics, Chem. Conf. No. 2, 106-19 (1948). C.A. 45, 4166h.

$*Co^{2+}$ and CoY^{2-} exchanged rapidly at pH 2.44, while $*Co^{2+}$ and CoY^- did not. $*Ni^{2+}$ and NiY^{2-} did not exchange at pH 5.5 in 24

hours but exchanged slowly at pH 2.9 ($t_{\frac{1}{2}}$ = 1450 minutes). Ni^{2+} and $*NiY^{2-}$ exchanged more rapidly in acid solution. Fe^{2+} and $*FeY^{2-}$ at pH 2.5 exchanged at once. $*Fe^{2+}$ and FeY^{2-} exchanged at once at pH 1.50. Fe^{3+} and FeY^{-} at pH 1.5 showed immediate partial exchange and subsequent slow exchange.

1069

THE THEORY OF THE SEPARATION OF ISOTOPES BY THERMAL DIFFUSION. Sudhansu Datta Majumdar. Phys. Rev. 81, 844-8(1951). C.A. 45, 4500f.

The time-dependent partial differential equation of the "separation column" of Clusius and Dickel has been solved exactly. Only an approximate solution, subject to the restriction that the fractional concentration is everywhere small compared to unity, was known previously. The present work makes a comparison between theory and experiment possible over the full range of concentration values.

1070

ISOTOPE ENRICHMENT THROUGH EXCHANGE REACTIONS. Klaus Clusius. Chimia Switzerland 4, 275-84(1950). C.A. 45, 4500g.

The theory and practice of isotope enrichment are reviewed, with specific examples, in some detail.

1071

THE VAPOR PRESSURES OF HYDROGEN, DEUTERIUM, AND TRITIUM UP TO THREE ATMOSPHERES. E. R. Grilly. J. Am. Chem. Soc. 73, 843-6(1951). C.A. 45, 4505g.

The vapor pressures of H_2, D_2 and T_2 were measured up to 3 atmospheres. Equations are derived to fit the data and triple points, triple point pressures, normal boiling points, ΔH^s at the triple points, and ΔH_v at the normal boiling points given.

1072

STUDY OF THE MECHANISM OF SEVERAL CHEMICAL REACTIONS WITH THE HELP OF RADIOACTIVE SULFUR. Roland Muxart. Compt. rend. 231, 1489-91 (1950). C.A. 45, 4534f.

The reaction: $SO_3HCl + SCl_2 \rightarrow SOCl_2 + SO_2 + HCl$ is studied as a function of temperature. No exchange of S is found between SO_2 and $SOCl_2$ or between SO_2 and SCl_2. An exchange of S is found in the system $SOCl_2$-SCl_2 held at 89° for 2 hr.

1073

KINETICS OF THE MAGANOUS-PERMANGANATE REACTION. Arthur W. Adamson. J. Phys. & Colloid Chem. 55, 293-303 (1951). C.A. 45, 4535i.

The mechanism of the manganous-permanganate ion reaction was investigated by means of the exchange reaction between radiomanganous and permanganate ions in 3M perchloric acid solution. Manganous and manganic ions exchange at a high but measurable rate in acid solution whereas the exchange between manganate and permanganate in alkaline solution is instantaneous. A mechanism and rate law is proposed.

1074

THE KINETICS OF THE EXCHANGE OF SULFUR BETWEEN THIOSULFATE AND SULFITE. D. P. Ames and J. E. Willard. J. Am. Chem. Soc. 73, 164-72(1951). C.A. 45, 4536b.

The transfer of the outer S atom of $S_2O_3^{2-}$ ion to SO_3^{2-} ion occurs at 60-100° at a rate that is proportional to the first power of the SO_3^{2-} concentration and also of the $S_2O_3^{2-}$ concentration. The rate and activation energy appear to be essentially independent of pH in the range from pH 5 to 14. A reproducible routine method of determining the relative specific activity of S^{35} in $BaSO_4$ is described.

1075

AMPLIFICATION OF THE ENRICHMENT OF GASEOUS ISOTOPES IN ULTRACENTRIFUGES. V. Faltings, W. Groth, and P. Harteck. Naturwissenschaften 37, 490-1 (1950). C.A. 45, 4576d.

Addition of light gases (H, He), can stop separation of isotopes in a gas centrifuge; in other cases it can amplify the convection effect. Experiments with an axial heating wire were negative, but heating the bottom of the rotor gave better separation.

1076

EXCHANGE REACTIONS OF TETRACYANONICKELATE ION. THE STRUCTURE OF NICKEL CYANIDE. F. A. Long. J. A. Chem. Soc. 73, 537-40(1951). C.A. 45, 4595f.

The exchange of CN^- between $Ni(CN)_4^{2-}$ ion and CN^- ion was studied by a solvent extraction procedure for removing the CN^- as HCN. The exchange is rapid. The exchange of Ni^{+2} between $Ni(CN)_4^{2-}$ and hydrated Ni^{+2} is slow compared to the rate of the precipitation of $Ni(CN)_2$, which occurs when these ions are mixed. The results lead to the conclusion that solid $Ni(CN)_2$ contains two nonequivalent kinds of Ni, and there is strong evidence that the solid $Ni(CN)_2$ is really $Ni[Ni(CN)_4]$. The exchange of $Ni(CN)_4^{2-}$ was studied with 4 complex ions of lower stability.

1077

REACTIONS IN LIQUID SULFUR DIOXIDE. I. EXCHANGE OF OXYGEN BETWEEN LIQUID SULFUR DIOXIDE AND THIONYL CHLORIDE. E. C. M. Grigg and I. Lauder. Trans. Faraday Soc. 46, 1039-41(1950). C.A. 45, 5005a.

No exchange of O was found between liquid SO_2 and $SOCl_2$; the heavy O isotope O^{18} was used as a tracer element. This result indicates that some aspects of Jander's theory of reactions in liquid SO_2 are incorrect.

1078

EXCHANGE REACTIONS BETWEEN MANGANESE COMPOUNDS OF DIFFERENT VALENCE. P. Jordan. Helv. Chim. Acta 34, 699-714(1951). C.A. 45, 5006a.

Exchange reactions of systems containing oxides of either solely Mn^{IV}, or solely Mn^{II}, or a mixture of both, were studied. The following conclusions were drawn: (1) The exchange of Mn^{II} between a solution of $Mn(OH)_2$ and solid MnO is rapid and goes to completion if the aggregate of the solid permits. (2) No exchange takes place between MnO and Mn^{II}. (3) In systems containing MnO and MnO_2 the exchange of Mn^{II} proceeds quickly and often completely, whereas the exchange of Mn^{IV} is slow and incomplete. (4) A rapid exchange takes place between a manganous salt and a manganite of Ca or Zn. (5) In manganomanganites, Mn^{II} may be replaced by various cations. (6) When permanganates are subjected to the Szilard effect, Mn^{VII} passes first into Mn^{II} and eventually into Mn^{IV}.

1079

THE CALCULATION OF THE CHANGE IN VIBRATIONAL FREQUENCY DUE TO CHANGES IN MASS, GEOMETRY, AND POTENTIAL CONSTANTS OF A MOLECULE. H. J. Bernstein. Can. J. Chem. 29, 284-95(1951). C.A. 45, 5021i.

The change in vibrational frequency is expressed in terms of changes in the kinetic and potential energies of a molecule. The differences in frequencies of corresponding modes of vibration in the cis and trans configurations of a molecule are discussed. The frequencies observed for a particular symmetry type are related to those calculated from force constants derived from some other types. Examples and applications of the equations are given.

1080

ENRICHMENT OF HEAVY WATER BY COUNTERCURRENT ELECTROLYSIS. H. Martin and E. Ruhtz. Z. Electrochem. 54, 560-6(1950). C.A. 45, 5044h.

By using a 10% H_2SO_4 electrolyte, 32 cm^3 of anolyte, H in the form of H_2O and H_2SO_4 was enriched from 6.88 mole % D to 7.22 mole % D, at 0.55 ampere with 0.82 cm^2 electrode for 19 hours by a countercurrent arrangement which makes it comparable with Urey's column, with the difference that concurrent and countercurrent flows are in a single phase. The principles, apparatus, and preliminary calculations are given.

1081

CHEMICAL CHARACTERIZATION OF CATALYSTS. II. OXYGEN EXCHANGE BETWEEN WATER AND CRACKING CATALYSTS. G. A. Mills and S. G. Hindin. J. Am. Chem. Soc. 72, 5549-54(1950). C.A. 45, 5394g.

Water containing the heavy isotope of oxygen O^{18} was used for measuring the rate by which this compound exchanges O with solid oxides such as silica gel, active silica-alumina cracking catalyst, kaolin, bentonite, and acid-activated bentonite, at temperatures of 100°, and in a few cases, at 565°. No exchange can be observed with natural kaolin or bentonite, either because of their relatively low specific surface area, or because of a lower reactivity toward water of these crystalline substances.

1082

THE EXCHANGE REACTION BETWEEN HYDROGEN CHLORIDE AND CHLORINE IN THE GASEOUS STATE. W. H. Johnston and W. F. Libby. J. Am. Chem. Soc. 73, 854-5(1951). C.A. 45, 5497h.

The exchange reaction between HCl and Cl_2 in the gaseous state is heterogeneous at room temperature; the homogeneous exchange is slow, and a rapid photochemical exchange reaction occurs. It appears that the photoexchange occurs through Cl atoms exchanging rapidly with both HCl and Cl_2.

1083

HEAT-FLUX SEPARATION OF HELIUM^3 IN LIQUID HELIUM (II). C. A. Reynolds, H. A. Fairbank, C. T. Lane, B. B. McInteer and A. O. Nier. Phys. Rev. 76, 167 (1949). C.A. 45, 5988h.

Helium was enriched in the He^3 isotope to concentrations as high as 4% by the heat-flux method.

1084

ISOTOPIC EXCHANGE BETWEEN A SINGLE PHASE COPPER AMALGAM AND CUPRIC IONS. G. Kayas. Compt. rend. 226, 2144-6 (1948). C.A. 45, 6021d.

The rate at which Cu^{64} (12.8 hours) passes into Cu^{++} solution from a single phase amalgam was measured as a function of concentration. The effect of temperature (between 0° and 60°) corresponds to an energy of activation of 9600 calories per gram atom.

1085

ISOTOPE EXCHANGE OF BROMINE BETWEEN SODIUM BROMIDE AND ALLYL BROMIDE IN ALCOHOLIC SOLUTION. M. B. Neĭman and Yu. M. Shapovalov. Doklady Akad. Nauk S.S.S.R. 77, 423-6(1951). C.A. 45, 6024h.

The rate of exchange using radioactive Br^{82}, second order rate constants, activation energy, and the steric factor are given. Allyl bromide exchanges Br about 25-30 times as rapidly as PrBr.

1086

BROMINE-EXCHANGE REACTIONS BY THE METHOD OF RADIOACTIVE INDICATORS. Ya. A. Fialkov and Yu. P. Nazarenko. Izvest. Akad. Nauk S.S.S.R. Otdel. Khim. Nauk. 590-8(1950). C.A. 45, 6025a.

A study of exchange reactions with tagged Br_2 was made of some 50 systems including simple bromides of 28 elements (20 of which were studied for the first time), complex bromides of P, Sb, and Hg, and systems of bromides of different elements with $AlBr_3$, KBr, or AgBr.

1087

KINETICS OF THE ISOTOPIC EXCHANGE REACTION BETWEEN CARBON MONOXIDE AND CARBON DIOXIDE. T. H. Norris and S. Ruben. J. Chem. Phys. 18, 1595-1600 (1950). C.A. 45, 6029f.

The rate of the exchange reaction between CO and CO_2 was studied, with C^{14} as a tracer. The reaction is accelerated by added N but not A.

1088

THE INFRARED SPECTRA OF $N^{15}N^{14}O^{16}$ AND $N^{14}N^{15}O^{16}$. SOME THERMODYNAMIC PROPERTIES OF THE ISOTOPIC MOLECULES. Jacob Bigeleisen and Lewis Friedman. J. Chem. Phys. 18, 1656-9 (1950). C.A. 45, 6057b.

The three fundamental frequencies of $N^{15}N^{14}O^{16}$ and one stretching frequency and the bending frequency in $N^{14}N^{15}O^{16}$ have been studied in the infrared. The partition function ratios for isotopic exchange reactions involving N and O in N_2O are calculated. The isomerization equilibrium $N^{15}N^{14}O^{16} \rightleftharpoons N^{14}N^{15}O^{16}$ has been calculated over the temperature range 273.16° - 1000°K.

1089

THE He^3 ISOTOPE. K. A. Tumanov. Uspekhi Fiz. Nauk 37, 405-13(1949). C.A. 45, 6063g.

A critical review with 23 references is presented.

1090

HYDROGEN EXCHANGE BETWEEN CRACKING CATALYST AND THE BUTANES. S. G. Hindin, G.A. Mills, and A. G. Oblad. J. Am. Chem. Soc. 73, 278-81(1951). C. A. 45, 6372a.

A general study was made of the H-exchange reactions of a typical silica-alumina cracking catalyst with various hydrocarbon classes.

1091

CRITICAL CONSTANTS, BOILING POINTS, TRIPLE-POINT CONSTANTS, AND VAPOR PRESSURES OF THE SIX ISOTOPIC HYDROGEN MOLECULES, BASED ON A SIMPLE MASS RELATIONSHIP. A. S. Friedman, D. White, and H. L. Johnston. J. Chem. Phys. 19, 126-7(1951). C.A. 45, 6441c.

It is assumed that the orientation effects in all the isotopic forms of H are the same and that the properties are simply related to mass. With these assumptions the above properties were calculated.

1092

TRANSPORT PROPERTIES OF GASES WITH A SQUARE-WELL MOLECULAR INTERACTION POTENTIAL. Eugene M. Holleran and Hugh M. Hulburt. J. Chem. Phys. 19, 232-41 (1951). C.A. 45, 6445h.

Mathematical. Calculations give excellent agreement with neon isotope data and predictions of the qualitative behavior of the thermal diffusion ratio are made.

1093

THE EXCHANGE OF IODINE ATOMS BETWEEN IODINE AND IODATE ION. R. E. Connick and Z. Z. Hugus, Jr. Brookhaven Conf. Rept. (BNL-C-8) Chem. Conf. No. 2, 164-70(1948). C.A. 45, 6466h.

The exchange in solutions containing I_2, $NaIO_3$, and $HClO_4$ (with $LiClO_4$ to maintain ionic strength) was studied at 25° with I^{131} as tracer.

1094

THE RELATIVE RATES OF REACTION OF HYDROGEN AND TRITIUM HYDRIDE WITH CHLORINE. W. M. Jones. J. Chem. Phys. 19, 78-85(1951). C.A. 45, 6468e.

The ratio of the specific rate constant for H_2 to that for HT in the photochemical reaction with Cl was determined at 4 temperatures and is represented by $R = (1.35 \pm 0.03) \exp [(552 \pm 7)/RT]$ to within about 0.3%.

1095

ISOTOPE EXCHANGES. RECENT PROGRESS. M. Haissinsky. J. chim. phys. 47, 957-82(1950). C.A. 45, 6477h.

A review with 166 references is presented.

1096

INTRAMOLECULAR ISOTOPIC FRACTIONATION—THE EXAMPLE OF NITROUS OXIDE. J. M. McCrea. J. Chem. Phys. 19, 48-9(1951). C.A. 45, 6487a.

The spectroscopic results of Richardson and Wilson are used to calculate the partition function ratios for the isotopic species of N_2O. A number of approximate calculations of types often necessary in other cases owing to limited data are given to show the errors introduced by these approximations.

1097

THE EXCHANGE REACTION BETWEEN MANGANATE AND PERMANGANATE IONS. Norman A. Bonner and Herbert A. Portratz. J. Am. Chem. Soc. 73, 1847-7 (1951). C.A. 45, 6879i.

The exchange is extremely fast even under conditions of low temperature and concentration. Exchange may be induced by the separation procedure.

1098

NEW POSSIBILITIES OF ISOTOPE SEPARATION WITH THE AID OF ION EXCHANGES. Gerhard Dickel. Z. Elektrochem. 54, 353-7 (1950). English Trans. AEC-tr-2356. C.A. 45, 6885a.

The theoretical fundamentals are given for the practically feasible combination of 2 methods of ion exchange, the continuously working residue method (I) and the true countercurrent method (II). After giving the basic equations for the selective exchange and the multiplicity theory, the equations for isotope separation by I and II are derived.

1099

ISOTOPIC EXCHANGE RATES AS A CRITERIA OF SURFACE HETEROGENEITY. R. P. Eischens. J. Chem. Phys. 19, 377(1951). C.A. 45, 6898c.

A monolayer of $C^{14}O$ was chemisorbed on reduced Fe, and the exchange with normal CO in the gas phase at 1 atm. was determined at −78°.

1100

ISOTOPIC EXCHANGE BETWEEN COBALT OR TANTALUM AND THEIR IONS IN SOLUTION. Maurice Cottin. Compt. rend. 231, 697-9 (1950). C.A. 45, 6909i.

The exchange of Ta and Co metals were measured with their respective salts in solution. No exchange occurred with Ta but various amounts of exchange took place between Co salts and Co.

1101

KINETICS OF THE AMMONIA-DEUTERIUM EXCHANGE BY A MICROWAVE METHOD. J. Weber and K. J. Laidler. J. Chem. Phys. 19, 381-2(1951). C.A. 45, 6911f.

NH_3 and D_2 were brought into contact with a singly-promoted Fe catalyst and the rate of disappearance of NH_3 was followed by determining the microwave spectrum of the gases. The activation energy of the exchange reaction is approximately 13 kcal/mole. The exchange apparently occurs between the adsorbed species of both molecules.

1102

DEMONSTRATION OF EXCHANGE AND FRIEDEL-CRAFTS REACTIONS OF GASEOUS ORGANIC CHLORIDES ON SOLID ALUMINUM CHLORIDE. M. Blau and J. E. Willard. J. Am. Chem. Soc. 73, 442-4(1951). C.A. 45, 7004b.

It was shown that under the proper conditions exchange of Cl occurs readily between solid $AlCl_3$ and gaseous CCl_4, $CHCl_3$, EtCl, PrCl, AmCl, and $PhCH_2Cl$ with a contact time of a few minutes at room temperature. Exchange was observed at −10° with CCl_4, PrCl, AmCl, and $PhCH_2Cl$; all produced a yellow or brownish color on the $AlCl_3$, and in each of these cases HCl was found in the products of the reaction which were condensed with liquid air and sealed off from the system.

1103

EXCHANGE BETWEEN RADIOACTIVE IODINE AND DERIVATIVES OF MONOPYRIDINE IODINE IN PYRIDINE. Jacob Kleinberg and James Sattizahn. J. Am. Chem. Soc. 73, 1865-6(1951). C.A. 45, 7415g.

Over a wide range of ratios of elementary iodine to unipositive iodine concentrations, the former exchanges completely with the latter after mixing. This exchange is independent of the nature of the organic anion in the complex and in harmony with the assumption of the dissociation of dissolved iodine into positive IPY^+ and negative I_3^-.

1104

CARBON[13] ISOTOPE EFFECT IN THE DECARBOXYLATION OF NORMAL MALONIC ACID. J. G. Lindsay, A. N. Bourns, and H. G. Thode. Can. J. Chem. 29, 192-200(1951). C.A. 45, 7420d.

The thermal decomposition of malonic acid containing a normal abundance of C^{13} was carried out at 138° ± 0.50 and the $C^{12}O_2/C^{13}O_2$ ratio determined in the product CO_2 by use of the mass spectrometer. The probability of rupture of a $C^{12}C^{12}$ bond was found to be 2% greater than that of a C^{12}-C^{13} bond.

1105

THE EXCHANGE REACTION BETWEEN EUROPIUM(II) AND EUROPIUM(III) IN HYDROCHLORIC AND PERCHLORIC ACID SOLUTIONS. D. J. Meier and C. S. Garner. J. Am. Chem. Soc. 73, 1894-5(1951). C.A. 45, 7457g.

The change in half time as a function of the Eu concentration showed that the reaction is of first order for both Eu(II) and Eu(III). The rate is independent of pH in the range 0.3—1.0 f. The exchange rate, R, is given by $R = k[Eu(II)][Eu(III)][Cl^-]$. The value for k at 39.4° is 0.102-0.108.

1106

DETERMINATION OF SELF-DIFFUSION COEFFICIENTS OF SULFUR BY THE METHOD OF ISOTOPIC EXCHANGE. M. Haïssinsky and D. Peschanski. J. chim. phys. 47, 191-7 (1950). C.A. 45, 7840f.

Tracer experiments with radioactive S show that exchange between S and the ions in Na_2S_y where y is about 4.6 and the solution is about 1.8M, is slow below 100° The exchange is about 45% in 5 hours at 123°.

107

EXCHANGE OF CARBON[13] DIOXIDE BETWEEN SOLID CARBONATES AND GASEOUS CARBON DIOXIDE. R. A. W. Haul, L. H. Stein, and J. D. Louw. Nature 167, 241-2(1951). C.A. 45, 7855e.

Exchange of C^{13} dioxide was measured over dolomite and calcite under pressure of 400 mm CO_2 at 700°. Exchange occurred in the surface layer, as indicated by decreasing

content of C^{13} dioxide in the CO_2 with successive decomposition of the dolomite after initial exchange. The mechanism is discussed.

1108

EXCHANGE REACTION BETWEEN THE TWO OXIDATION STATES OF THALLIUM IN SOLUTION. G. Harbottle and R. W. Dodson. J. Am. Chem. Soc. 73, 2442-7(1951). C.A. 45, 7857f.

The two electron transfer between Tl(I) and Tl(III), followed by the precipitation of Tl_2CrO_4 is 1st order for the over-all concentrations of Tl(I) and Tl(III). The rate decreases with H^+ concentration, is depressed by small concentrations of Cl^-, and is increased by high concentrations of Cl^-. $TlCl_2^+$ or $TlCl^{++}$ and Tl^+ exchange slowly whereas $TlCl_4^-$ and $TlCl_3^{2-}$ exchange rapidly.

1109

KINETICS OF THE EXCHANGE REACTION BETWEEN THE TWO OXIDATION STATES OF CERIUM IN ACID SOLUTION. J. W. Gryder and R. W. Dodson. J. Am. Chem. Soc. 73, 2890-5(1951). C.A. 45, 7858a.

The rate of the electron transfer exchange reaction between cerous and ceric cerium in nitrate and perchlorate solutions was measured at several temperatures between −9.8° and 25°.

1110

DETERMINATION OF AN ISOTOPE EFFECT IN THE DECARBOXYLATION OF MALONIC −1-C^{14} ACID. A. Roe and Max Hellmann. J. Chem. Phys. 19, 660(1951). C.A. 45, 7891h.

The ratio of the rate of rupture of $C^{12}-C^{12}$ bonds to that of $C^{12}-C^{14}$ bonds is 1.06 ± 0.02, as compared to the theoretical value of Bigeleisen of 1.04 (C.A. 43, 7333a).

1111

ISOTOPE CONCENTRATION PROCESS. Aristid V. Grosse and Allen F. Reid. U. S. Patent 2,559,152 July 3, 1951. C.A. 45, 7892f.

A method for the concentration of isotopes of C and O is given in U. S. patent 2,435,796 (C.A. 42, 2522h). An improved contact-tower packing for use in this process is prepared.

1112

ABUNDANCE OF N^{15} IN THE NITROGEN PRESENT IN CRUDE OIL AND COAL. Paul V. Smith, Jr. and Boyd E. Hudson, Jr. Science 113, 577 (1951). C.A. 45, 8236f.

It was shown that the percentage abundance of N^{15} in the N obtained from the organic matter in the coal and oil is essentially the same as found in the atmosphere today. In no case was the deviation greater than the probable overall reproducibility of the experiments.

1113

EFFECT OF TURBULENCE IN THERMAL DIFFUSION COLUMNS. J. Donaldson and W. W. Watson. Phys. Rev. 82, 909-13(1951). C.A. 45, 8313i.

A certain amount of controlled turbulence improves markedly the separation factor and transport of thermal diffusion isotope separation columns. Measurements on this effect are reported for hot-wire columns 3 m long, operating on argon gas, and with power input about 725 w.

1114

THE KINETICS OF EXCHANGE REACTIONS. IV. SUBSTITUTED PHENYL AND BENZYL BROMIDES. S. Sugden and J. B. Willis. J. Chem. Soc. 1360-3(1951). C.A. 45, 8334d.

Exchange of radioactive Br^- takes place with phenyl and benzyl bromides in anhydrous ethylene diacetate. Rate constants, activation energies and effective collision diameters are reported for various phenyl and benzyl bromides.

1115

AMMONIA DECOMPOSITION AND RELATED PHENOMENA ON RHENIUM CATALYSTS. J. P. McGreer and Hugh S. Taylor. J. Am. Chem. Soc. 73, 2743-51(1951). C.A. 45, 8337d.

Isotopic exchange between NH_3 and D_2, H_2 and D_2, and H_2O and D_2 occurs over Re between 0 and 100°. Isotopes of N_2 exchange readily over Re only above 500°. Careful reduction of an Fe synthetic-NH_3 catalyst enabled it to cause an exchange of isotopes of N_2 much faster than was observed by Joris and Taylor and comparable with the rapid exchange reported by Kummer and Emmett. Addition of H_2 accelerates exchange of isotopes of N_2 over both Fe and Re, whereas traces of H_2O act as poisons.

1116

ISOTOPIC EXCHANGE OF PHOSPHORUS BETWEEN THE PHOSPHATE ION AND ESTERS OF PHOSPHORIC ACID. A. F. Lukovnikov, V. P. Medvedev, M. B. Neiman, An. N. Nesmeyanov and I. S. Shaverdina. Guide to Russ. Sci. Periodical Lit. 3, 187-9 (1950). (English Translation) C.A. 45, 8862e.

See Ref. 954.

1117

SOME ATTEMPTS TO CONCENTRATE THE K^{40} ISOTOPE. D. M. Douglas, G. A. Elliott, W. R. Ellis, and R. H. Lee. Proc. Conf. Applications Isotopes Sci. Research, Univ. Melbourne 1950, 125-36 (1951). C.A. 45, 9315g.

Cation-exchange experiments using a natural green-sand and a commercial zeolite gave negative results as well as a countercurrent ionic migration method.

1118

USE OF THE HEAVY OXYGEN ISOTOPE, O^{18}, AS A TRACER ELEMENT. II. THE INTERCHANGE OF OXYGEN BETWEEN WATER AND INORGANIC OXYGEN COMPOUNDS. I. Lauder. Proc. Conf. Appl. Isotopes Sci. Research Univ. Melbourne 1950, 117-24(1951). C.A. 45, 9315g.

A review of previous work involving acid radicals of the types MO_3 and MO_4.

1119

SOME PROPERTIES OF SOLUTIONS OF He^3 IN He^4. I. SEPARATION OF THE HELIUM ISOTOPES. B. N. Esel'son and B. G. Lazarev. Zhur. Eksptl. Teoret. Fiz. 20, 742-7 (1950). C.A. 45, 9324c.

First-stage enrichment in He^3, by a factor of 2 x 10^3, to a final concentration of He^3 of about 0.01% is obtained on repeated removal of the superfluid at a rate of 1.5 l./hour. Further enrichment, by a factor of 150, to a final concentration He^3 of 1.5% is obtained with a rectification column. The final enrichment is by a factor of 3 x 10^5.

1120

MEASUREMENT OF THE VAPOR PRESSURE OVER SOLUTIONS OF He^3 IN He^4. B. N. Esel'son, B. G. Lazarev, and N. E. Alekseevskiĭ. Zhur. Eksptl. Teoret. Fiz. 20, 1055-6 (1950). C.A. 45, 9324h.

The validity of Raoult's law was confirmed by the agreement of the concentrations calculated from the vapor pressure at 1.4°K with the known concentrations of He^3; 0.15, 0.38, 0.98, and 1.89%.

1121

EXCHANGE OF WATER BETWEEN HYDRATED CATIONS AND SOLVENT. J. P. Hunt and H. Taube. J. Chem. Phys. 19, 602-8(1951). C.A. 45, 9340e.

The rate of exchange of water between the hydrated forms of Al^{3+}, Cr^{3+}, Fe^{3+}, Ga^{3+}, and Th^{4+} and the solvent water was measured in solutions of varying acidity. With the exception of Cr^{3+} ion, and of Fe^{3+} ion at low acidity, the exchange is complete in about 3 min at 25°.

1122

ACID-BASE EXCHANGE REACTIONS IN LIQUID SULFUR DIOXIDE. Rowland E. Johnson, T. H. Norris, and J. L. Huston. J. Am. Chem. Soc. 73, 3052-5(1951). C.A. 45, 9340h.

The tracer S^{35} was used to study the rate of exchange between the solvent SO_2 and 3 solutes, $(Me_4N)_2S_2O_5$, $SOCl_2$, and $SOBr_2$. This pyrosulfite exchanges almost completely within 20 minutes even at ~ −75°. $SOBr_2$ exchanges with a half time at 25° of about 1-9 years. $SOCl_2$ exchanges even slower. Mechanisms are discussed.

1123

ISOTOPIC EXCHANGE REACTIONS OF LIQUID SULFUR TRIOXIDE AND SULFUR DIOXIDE. J. L. Huston. J. Am. Chem. Soc. 73, 3049-51(1951). C.A. 45, 9341b.

No isotopic exchange of S takes place at room temperature when SO_3 is dissolved in liquid SO_2 or when SO_2 is dissolved in liquid SO_3, and exchange occurs only slowly at 132°. It is suggested on the basis of these results that the two compounds undergo rapid exchange of O^{--} ions at room temperature, interacting as a Lewis acid and a Lewis base but not undergoing oxidation-reduction interaction. SO_3 reacts with $K_2S_2O_5$ at room temperature converting it to K_2SO_4 and $K_2S_2O_7$. The process induces a small exchange between SO_2 and SO_3; this indicates that some oxidation-reduction interaction takes place under these conditions. Isotopic exchanges of SO_3 with $BaSO_4$ and with K_2SO_4 were observed. When K_2SO_4 and SO_3 react to form potassium dipyrosulfate, substantial, and possibly complete, exchange occurs between excess SO_3 and the S originally in K_2SO_4.

1124

THE USE OF O^{18} IN STUDIES OF THE REACTIVITY OF SOLID OXIDES. E. R. S. Winter. Discussions Faraday Soc. No. 8, 231-4(1950). C.A. 45, 9988i.

An experimental technique is outlined for following continuously with a mass spectrometer O^{18} exchange between solid oxides and O gas. Preliminary results are given for thorium oxide and chromic oxide.

1125

CALCULATION OF REACTION EQUILIBRIUM FOR ISOTOPE EXCHANGE. V. M. Tatevskii. Zhur. Fiz. Khim. 25, 261-73(1951). C.A. 45, 10009c.

Two methods of calculation of the equilibrium constant K_p of an isotope exchange reaction are given. Molecules are treated as harmonic oscillators and rigid rotators. For very large temperatures, K_p depends only on the symmetry numbers of the molecules involved: it is practically independent of temperature for T°K. $\geq 0.5\ \omega_m$ or $1\ \omega_m$ where ω_m is largest vibration frequency (in cm^{-1}). The approximate calculation at temperatures T°K. $\geq (\omega_m/4)\ cm^{-1}$ necessitates the knowledge of the symmetry numbers the shapes (but not the dimensions) of all molecules, and the fundamental frequencies of only one isotopic molecule of each kind. The ratio of the products of the principal moments of inertia of the isotopic molecules depends only on masses and shapes and not on dimensions of the molecules. Applications are given to the calculation of K_p for equilibrium between isotopic methane molecules at 1000 and 2000°K., for CCl_4 molecules (exchange between Cl^{35} and Cl^{37}) at room temperature and for the reaction between H_2O and D_2S at T = 1000°K.

1126

APPLICATION OF THE THEOREMS OF SIMILITUDE TO THE CALCULATION OF VIBRATIONAL SPECTRA OF ISOTOPIC MOLECULES. V. M. Tatevskiĭ. Zhur. Fiz. Khim. 25, 274-82(1951). C.A. 45, 10035f.

Similitude theorems are applied to the calculation of the vibrational frequencies ω of isotopic molecules of the type $X\overline{Y}_n$ from the frequencies ω of XY_n where $\overline{Y}$ and Y are isotopic molecules.

1127

CONCENTRATION-DEPENDENT HYDROGEN-DEUTERIUM EXCHANGE PROCESS ON THE SURFACES OF ALUMINUM CATHODES. E. Kühne-Sauter. Z. Naturforsch 5a, 499-501 (1950). C.A. 45, 10037c.

The exchange between H adsorbed in Al and D in H_2O was investigated spectroscopically in the silent electrical discharge to an Al cathode.

1128

INTERCEPTION OF ATOMS IN THE RADIOCHEMICAL EXCHANGE REACTIONS BETWEEN HYDROGEN AND DEUTERIUM. W. Mund, P. Huyskens, and R. Lories. J. chim. phys. 48, 202-5(1951). C.A. 45, 10065a.

α-Radiation from Rn produces exchange between H_2 and D_2 by the production of atoms and resulting chain reactions. Impurities intercept the atoms and break the chains. The effectiveness of inhibition is a function of concentration and the chemical nature of the impurity. CCl_4 and $CHCl_3$ show similar inhibition; hence H in the molecule has no specific effect.

1129

SHIFT OF ISOTOPIC ABUNDANCES IN THE SOLUTION EQUILIBRIUM: HYDROCYANIC ACID—GLACIAL ACETIC ACID. E. W. Becker and W. Vogell. Z. Physik 130, 129-38 (1951). C.A. 45, 10091e.

The change in the ratio of the C and N isotopes between gaseous HCN and its solution in glacial acetic acid has been measured. The purpose of the investigation was to determine whether the isotope effect depends on the lattice vibration of the solvent or on an influence of the internal vibrations of the dissolved molecule. Since the ratio of the C and N isotope displacements was found to vary appreciably from one (1.75 ± 0.3), it is concluded that the influence of internal vibrations is important. The equilibrium constants for C^{13} and N^{15} exchange were found to be 1.0019 ± 0.0006 and 1.0011 ± 0.0005, respectively. The enrichment of both isotopes takes place in the liquid phase.

1130

EXPERIMENTS ON THE CATALYTIC EXCHANGE OF ACETONE AND PROPANE WITH DEUTERIUM. L. N. Kauder and T. I. Taylor. Science 113, 238-41(1951). C.A. 45, 10193c.

The reduction of Me_2CO to Me_2CH_2 with D_2 on platinized Pt was attempted at a low temperature (−20°) in an effort to prepare Me_2CD_2. The results were analyzed with the Nier-type spectrometer. Masses up to 52 were obtained, indicating all the deuteriated propanes up to C_3D_8 were formed. The reaction did not lead to formation of pure Me_2CD_2. The data indicated that D_2 exchanges preferentially at the secondary position. Exchange with Me_2CO took place as low as −22°. This was more rapid than the reduction since the mass spectra indicated the distribution of D in the propane was the same at both 30% and 70% reductions. The exchange and reduction of Me_2CO were almost complete in 9 min at 25°.

1131

OXYGEN EXCHANGE AS EVIDENCE FOR THE EXISTENCE OF AN INTERMEDIATE IN ESTER HYDROLYSIS. M. L. Bender. J. Am. Chem. Soc. 73, 1626-9(1951). C.A. 45, 10217c.

EtOBz, iso-PrOBz, and tert-BuOBz were labeled in the

CO group with O^{18}. The kinetics of the hydrolysis of these esters, and of O exchange accompanying hydrolysis, were determined. The fact that O exchange occurs in every case between the carbonyl O of the ester and the solvent during the process of hydrolysis strongly suggests that a true intermediate, in which the carbonyl O participates in a reversible fashion, occurs during the hydrolysis.

1132

FIRST REGULAR ANNUAL PROGRESS REPORT FOR JULY 1, 1949 TO APRIL 1, 1950. W. W. Watson. Apr. 1, 1950. 19p. (NYO-503). NSA 5, 653.

Progress made in isotope separation by thermal diffusion and in spectroscopic work with separated isotopes during the period is reported. Several 40-cc samples of argon whose A^{36} content is 95.9% have been obtained. Experiments on concentrating He^3 by thermal diffusion have been completed. The highest concentration obtained was 0.45% He^3. The experiments stimulated by early and unproved results with thermal diffusion columns that a certain amount of turbulence improves the isotope separation look promising.

1133

THE ENRICHMENT OF LITHIUM ISOTOPES BY ION EXCHANGE. J. H. Gross. Nov. 29, 1950. 3p. (AECD-2952). NSA 5, 1049.

Partial separations of the isotopes of lithium have been accomplished by an ion-exchange method using commercially available sulfonated styrene-divinyl benzene ion exchange polymers. The Li^+ was developed from an initial 5-cm band of saturated exchanger through a 146-cm bed of hydrogen-form exchanger with 0.1M HCl at a flow rate of 0.18 cm/min at 30.0°. The exchanger particle-size range was 80 to 200 μ. Mass analysis indicated that after only 0.05% of total Li had been eluted the concentration of Li^7 had increased from 92.476 to 94.397 at. %. It is suggested that this separation may depend on differences in the exchange equilibriums of the isotopes rather than on differences in diffusion rates.

1134

ANNUAL PROGRESS REPORT; SEPARATION OF ISOTOPES BY CHEMICAL EXCHANGE IN THERMAL DIFFUSION COLUMNS; CHEMISTRY DEPT. W. P. Senett, R. W. Pierce, and T. I. Taylor. [nd] 28p. (NYO-623). NSA 5, 1050.

Results on the effect of time, pressure, and temperature on the thermal diffusion column separation of the nitrogen isotopes, using the NO_2-NO system, are given graphically. Investigation of oxygen-isotope separation on the same system has produced data confirming oxygen enrichment concurrent with nitrogen enrichments. Statistical thermodynamic calculations of the enrichment factor have confirmed the possibility of observing this effect. Preliminary to testing columns of different designs under optimum conditions, particular emphasis has been placed on systems for the study of chemical converter and for the comprehensive investigation of catalysts suitable for chemical exchanges.

1135

CHEMICAL EXCHANGE AS A VERSATILE ISOTOPE SEPARATION PROCESS. G. H. Clewett. Nov. 7, 1950. 27p. (Y-683). NSA 5, 1051.

For the lighter elements, the chemical exchange method is generally accepted as being one of the most efficient. The specifications to be met by a suitable chemical exchange system are reported as follows: the element must be distributed between two phases, rapid isotopic exchange must take place between the chemical forms in the two phases, and the equilibrium constant of the isotopic exchange reaction must be other than unity. Engineering requirements are as follows: the two immiscible phases of the chemical exchange system must be efficiently contacted as countercurrent streams, the apparatus must have low holdup and high throughput, and means for achieving total reflux at the top and bottom of the plant must be provided. Enrichment of N^{15} by exchange between NH_3(gas) and NH_4^+(liquid) is used as an example.

1136

RELATIVE ISOTOPIC ABUNDANCES OF THE ELEMENTS. K. T. Bainbridge and A. O. Nier. Nucleonics 8, No. 4, 77(1951). [NP-1971] NSA 5, 2838.

Available values of the relative isotopic abundances of the elements are listed. Adopted values presented by the authors are based on critical consideration of the nature of the original research, source of material used, purpose of investigation, etc.

1137

SEPARATION OF ISOTOPES. W. Groth. Umschau 50, 402-4(1950) NSA 5, 4478.

A concise outline of various known methods of isotope separations. It is stated that in the electrolytic enrichment of heavy water used by the Germans during the last war the yield was notably increased by the introduction of an exchange reaction between the liberated hydrogen and water vapor; the reaction took place in the presence of a catalyst and resulted in the enrichment of water vapor in D, after which the water was added to that of the electrolytic cell. Mention is made of several methods now in experimental or development stages, such as those utilizing differences in chemical-dynamical constants of reactions. those employing biochemical reactions (ferments), desorption procedures, processes in glow-discharge tubes, diffusion in solids, and others.

1138

THE DISCRIMINATION OF ISOTOPIC CARBON BY ENZYMES. D. W. Racusen and S. Aronoff. [nd.] 18p. (AECU-1490). NSA 5, 4676.

It has been shown recently that an enzyme may be able to discriminate between isotopic carbons in vivo reactions under some circumstances. Furthermore, it has been noted that isotopic discrimination may occur in relatively simple nonenzymatic reactions. Various types of isotopic discrimination are discussed and classified in the present report. The steric conditions in which discrimination by an enzyme system cannot occur are set forth. Experimental evidence is given to support the thesis that molecules have a twofold (or greater) axis of symmetry cannot be operated upon by discriminatory enzyme action. Malic acid-β-C-14 has been synthesized and used in a degradation scheme which determines the β-carboxyl. A simple, rapid synthesis of cyanide from Ba carbonate is described.

1139

MECHANISMS OF SURFACE REACTIONS INVOLVING HYDROGEN. Keith J. Laidler. J. Phys. and Colloid.

Chem. 55, 1067-77(1951). C.A. 46, 26e.

Mechanisms are discussed for the D_2-NH_3 exchange.

1140

MOBILITY OF HYDROGEN IN AROMATIC COMPOUNDS. A. I. Shatenshteĭn, N. M. Dykhno, E. A. Izrailevich, L. N. Vasil'eva, and M. Faĭvush. Doklady Akad. Nauk S.S.S.R. 79, 479-82(1951). C.A. 46, 29g.

Determinations of rates of isotopic H-D exchange between aromatic hydrocarbons and the solvent ND_3 catalyzed (or not) by NH_2K are tabulated. In these experiments the mean value of α = distribution coefficient or ratio of D concentration in the hydrocarbon and in the solvent in the equilibrium mixture is 0.88. The rate of exchange increases with the number of rings from C_6H_6 to $C_{10}H_8$ to $C_{14}H_{10}$ (phenanthrene). The exchange is considerably hindered in completely hydrogenated aromatic compounds. The rate of H exchange in C_6H_6 is slowed down by an electropositive substituent and is accelerated by a electronegative group. With 0.2M NH_2K all H atoms of $C_{10}H_8$ are exchanged in 10 minutes at 25°, whereas in the absence of NH_2K there is no exchange in 100 hours at 120°.

1141

KINETICS OF THE EXCHANGE REACTION BETWEEN DIBORANE AND DEUTERIUM. P. Calvin Maybury and W. S. Koski. J. Chem. Phys. 19, 1327(1951). C.A. 46, 30e.

The reaction between B_2H_6 and D_2 was followed between 35° and 75° by determining the rate of appearance of H by a thermal-conductivity method. The specific rate constant at 55° is 0.0038 $l/equiv^{-sec}$; the activation energy is approximately 18 kcal/mole. A mechanism is proposed.

1142

CATALYZED REACTIONS OF UNSATURATED HYDROCARBONS WITH HYDROGEN AND DEUTERIUM. T. I. Taylor and V. H. Dibeler. J. Phys. and Colloid. Chem. 55, 1036-65(1951). C.A. 46, 30f.

The existing proposals and the significance of recent experiments for the Ni-catalyzed hydrogenation, the isomerization, and D exchange with the butenes are discussed. Experimental results are presented.

1143

GASEOUS DIFFUSION AS A RANDOM PROCESS. W. H. Furry and P. R. Pitkanen. J. Chem. Phys. 19, 729-38 (1951). C.A. 46, 309b.

An accurate treatment of gaseous diffusion based on the random flight method is given. The determination of the diffusion coefficient is made to depend on the solution of an integral equation; the unknown function of this equation can be interpreted as the unambiguously defined effective mean free path, for diffusion, of molecules of given speed. The resulting value of D_{12} is the same as is obtained from the standard Enskog (C.A. 5, 1697)—Chapman (C.A. 11, 552) treatment based on Boltzmann's equation.

1144

SOLVENT EFFECT ON IODIDE EXCHANGE. R. D. Heyding and C. A. Winkler. Can. J. Chem. 29, 790-803 (1951). C.A. 46, 327d.

The effect of the dielectric constant of the solvent on the kinetics of the exchange reaction HI* + BuI → HI + BuI* are determined. Various alcohols and AcOH are the solvents.

1145

EXCHANGE REACTION BETWEEN THE DIFFERENT OXIDATION STATES OF THALLIUM. G. Harbottle and R. W. Dodson. Brookhaven Conf. Report., (BNL-C-8) Isotopic Exchange Reactions and Chem. Kinetics. Chem. Conf. No. 2, 226-34(1948). C.A. 46, 327g.

The electronic exchange between Tl(I) and Tl(III) was studied with 2.7 yr Tl^{208}. From data at 3 temperatures activation energy of exchange as a function of H ion concentration is calculated. Cl^- ion greatly increases the exchange rate.

1146

KINETICS OF ISOTOPE EXCHANGE REACTIONS. G. M. Harris and D. R. Stranks. Trans. Faraday Soc. 47, 716-21(1951). C.A. 46, 327h.

The rate characteristics of isotopic exchange reactions are analyzed in general terms. Irrespective of the magnitude of the isotope effect, isotopic exchange always approximates closely to a 1st-order process provided the relative concentration of distinguishable isotope is small enough. The exact influence of the isotope effect on the kinetics is still entirely determined by the exchange mechanism.

1147

EXCHANGE REACTIONS OF ALICYCLIC IODIDES WITH SODIUM IODIDE. Sylvia F. Van Straten, R. V. V. Nicholls, and C.A. Winkler. Can. J. Chem. 29, 372-6(1951). C.A. 46, 327i.

Activation energies and second order rate constants are given for the exchange at 25° between NaI^{131} and cyclopentyl, cyclohexyl, cycloheptyl, cycloöctyl, cyclopentadecyl, and 2-heptyl iodides.

1148

THE RATE OF REACTION OF METHANE AND DEUTERIUM ON EVAPORATED NICKEL CATALYSTS. C. Kemball. Proc. Roy. Soc. (London) A207, 539-54(1951). C.A. 46, 331b.

The production of all 4 deuteriomethanes from the reaction of CH_4 and D on evaporated Ni films in the temperature range 206-255° was followed with a mass spectrometer. The equilibrium constants for the interconversion of the 5 methanes were determined at 466° and compared with calculated values.

1149

ISOTOPE EFFECTS IN SOME SIMPLE CHEMICAL PROCESSES. P. E. Yankwich. Brookhaven Conf. Rept., (BNL-C-8) Isotopic Exchange Reactions and Chem. Kinetics. Chem. Conf. No. 2, 44-52(1948). C.A. 46, 364a.

The isotope effect in nonequilibrium processes is discussed with isomerization of propane, decarboxylation of malonic and bromomalonic acids, and photosynthetic uptake of CO_2 as examples.

1150

THEORY OF ISOTOPE EFFECTS IN CHEMICAL REACTION RATES. Jacob Bigeleisen. Brooknaven Conf. Rept., (BNL-C-8) Isotopic Exchange Reactions and Chem. Kinetics. Chem. Conf. No. 2, 53-75(1948). C.A. 46, 364b.

The effect of isotopic composition of reactants on that of the products of a reaction is discussed. The effect on rate constants is reviewed and a table of ratios of rate constants for stable isotopes to those of tracer isotopes is given. 28 references.

1151

FRACTIONATION OF THE CARBON ISOTOPES IN DECARBOXYLATION REACTIONS. III. THE RELATIVE RATES OF DECOMPOSITION OF CARBOXYL-C^{12} AND -C^{13} MESITOIC ACIDS. A. A. Bothner-By and Jacob Bigeleisen. J. Chem. Phys. 19, 755(1951). (AECU-1161) C.A. 46, 364c.

The relative rates of decarboxylation of C^{12}- and C^{13}-carboxyl mesitoic acids have been studied at 61.2 and 92.0°. The ratios of the rate constants are 1.037 and 1.032 respectively. Comparison is made with other rates and with theory.

1152

FRACTIONATION OF THE CARBON ISOTOPES IN DECARBOXYLATION REACTIONS. IV. THE RELATIVE RATES OF DECOMPOSITION OF 1-C^{12} AND 1-C^{13} TRICHLORACETATE IONS. Jacob Bigeleisen and T. L. Allen. J. Chem. Phys.

19, 760 (1951). C.A. 46, 364d.

A precise determination of the relative rates of decomposition of 1-C^{12} and 1-C^{13} trichloracetate ions has been made. The 1-C^{12} ion has been found to decompose 1.0338 ± 0.0007 times as fast as the 1-C^{13} ion into chloroform and bicarbonate at 70.4°. The errors in the determination of the effect of isotopic substitution on the rates of chemical reactions are discussed. In the study of the isotopes of carbon, experiments using mass spectrometric analyses of C^{13} at the natural abundance level are capable of a precision of one order of magnitude greater than ones in which the specific activity of C^{14} is determined by counting.

1153

MICROWAVE SPECTROSCOPIC INVESTIGATION OF THE KINETICS OF THE HETEROGENEOUS AMMONIA-DEUTERIUM EXCHANGE. J. Weber and Keith J. Laidler. J. Chem. Phys. 19, 1089-96(1951). C.A. 46, 828e.

The kinetics of the NH_3-D_2 exchange reaction on a singly promoted Fe catalyst was investigated by means of microwave techniques. Results indicate the mechanism involves reaction between adsorbed NH_3 and adsorbed D atoms.

1154

CATALYTIC ISOTOPIC EXCHANGE REACTION OF HYDROGEN BETWEEN DIFFERENT OLEFINIC HYDROCARBONS. II. Masao Koizumi. J. Inst. Polytech., Osaka City Univ. 1, No. 2, 1-9(1950). C.A. 46, 1339f.

The exchange reaction of D between heavy ethylene and C_3H_6 over Ni catalyst at 45° was studied.

1155

SEPARATION OF THE STABLE ISOTOPE OF SULFUR 34. E. D. North and R. R. White. Ind. Eng. Chem. 43, 2390-7 (1951). C.A. 46, 1360c.

S^{34} was enriched in an exchange column using the reaction $S^{34}O_2(g) + HS^{32}O_3^-(aq) \rightleftharpoons S^{32}O_2(g) + HS^{32}O_3^-(aq)$. In a 63 ft high column 2 inches in diameter a total number of theoretical plates of from 17-32 was obtained with single stage separation factors of 1.0136 to 1.0155.

1156

ISOTOPIC EXCHANGE REACTIONS IN THE SYSTEM BROMINE-BROMATE-HYPOBROMOUS ACID. R. H. Betts and A. N. MacKenzie. Can. J. Chem. 29, 655-65(1951). C.A. 46, 1380i.

The following set of reactions is postulated as applicable in the above system: $HBr + HBrO_3 \rightarrow HBrO_2 + HOBr$, $HBr + HBrO_2 \rightarrow 2HOBr$, $HOBr + HBr \rightarrow Br_2 + H_2O$. $NaBr^{82}$ was used as the tracer. The Br was extracted with C_6H_6 after the allotted reaction time and the γ-activity of the aqueous phase was determined. This is associated only with the BrO_3^-. The rate of the bromine-bromate exchange reaction is inversely related to the concentration of the HOBr.

1157

RELATIVE ABUNDANCES OF OXYGEN AND CARBON ISOTOPES IN CARBONATE ROCKS. P. Baertschi. Nature 168, 288-9(1951). C.A. 46, 1400a.

A mass spectrometer was used to determine O^{18}/O^{16} and C^{13}/C^{12} ratios relative to a standard limestone. Data are presented and interpretated in terms of the isotopic fractionation between carbonates and their aqueous solutions.

1158

REACTION OF DEUTERIUM WITH HYDROCARBONS OVER A COBALT THORIA FISCHER-TROPSCH CATALYST. S. O. Thompson, J. Turkevich, and A. P. Irsa. (AECU-1206); J. Am. Chem. Soc. 73, 5213-15(1951). C.A. 46, 1850h.

Deuterium was found to exchange with ethane, propane, butane, and isobutane when a mixture of six volumes of deuterium and one volume of each of the hydrocarbons was passed over a Fischer-Tropsch cobalt catalyst under conditions of temperature and flow rate similar to these of hydrocarbon synthesis. The exchanged products were found to be extremely deuterated and the amount of exchange was less than 10% in the case of the ethanes and propanes, 45% for n-butane, and 51% for isobutane. Cracking of the hydrocarbon gases to produce deuterated methane was also observed. The exchange reactions between CH_4 and D_2 and CD_4 and CH_4 were studied.

1159

THE EXCHANGE MECHANISM OF HYDROCARBON RADICALS WITH MOLECULAR DEUTERIUM. V. V. Voevodskiĭ, G. K. Lavrovskaya, and R. E. Mardaleĭshvili. Translated by E. Rabkin from Doklady Akad. Nauk S.S.S.R. 81, 215-18 (1951). 9p. (AEC-tr-1538; Tech. Trans. TT-358). C.A. 46, 1852f.

The high rate of deuterization of hydrocarbons cannot be explained by the mechanism of exchange of free aliphatic radicals with D atoms. The more probable exchange occurs between a free radical and a D_2 molecule. This reaction is rapid because of a decrease in the activation energy and an increase in the entropy factor. The experimental results are in agreement with the calculated results.

1160

CONCENTRATION OF HEAVY NITROGEN. II. Asao Sugimoto, Ryohei Nakane, Tsunao Watanabe, Tadashi Matsuo, Shohei Isomura, and Mitsuzo Morishita. Repts. Sci. Research Inst. (Japan) 27, 19-23(1951). C.A. 46, 1887h.

With a 2-step (8 and 6 m long) concentrating tower and an improved boiler employing 30% NaOH, NH_4NO_3 was concentrated using the NH_4NO_3-$NH_3(g)$ exchange system to contain 8-9% N^{15}.

1161

EXCHANGE REACTIONS OF SOME FOUR-COORDINATED NICKEL COMPLEXES. Norris F. Hall and Bennett R. Willeford, Jr. J. Am. Chem. Soc. 73, 5419-23 (1951). C.A. 46, 1910b.

Exchange between $*NiCl_2$ and various complexes was studied in several solvents. The complexes studied are given in C.A.

1162

THE INTERACTION OF ETHYLENE AND DEUTERIUM. John Turkevich, Donald O. Schissler, and Peter Irsa. J. Phys. and Colloid Chem. 55, 1078-84(1951). C.A. 46, 1953i.

The authors report the first phases of their studies of the interaction of C_2H_4 and D in which a mass-spectrometric analysis was made of the various products during the catalytic (Ni) conversion of C_2H_4 into ethanes.

1163

THE CHEMISTRY OF THE ISOTOPES OF OXYGEN. Malcolm Dole. Rev. brasil. quim. (São Paul) 32, 124-31(1951). C.A. 46, 2356c.

The isotopes of oxygen are discussed with regard to relative abundances in air and in O_2 produced by photosynthesis, nuclear reactions necessary to form them, separation procedures, half lives, radiations, and masses. Chemical applications briefly condensed and illustrated by specific examples are direct analysis of organic compounds of O_2 by the method of isotopic dilution, tracer applications, studies of isotope exchange, and equilibrium studies in reactions involving isotope exchange.

1164

THE DETERMINATION OF THE ISOTOPE EFFECT AND ITS VARIATION WITH TEMPERATURE IN THE DEHYDRATION OF FORMIC-C^{14} ACID. G. A. Ropp, A. J. Weinberger, and O. K. Neville. J. Am. Chem. Soc. 73, 5573-5(1951). C.A. 46, 2424d.

An isotope effect of 11.11 ± 0.52% at O°C and of 8.59 ± 0.58% at 24.75° has been measured in the dehydration of formic-C^{14} acid in sulfuric acid. These values, expressed as $100(k_{12}-k_{14})/k_{12}$, correspond to a difference of 189 ± 53 cal/mole between the Arrhenius activation energies for the reaction of formic-C^{12} acid and formic-C^{14} acid. A sensitive flow method of measurement has been developed, which is applicable in the study of first-order reactions yielding a gaseous radioactive product.

1165

ISOTOPIC EXCHANGE BETWEEN METAL IONS OF DIFFERENT VALENCY. Joseph Weiss. J. Chem. Phys. 19, 1066-7(1951). C.A. 46, 2867b.

A theoretical consideration of exchange reactions occurring by means of reversible oxidation-reduction processes. Suggested mechanisms are given for ions of Cr, Ti, V, Cu, $Fe(CN)_6$, Fe, Mn, Ce, and Co.

1166

SUM RULES FOR THE VIBRATIONAL FREQUENCIES OF ISOTOPIC MOLECULES. J. C. Decius and E. B. Wilson. J. Chem. Phys. 19, 1409-12(1951). C.A. 46, 2909d.

The squares of the frequencies of isotopically related molecules obey certain simple sum rules. Whenever there exists a chemical exchange reaction involving only isotopic variations of a single type of molecule, such that the reaction is balanced at each atomic position of the molecule, then a relation of identical form exists between the sums of the squares of the frequencies. If the molecules all have the same symmetry, the sum rule may be applied separately to each factor of the secular equation. When forms of lower symmetry appear, symmetry factoring may or may not be possible. In such cases it is necessary to employ certain group-theoretical considerations; the possible factoring is not in general identical with that appropriate for the product rule. Examples of the application of the sum rule are given, involving the acetylene, water, methane, and hydrocyanic acid molecules. The existence of higher order isotope rules, intermediate between the sum and product rules, is pointed out.

1167

SEPARATION OF STABLE ISOTOPES BY ELECTROMAGNETIC MEANS. W. D. Allen. Nature 168, 451-3(1951). C.A. 46, 2929e.

A discussion is given on electromagnetic separation of isotopes of elements forming vaporizable compounds and comparisons made with other methods of separation. The application of separated isotopes is discussed.

1168

CARBONATE-WATER ISOTOPIC TEMPERATURE SCALE. Samuel Epstein, Ralph Buchsbaum, Heinz Lowenstam, and Harold C. Urey. Bull. Geol. Soc. Am. 62, 417-26(1951). C.A. 46, 2974h.

An equation relating temperature to the difference in O^{18} isotopic composition of samples of CO_2, prepared from organically precipitated calcium carbonate, and an arbitrarily selected sample of CO_2 is presented. A linear relation is found to exist after corrections are made for the isotopic compositions of the sea water in which the animals lived. The temperature can be determined to an accuracy of ±1.0°.

1169

THERMAL DIFFUSION IN H_2-D_2 AND H_2-He MIXTURES AT LOW TEMPERATURES. A. de Troyer, A. van Itterbeek, and A. O. Rietveld. Physica 17, 938-42(1951). C.A. 46, 3353g.

Thermal diffusion in the binary gas mixtures H_2-D_2 and H_2-He was measured between room temperature at one end and liquid O or H temperatures at the other end.

1170

VAPOR PRESSURES OF HYDROGEN, DEUTERIUM, AND HYDROGEN DEUTERIDE AND THE DEW-POINT PRESSURES OF THEIR MIXTURES. Harold J. Hoge and Robert D. Arnold. J. Research Natl. Bur. Standards 47, 63-74(1951). C.A. 46, 3354f.

The vapor pressures of H_2, D_2 and HD were determined from temperatures near their triple points to their critical points.

1171

CRITICAL TEMPERATURES, PRESSURES, AND VOLUMES OF HYDROGEN, DEUTERIUM, AND HYDROGEN DEUTERIDE. Harold J. Hoge and James W. Lassiter. J. Research Natl. Bur. Standards 47, 75-9(1951). C.A. 46, 3354g.

1172

SOLID DIFFUSION IN CHROMATOGRAPHY. Henry C. Thomas. J. Chem. Phys. 19, 1213(1951). C.A. 46, 3366h.

The simple case of isotopic exchange where a linear isotherm is to be found is treated for a slightly idealized system.

1173

HYDROGEN-DEUTERIUM EXCHANGE ACTIVITY OF CATALYSTS. V. C. F. Holm and R. W. Blue. Ind. Eng. Chem. 44, 107-13(1952). C.A. 46, 3381c.

Various oxides were tested at atmospheric pressure and temperatures from −78° to 300° for catalysis of the reaction $H_2 + D_2 = 2HD$. First-order rate constants were calculated and presented. NiO on kieselguhr was the most active catalyst.

1174

THE THEORY OF ISOTOPE SEPARATION AS APPLIED TO THE LARGE SCALE PRODUCTION OF U^{235}. Karl Cohen and George M. Murphy. McGraw-Hill Book Co., New York, (1951). National Nuclear Energy Series, Division III, Volume 1B. 165p. (1951). C.A. 46, 3420a.

The subjects treated include ideal and square gas diffusion cascades, equilibrium time of a square cascade, determination of cascade constants, control of a cascade, and isotope separation by the centrifuge and other separation methods. Mathematical details are given.

1175

VAPOR PRESSURE OF ISOTOPIC CARBON TETRACHLORIDES. D. H. Rank and R. E. Kagarise. Nature 168, 740-1(1951). C. A. 46, 3420b.

CCl_4 was fractionated in three successive columns totaling 700 theoretical plates but no difference in density was observed. It was concluded that neighboring isotopic molecules of CCl_4 do not differ in boiling point by more than 6×10^{-5} degrees.

1176

RELATION BETWEEN THE FREQUENCIES OF ISOTOPIC MOLECULES (SUMS OF PRODUCTS RULES). L. M. Sverdlov. Doklady Akad. Nauk. S.S.S.R. 78, 1115-19(1951). C.A. 46, 3813f.

A new relation between the vibration frequencies of isotope-substituted molecules paralleling Teller and Redlich's (C.A. 29, 4673_2) rule of products, is derived for a molecule, a, of N atoms and n = 3N − 6 degrees of freedom, by the device of separating arbitrarily a group of atoms in the molecule, dividing it into 2 subgroups, and carrying out isotopic substitution first in one subgroup, then in the other, and finally in the whole group of atoms. These molecules

are designated, respectively, by b, c, d. The secular equation yields the relation (rule of sums) $\Sigma^a\omega_l^2 + \Sigma^d\omega_l^2 = \Sigma^b\omega_l^2 + \Sigma^c\omega_l^2$ where the summation is from l = 1 to n. This rule is valid on condition that the potential energy remains unchanged on isotopic substitution. For isotopic molecules of the same symmetry this holds for vibrations of each type separately, otherwise, the rule holds only for types of vibration of the same symmetry. The rule is tested by calculations in simple molecules and the unknown frequency ν_3 of HDO is calculated.

1177

METHOD AND APPARATUS FOR THE SEPARATION OF ISOTOPES, ETC. BY MOLECULAR DISTILLATION. Thomas Robinson. U. S. Patent 2,586,717. Feb. 19, 1952. C.A. 46, 4284c.

A molecular distillation apparatus containing an inclined evaporating surface and a moving condensing surface to give counter-current flow of the streams and multi-stage operation.

1178

DIFFUSION PROPERTIES OF GASES. V. THERMAL DIFFUSION OF CARBON MONOXIDE, NITROGEN, AND METHANE. A. N. Davenport and E. R. S. Winter. Trans. Faraday Soc. 47, 1160-9(1951). C.A. 46, 4296d.

A coaxial-cylinder thermal-diffusion column, 316 cm long was used to study the separation of C^{13} in CO and of N^{15} in N. Data agrees reasonably well with theory.

1179

EXCHANGE STUDIES WITH COMPLEX IONS. II. THE KINETICS OF THE EXCHANGE OF RADIOCYANIDE ION WITH POTASSIUM HEXACYANOMANGANATE (III) IN AQUEOUS SOLUTION. Arthur W. Adamson, Joan P. Welker, and W. B. Wright. J. Am. Chem. Soc. 73, 4786-90 (1951). C.A. 46, 4334d.

The exchange rate in aqueous solution between $K_3Mn(CN)_6$ and K radiocyanide is first order in complex-ion concentration and is independent of the CN^- concentration, of pH over the range 9.0 to 10.8, and of ionic strength.

1180

MOBILITY OF HYDROGEN ATOMS IN THE SALTS OF ACETIC ACID. G. P. Miklukhin. Zhur. Fiz. Khim. 25, 688-93(1951). C.A. 46, 4334f.

The exchange reaction between the Na, Ca, Ba, Co, Cd, Hg, and Pb salts of HOAc and heavy water was studied kinetically at 150° using 2-3 moles of H_2O per mole of salt. The half times of exchange were 8, 22, 50, 115, and 150 hours for the Pb, Hg, Cd, Co, and Na salts respectively.

1181

ON THE CONCENTRATION OF HEAVY WATER IN GLACIER ICE. Arne Eld Sandström. Arkiv Fysik 3, 549-56(1952). C.A. 46, 4441g.

Melted ice taken from the small glaciers of the North Scandinavian mountain range showed a density higher by 0.02 to 0.10% than the density of ordinary subsoil water. This corresponds to an enrichment of not less than five times normal concentration of D_2O and is of the same order of magnitude as that of the ice from other glaciers.

1182

ISOTOPIC COMPOSITION OF OXYGEN IN ALUMINOSILICATES OF MINERAL DEPOSITS. A. P. Vinogradov and E. I. Dontsova. Doklady Akad. Nauk. S.S.S.R. 58, 83-4(1947). C.A. 46, 4442a.

Samples were converted to CO and thence to H_2O for density measurements. The O isotopic content was found to be the same as in H_2O.

1183

SOME CHARACTERISTICS OF STEDMAN PACKING IN THE DISTILLATION OF HYDROGEN AND ITS ISOTOPES. A. Fookson, P. Pomerantz, and S. Rothberg. J. Research Natl. Bur. Standards 47, 449-55(1951). C.A. 46, 4858f.

Apparatus was designed and constructed in which some characteristics of Stedman packing in the distillation of hydrogen isotopes were measured. The average still holdup and the holdup at various boil-up rates were measured. From the distillation data the height equivalent to a theoretical plate was calculated and found to be 1.0 inch for the 12-inch packing used in these experiments.

1184

SEPARATION OF ISOTOPES. Alois Langer and Wm. E. Stephens. U. S. Patent Appl. 357,386. Official Gazette 644, 305(1951). C.A. 46, 4922d.

Diffusion through a membrane separates the isotopes of U in a solution of a U salt in a suitable solvent, the lighter isotope diffusing faster than the heavier.

1185

MASS SPECTROMETRIC DETERMINATION OF OXYGEN IN WATER SAMPLES. Israel Dostrovsky and F. S. Klein. Anal. Chem. 24, 414-15(1952). C.A. 46, 4951h.

The method of Cohn and Urey for determination of O^{18} is modified by carrying out equilibration of the water and CO_2 on a Pt wire placed in the gaseous mixture. A complete analysis can be made in 15 min with comparable results.

1186

THE DETERMINATION OF RELATIVE ABUNDANCES OF THE OXYGEN ISOTOPES IN SILICATE ROCKS. Peter Baertschi and Sol R. Silverman. Geochim. et Cosmochim. Acta 1, 317-28(1951). C.A. 46, 4972f.

O liberated from silicate rocks on mass-spectrometric analysis shows O^{18}/O^{16} ratio differences as high as 2.4%. O^{18}/O^{16} ratios were reliable to within 0.05%.

1187

DISTRIBUTION OF COMPONENTS OF TERNARY ISOTOPIC MIXTURE ALONG THE CLUSIUS-DICKEL COLUMN. F. K. Elder, Jr. and R. E. McDonald. Phys. Rev. 85, 500-1(1952). C.A. 46, 5376c.

The distribution of the 3 isotopes Ne^{20}, Ne^{21} and Ne^{22} along a 3 meter glass thermal diffusion column was determined after various times of operation.

1188

ISOTOPE FRACTIONATION IN THE BACTERIAL REDUCTION OF SULFATE. H. G. Thode, H. Kleerekoper, and D. McElcheran. Research (London) 4, 581-2(1951). C.A. 46, 5376d.

Reducing bacteria fed sulfate of known isotopic composition produced H_2S depleted by approximately 1% in S^{34}.

1189

THE DISTRIBUTION OF S^{34} IN NATURE AND THE ORIGIN OF NATIVE SULFUR DEPOSITS. J. Macnamara and H. G. Thode. Research (London) 4, 582-3(1951). C.A. 46, 5376e.

S^{32}/S^{34} ratios were determined for a number of native S deposits. Deposits having an organic or bacterial origin showed higher ratios (up to 3.2% fractionation).

1190

CONCENTRATION OF HEAVY CARBON BY THE THERMAL DIFFUSION OF METHANE. Yosihio Horibe. J. Chem. Soc. Japan, 73, 75-6(1952). C.A. 46, 5387d.

Six glass tubes, 2 meters long, each with inner diameters of 10 mm were coupled together to produce, after 125-260 hr, CH_4 containing 2.1 to 3.5% C^{13}. An electrically heated Nichrome wire was used at the center of the tubes and the outer walls cooled by tap water.

1191

THE BEHAVIOR OF ISOBUTANE IN CONCENTRATED SULFURIC ACID. J. W. Otvos, D. P. Stevenson, C. D. Wagner, and O. Beeck. J. Am. Chem. Soc. 73, 5741-6 (1951). C.A. 46, 5518h.

The behavior of various deuterated butanes circulated through H_2SO_4 and of isobutane circulated through D_2SO_4 were studied using mass spectrometric analyses.

1192

FAILURE OF PHOSPHORUS^{32} TO EXCHANGE WITH ORGANIC PHOSPHORUS COMPOUNDS. D. R. H. Gourley. Nature 169, 192-3 (1952). C.A. 46, 5627b.

Radioactive P^{32} as PO_4^{3-} in aqueous solution at pH 8 did not exchange with glucose 1-phosphate, adenylic acid, 2,3-diphosphoglyceric acid, and adenosine triphosphate. The concentration of organic phosphates was near blood levels and the solutions shaken in a Warburg apparatus for 3 hours at 37°.

1193

THE ISOTOPIC CHANGES OCCURRING ON THE FRACTIONATION OF METHANOL. I. Dostrovsky, E. D. Hughes, and D. R. Llewellyn. Bull. Research Council Israel 1, 133(1951). C.A. 46, 5917d.

The hypothesis was tested that the forces associated with the H bond are responsible for the possibility of separating D in hydrolytic liquids by fractionation. MeOH on fractional distillation showed no change in the isotopic composition of C or H of the Me group. O and H of the OH group were enriched by factors of 2 and 16 respectively. These results show the volatility ratio of the pairs $CH_3OH:C^{13}H_3OH$ and $CH_3OH:CH_2DOH$ to be unity while the relative volatilities of the pairs $CH_3OH:CH_3OD$; $CH_3OH:CH_3O^{18}H$, and $CH_3OD:CH_3O^{18}H$ differ from unity.

1194

SEPARATION OF ISOTOPES BY FRACTIONAL DISTILLATION. I. Dostrovsky, J. Gillis, and D. R. Llewellyn. Bull. Research Council Israel 1, 120-1(1951). C.A. 46, 6006c.

A mathematical study of the process of isotope separation in a packed column has been made. The isotope concentrations in the liquid and the vapor at any point in the column are functions of the distance from one end and of the time. These functions satisfy certain partial differential equations. Solutions were obtained for the cases: (a) finite supply reservoir operating without production; (b) infinite supply with production from the boiler.

1195

THE ISOTOPIC CONSTITUTION OF IGNEOUS SULFUR AND THE PRIMORIDAL ABUNDANCE OF THE TERRESTRIAL SULFUR ISOTOPES. J. Macnamara, W. Fleming, A. Szabo, and H. G. Thode. Can. J. Chem. 30, 73-6(1952). C.A. 46, 6052i.

S^{32}/S^{34} ratios were determined with a mass spectrometer for various igneous rocks and various sulfide ores of igneous origin. Although the ratios overlap, most of the latter appear to be enriched by 0.5% in S^{34} with respect to meteoritic S.

1196

ISOTOPIC EXCHANGE IN THE IODATE-PERIODATE-IODINE SYSTEM. M. Cottin, M. Haïssinsky, and D. Peschanski. J. chim. phys. 48, 500(1951). C.A. 46, 6473h.

Qualitatively the exchange between periodate and I in 0.5N HNO_3 at room temperature is slow, and comparable to that of the IO_3^-/I_2 couple. Activation energies are similar. The exchange IO_4^-/IO_3^- is extremely slow (half time 100-200 days at 98° and 1N HNO_3).

1197

REACTION BETWEEN DEUTERIUM AND AMMONIA ON EVAPORATED METAL CATALYSTS. J. H. Singleton, E. R. Roberts, and E. R. S. Winter. Trans. Faraday Soc. 47, 1318-31(1951). C.A. 46, 6475i.

The exchange reaction was examined on evaporated metal films of Fe, W, and Ni above 500°K. The effects of pressure of NH_3 and D were examined and energies of activation given.

1198

EFFECT OF ULTRASONIC RADIATION OF THE ELECTROLYTIC SEPARATION OF DEUTERIUM. D. F. Mason, R. E. Biddick, and C. A. Boyd. J. Chem. Phys. 19, 1551-3(1951). C.A. 46, 6522b.

The application of ultrasonic radiation to the polished platinum cathode of an electrolysis cell is shown to increase the coefficient for the electrolytic separation of deuterium. The radiation also decreases the temperature dependence of the separation coefficient. This is thought to be due to the rapid removal of the discharged gases by the ultrasonic radiation, preventing the surface-catalyzed exchange reaction between the discharged gases and the electrolyte.

1199

FLUORINE-EXCHANGE REACTIONS BETWEEN HYDROGEN FLUORIDE AND THE HALOGEN FLUORIDES. Max T. Rogers and Joseph J. Katz. J. Am. Chem. Soc. 74, 1375-7(1952). (AECU-1251; UAC-360). C.A. 46, 6536c.

Using radioactive F^{18} the exchange reactions between HF and the liquid interhalogen compounds BrF_3, ClF_3, BrF_5, and IF_5 were found to be essentially complete at room temperature in 10 min. The exchange reactions between HF and gaseous ClF_3, BrF_3, and IF_7 are essentially complete in a contact time of 3 minutes at room temperature and atmospheric pressure whereas the exchange between HF and SF_6 or CCl_2F_2 and between ClF_3 and F_2 is essentially zero. Mechanisms are discussed.

1200

SEPARATION OF TITANIUM, ZIRCONIUM, AND THORIUM BY ION EXCHANGE. William E. Brown and William Rieman, III. J. Am. Chem. Soc. 74, 1278-82 (1952). C.A. 46, 6546a.

Radiochemical work indicated that Ti^{51} was separated from the normal isotopes to a certain extent by ion exchange.

1201

VAPOR PRESSURE OF THE MIXTURE OF He^4 AND He^3. Yosakn Fukuda. Busseiron Kenkyû (Researches on Chem. Phys.) No. 33, 10-22 (1950); Correction, Ibid No. 38, 119-20 (1951). C.A. 46, 6887f.

Quantum statistical-mechanical calculations of the vapor pressure curve gives good agreement with the experimental curve of Abraham, Weinstock and Osborne (C.A. 44, 3758g).

1202

CALCULATION OF THE EQUILIBRIUM CONSTANT FOR THE EXCHANGE OF OXYGEN ISOTOPES BETWEEN WATER MOLECULES AND PHOSPHATE IONS. Kung-Hwa Lee. J. Chinese Chem. Soc. 18, 121-34(1951). C.A. 46, 6907i.

Exchange equilibria and the development of methods for calculation of the equilibrium constant is discussed. The equilibrium constant and the partition function ratio for O^{18} exchange between phosphate ion and H_2O is calculated by assuming central forces in the tetrahedral molecular model and from spectroscopic data.

1203

THE INFLUENCE OF NITRO COMPOUNDS ON THE CATALYTIC EXCHANGE REACTION BETWEEN DEUTERIUM GAS AND ACETIC ACID. EVIDENCE FOR THE MECHANISM OF THE CATALYTIC HYDROGENATION OF NITRO GROUPS. Lloyd E. Line, Jr., Betty Wyatt, and Hilton A. Smith. J. Am. Chem. Soc. 74, 1808-11(1952). C.A. 46, 6916a.

Studies of the kinetics of exchange between D and glacial AcOH in the presence of Adams' Pt catalyst (C.A. 22, 1715) indicate that the reaction is 1st order with respect to the D pressure and essentially zero order with respect to the AcOH concentration (in heptane over the range 10-100%) and has an activation energy of about 13.6 kcal.

1204

EXCHANGE OF CALCIUM IONS IN THE SYSTEM $CaSO_4$-$CaCl_2$. Jean Govaerts. Ann. soc. sci. Bruxelles, Ser. I, 65, 129-34 (1951). C.A. 46, 6918e.

Using radioactive Ca it was shown that there is only a slight, rapidly attained, exchange between $CaSO_4$ (solid) and $CaCl_2$ (in solution).

1205

AN UNUSUAL ISOTOPE EFFECT. Henry Gilman, G. E. Dunn, and G. S. Hammond. J. Am. Chem. Soc. 73, 4499-5000(1951). C.A. 46, 6965g.

The hydrolysis of Ph_3SiD in moist piperidine is 6 times faster than the hydrolysis of Ph_3SiH.

1206

RELATIVE ISOTOPE EFFECTS OF CARBON^{13} AND CARBON^{14}. Wm. H. Stevens, James M. Pepper, and MacKenzie Lounsbury. J. Chem. Phys. 20, 192(1952). C.A. 46, 6965h.

The C^{13} isotope effect obtained in the decarboxylation of mesitoic acid was very close to that found by Bothner-By and Bigeleisen (C.A. 46, 364c); the C^{14} effect was distinctly more than double the C^{13} effect. Analyses were made with a mass spectrometer.

1207

ISOTOPE EFFECT IN THE CANNIZZARO REACTION OF CARBON^{14}-LABELED FORMALDEHYDE. A. M. Downes and G. M. Harris. J. Chem. Phys. 20, 196-7(1952). C.A. 46, 6966a.

The disproportionation of C^{14} labeled CH_2O was carried out in aqueous solution at 60°. The specific rate constant of labeled reactant/specific rate constant of unlabeled reactant = 0.9434 ± 0.0012. This compares closely with Roe and Hellmann (C.A. 45, 7891h).

1208

INTRAMOLECULAR ISOTOPE EFFECTS IN THE DECARBOXYLATION OF MALONIC ACID. Peter E. Yankwich, Edward C. Stivers, and Robert F. Nystrom. J. Chem. Phys. 20, 344(1952). C.A. 46, 6966c.

Single C^{14}-labeled malonic acid was decarboxylated at 138° under 1 atmosphere of helium. The ratio of the rate of rupture of C^{12}-C^{12} bonds to rate for C^{12}-C^{13} and C^{12}-C^{14} bonds was determined. The C^{13} results agree well with those of Lindsay, et al. (C.A. 45, 7420d); the C^{14} results agree with those of Y. and Calvin (C.A. 43, 2862d) but not with those of Roe and Hellmann (C.A. 45, 7891h). C^{13} and C^{14} effects for bromomalonic acid are only slightly larger than those for the unsubstituted acid.

1209

REACTION OF METHYL AND METHYL-d_3 RADICALS WITH HYDROGEN AND DEUTERIUM. T. G. Majury and E. W. R. Steacie. J. Chem. Phys. 20, 197-8(1952). C.A. 46, 7412d.

Reactions of the type $CH_3 + H_2 \rightarrow H$ were effected with H and D and the energies of activation and steric factors were determined.

1210

THE KINETICS OF THE EXCHANGE OF WATER BETWEEN $Cr(H_2O)_6^{+++}$ AND SOLVENT. Robert A. Plane and Henry Taube. J. Phys. Chem. 56, 33-8(1952). C.A. 46, 7412h.

The kinetics of the exchange was studied under various conditions, using O^{18} tracer.

1211

EXCHANGE REACTION OF Cl^{36} BETWEEN CHLOROFORM AND AQUEOUS HYDROCHLORIC ACID: MECHANISM OF DECOMPOSITION OF CHLOROFORM. Juro Horiuchi and Kozo Tanabe. Proc. Japan Acad. 27, 404-9(1951). C.A. 46, 7417b.

In the absence of air, Cl exchange occurred in the aqueous HCl-$CHCl_3$ system at 20-26° over 70-146 hours at pH values above 3. Sakamoto's mechanism (C.A. 31, 4189$_4$) predicts this.

1212

EXCHANGE REACTIONS WITH RADIOACTIVE TRACERS AND THE DETERMINATION OF SPECIFIC SURFACE. I. LABORATORY TECHNIQUE. J. M. Gamboa and A. G. Maddock. Anales real soc. españ. fís. y quím. 47B, 401-12 (1951). C.A. 46, 7854a.

1213

KINETICS OF ISOTOPIC EXCHANGE REACTIONS. EXCHANGE BETWEEN FREE CARBONATE ION AND CARBONATOTETRAMMINECOBALTIC COMPLEX ION. G. M. Harris and D. R. Stranks. Trans. Faraday Soc. 48, 137-44(1952). C.A. 46, 7854b.

C^{14} was used in mixtures of Na_2CO_3 and $[Co(NH_3)_4CO_3]NO_3$ in aqueous solution. Concentration, pH, ionic strength, and temperature were varied. Results agree with the earlier non-tracer studies.

1214

THE EXCHANGE OF IODINE BETWEEN p-IODOPHENOL AND SODIUM IODIDE. Serge May and Bernard Giraudel. Compt. rend. 234, 326-8(1952). C.A. 46, 7854c.

The reaction was effected by heating p-iodophenol and radioactive NaI in 2-octanol.

1215

THE EXCHANGE REACTION OF Cl^{36} BETWEEN CARBON TETRACHLORIDE AND AQUEOUS CHLORIDE SOLUTION. Juro Horiuchi and Kozo Tanabe. Proc. Japan Acad. 28, 127-9(1952). C.A. 46, 7854d.

No exchange was found using Cl^{36} in aqueous solution and CCl_4 over a pH range of 1.2-9.6 and reaction time of 7-8 hours at 96.5-98°.

1216

EXCHANGE REACTIONS WITH RADIOACTIVE TRACERS AND THE DETERMINATION OF SPECIFIC SURFACE. III. EXPERIMENTS WITH Fe_2O_3. J. M. Gamboa and A. G. Maddock. Anales real soc. españ. fís. y quím. 47B, 489-94 (1952). C.A. 46, 7854g.

The kinetics of exchange of Fe^{3+} in aqueous solution and powdered crystalline Fe_2O_3 are determined with Fe^{59} as a tracer.

1217

EFFECT OF OXYGEN IN THE EXCHANGE REACTION OF CHLORINE^{36} BETWEEN CHLOROFORM AND AQUEOUS CHLORIDE SOLUTION. Juro Horicuchi and Kozo Tanabe. Proc. Japan Acad. 28, 130-2(1952). C.A. 46, 7902e.

The exchange reaction of Cl^{36} in aqueous solution and $CHCl_3$ at an initial pH of 14 and at 97° for 7 hours was measured at partial pressures of O from 10^{-5} to 720 mm Hg. The presence of O reduces the exchange.

1218

THE FRACTIONATION OF THE ISOTOPES OF CARBON DURING THE ABSORPTION OF CARBON DIOXIDE. Peter Baertschi. Helv. Chim. Acta 35, 1030-6(1952). C.A. 46, 8204b.

$C^{12}O_2$ is absorbed faster than $C^{13}O_2$ by alkaline solutions (α = 1.014-0.002). In a thin film experiment α was found to be 1.011.

1219

PHYSICAL PROPERTIES AND ANALYSIS OF HEAVY WATER. Isidor Kirshenbaum. (Edited by G. M. Murphy

and H. C. Urey). New York, McGraw-Hill Book Co., Inc. (1951). 438p. National Nuclear Energy Series III, Volume 4A. C.A. 46, 8443a.

A critical evaluation of the published literature on the isotopes of hydrogen supplemented by additional experiments performed mostly at SAM laboratories at Columbia University. Chapter headings are: Physical Properties, Equilibrium Constants for Exchange Reactions, Isotopic Analysis by the Mass Spectrometer, Isotopic Analysis of Heavy Water by the Mass Spectrometer, Other Methods of Isotopic Analysis of Heavy Water, and Natural Abundance of Hydrogen and Oxygen Isotopes.

1220

APPROXIMATE ADSORPTION ISOTHERMS FOR A MIXTURE OF TWO ISOTOPES. Wm. Band and Earle B. Emery. J. Phys. Chem. 56, 384-8(1952). C.A. 46, 8456c.

The Brunauer-Emmett-Teller theory of multi-molecular adsorption (C.A. 32, 4037_9) is generalized to include the case of mixtures of 2 isotopes in which one of the 2 is present in only very small concentrations.

1221

REACTION OF METHYL RADICALS WITH HYDROGEN AND DEUTERIUM. Sol Davidson and Milton Burton. J. Am. Chem. Soc. 74, 2307-12(1952). C.A. 46, 8479g.

Methyl radicals were formed by photolysis of Me_2CO or AcH in the presence of D or mixtures of D and H at temperatures from 409 to 731°K. Gaseous products were determined by mass spectrometric analysis, and activation and steric factors determined.

1222

INFLUENCE OF TEMPERATURE ON THE INTERMOLECULAR C^{13} ISOTOPE EFFECT IN THE DECARBOXYLATION OF NORMAL MALONIC ACID. J. G. Lindsay, A. N. Bourns, and H. G. Thode. Can. J. Chem. 30, 163-5(1952). C.A. 46, 8481f.

The intermolecular isotope effect in the decarboxylation of malonic acid has been found to be constant over the temperature range 137 to 196°, in agreement with theory (Bigeleisen, J. Chem. Phys. 17, 675, 998(1949).

1223

THE KINETICS OF THE VANADIUM(III) VANADIUM(IV) EXCHANGE REACTION IN AQUEOUS PERCHLORIC ACID SOLUTION. Sydney C. Furman and Clifford S. Garner. J. Am. Chem. Soc. 74, 2333-7 (1952). C.A. 46, 8482h.

A kinetic study was made of the exchange of radioactive V^{48} between V(III) and V(IV) in solutions in the formal concentration range 0.01-0.05 $V(ClO_4)_3$, 0.01-0.05 $VO(ClO_4)_2$, 0.5-2.0 $HClO_4$, with the ionic strength adjusted to 2.5 with $NaClO_4$, and at temperatures from 25 to 40°. The exchange rate is about 5 to 10 times as great in solutions 4 formal in NH_4SCN as in those not containing NH_4SCN.

1224

HYDROGEN-EXCHANGE REACTIONS OVER IRON SYNTHETIC AMMONIA CATALYSTS AT −195°. J. T. Kummer and P. H. Emmett. J. Phys. Chem. 56, 258-61(1952). C.A. 46, 8488i.

The behaviors of singly promoted and doubly promoted Fe catalysts were compared for the ortho-para H_2 interconversion and for the H_2-D_2 exchange reaction at −195°. Singly promoted Fe catalysts unlike the doubly promoted catalysts, rapidly catalyze the H_2-D_2 exchange at −195° as well as the ortho-para H_2 conversion.

1225

REACTION OF AMMONIA AND DEUTERIUM ON EVAPORATED NICKEL CATALYSTS. Charles Kemball. Trans. Faraday Soc. 48, 254-8(1952). C.A. 46, 8489c.

The exchange reaction was followed between 33° and 115° by means of a mass spectrometer. The initial product was NH_2D and the energy of activation 8.7 kcal/mole for this reaction. The equilibrium constants for the interconversion of the 4 ammonios were measured at 248 and 386°.

1226

SEPARATION OF ISOTOPES AND THEIR USE IN EXPERIMENTATION. Klaus Clusius. Verhandl. schweiz. naturforsch. Ges. 33-52(1950). C.A. 46, 8529d.

1227

CONCENTRATING ISOTOPIC CARBON. Melvin Calvin and John W. Weigl. U. S. Patent 2,602,047. July 1, 1952. C.A. 46, 8538b.

The light and heavy isotopes of carbon are separated by the preferential absorption of the lighter isotopes by living chlorophyllic organisms.

1228

THE EXCHANGE REACTION BETWEEN SULFUR AND DIBENZOTHIOPHENE-5, 5-DIOXIDE. Raymond R. Brown, Sam Kirkwood, Léo Marion, Stanley Naldrétt, Robert K. Brown, and Reuben B. Sandin. J. Am. Chem. Soc. 73, 465-6(1951). C.A. 46, 8646c.

In the reaction between dibenzothiophene-5, 5-dioxide (I) and S^{35} to form dibenzothiophene (II) the replacement of the sulfone group in I by S is a direct one as the SO_2 and a little H_2S recovered contained less than 4% of the original activity.

1229

ISOTOPE EFFECTS IN THE THERMAL DEAMMONIATION OF PHTHALAMIDE. F. W. Stacey, J. G. Lindsay, and A. N. Bourns. Can. J. Chem. 30, 135-45(1952). C.A. 46, 8942h.

Phthalamide having a normal N^{15} content of 0.4% was decomposed at 180-210°. The ratios of the various specific reaction rate constants were determined and agree with theoretical expectations.

1230

HYDROGEN EXCHANGE BETWEEN DEUTERIUM OXIDE AND HYDROCARBONS ON SILICA-ALUMINA CATALYST. R. C. Hansford, P. G. Waldo, L. C. Drake, and R. E. Honig. Ind. Eng. Chem. 44, 1108-13(1952). C.A. 46, 9292f.

The H exchange between D_2O and hydrocarbons has been studied further and the mechanism of reaction has been related to the current ionic theory of catalytic cracking.

1231

HYDROGEN-DEUTERIUM EXCHANGE IN AQUEOUS SOLUTIONS OF GLYCOLIC ACID AND OF SODIUM FORMATE. L. D. C. Bok and L. B. Petters. J. Chem. Soc. 1524-5(1952). C.A. 46, 9389e.

Three hundred and thirty hours has been obtained as the approximate time of half-exchange for the forward (protium-rich substance + deuterium rich solvent) exchange of the α-carbon hydrogen and 470 hours for the reverse reaction at 160°. An approximate activation energy calculated for the hydrogen exchange in glycolic acid is 30 kcal. Na formate exchanged the α-carbon hydrogen with DCl at about the same rate (half time 800 hours) as the formate ion.

1232

REACTIVITY OF SOME AROMATIC COMPOUNDS. A. I. Shatenshteĭn and Ya. M. Varshavskiĭ. Doklady Akad. Nauk S.S.S.R. 85, 157-60(1952). C.A. 46, 9395g.

H-D exchange between $C_{10}H_8$ or C_6H_6 and liquid DBr, catalyzed by $AlBr_3$ gave for the D distribution coefficient, α, between an aromatic C-H bond and the H-Br bond at 20, 50, 75° the values α = 2.8, 2.5, 2.2 respectively. Cyclohexane, in the presence of $AlBr_3$, exchanged with

DBr completely with $\alpha = 1.9$ at 20°. The rate of exchange increases with the number of rings from C_6H_6 through $C_{10}H_8$ and phenanthrene, to anthracene. The exchange is inhibited by electronegative and accelerated by electropositive substituents. The effects of the substituents are reversed in the basic solvent NH_2D.

1233

IODINE EXCHANGE BETWEEN SODIUM IODIDE AND p-IODONITROBENZENE. Serge May and Bernard Giraudel. Compt. rend. 234, 2280-1(1952). C.A. 46, 9396g.

A rate study was made of the iodine exchange in a 240° solution of NaI^{131} and p-$IC_6H_4NO_2$ in either MeCN or 2-octanol. The rate was bimolecular in the former and unimolecular in the latter solvent.

1234

THE EXCHANGE OF DEUTERIUM FOR HYDROGEN IN HEPTANE. Joseph A. Dixon and Robert W. Schiessler. J. Am. Chem. Soc. 73, 5452-3(1951). C.A. 46, 9396h.

Vapor phase exchange took place at 135° over Ni catalyst while exchange did not take place in the liquid at 150°. The exchange is accompanied by scission of the C–C bonds.

1235

CONCENTRATION OF N^{15} BY CHEMICAL EXCHANGE REACTION METHOD. Asao Sugimoto, R. Nakane, and T. Watanabe. Bull. Chem. Soc. Japan 24, 153-5(1951). C.A. 46, 9445i.

Apparatus used to concentrate N^{15} up to 8 to 9.3 atom % by exchange between NH_3 gas and NH_4^+ ion in packed columns is described briefly.

1236

THE IDEAL PLANT FOR THE SEPARATION OF ISOTOPES. C. Marchetti and M. Silvestri. Nuovo cimento 9, 97-104(1952). C.A. 46, 9445i.

Integral equations for an ideal cascade, i.e., one without mixing inefficiency, are derived. The energy consumption necessary to obtain a predetermined separation is expressed as a function of three constants characteristic of the process used. The results can be used to check the efficiency of real cascades against this standard of maximum efficiency physically attainable.

1237

QUINONE-HYDROQUINONE EXCHANGE REACTIONS. I. NON-EXCHANGE IN DUROQUINHYDRONE. Askel A. Bothner-By. J. Am. Chem. Soc. 73, 4228-30(1951). C.A. 46, 9535h.

Quinhydrone complexes were prepared from duroquinone-α-C^{14} and durohydroquinone-α-C^{14}. Thermal decomposition in vacuo yielded the original compounds, no exchange of C^{14} having taken place after compound formation. The formulation of quinhydrones as resonance hybrids is thus disproved.

1238

THE SEPARATION OF BINARY MIXTURES. Alfred Klemm. Z. Naturforsch. 7a, 417-21 (1952). C.A. 46, 9895f.

The nonlinear differential equation for the case of a binary mixture in an endless separation tube closed at one end has been solved. The time dependence of the separation factors at the ends of the tube is represented graphically for different concentrations and for the two extreme concentrations, 0 and ∞, it is compared with experimental data.

1239

MECHANISM OF SUBSTITUTION AND REARRANGEMENT IN PROTOTROPIC SYSTEMS. RACEMIZATION AND HYDROGEN EXCHANGE IN METHYLENEAZOMETHINES. R. Perez Ossorio and E. D. Hughes. J. Chem. Soc., 426-9 (1952). C.A. 46, 9951a.

It was shown that the initial rate of racemization and the initial rate of D uptake are almost identical.

1240

MOBILITY OF HYDROGEN IN SOME HYDROCARBONS. A. I. Shatenshtein, L. N. Vasil'eva, N. M. Dykhno, and E. A. Izrailevich. Doklady Akad. Nauk S.S.S.R. 85, 381-4 (1952). C.A. 46, 9954d.

Determinations of the D distribution coefficient α in the H-D exchange between a hydrocarbon and deuteriated NH_3 in the presence of dissolved KNH_2, at 25°, with C_6H_6, $C_{10}H_8$, C_5H_{10}, cyclohexene, and C_8H_{16}, gave the mean values for the aromatic C-H bond $\alpha = 0.91 \pm 0.02$, and for the aliphatic C-H bond $\alpha = 0.90 \pm 0.03$. First order rate constants and activation energies are calculated. Experiments were also done with toluene and tetrahydronaphthalene. Ethylenic hydrocarbons with 1 double bond suffer isomerization under the action of KNH_2 in liquid NH_3. Exchange rates were investigated with various ethylenic hydrocarbons in deuteriated NH_3 in the presence of 0.05N KNH_2 at 25 and 50°. At high concentrations of KNH_2 (0.8N) and 120° some exchange was observed in 150-170 hours even in C_7H_{16} and in cyclohexane and decahydronaphthalene. Mechanisms are discussed.

1241

DECARBOXYLATION OF ANTHRANILIC ACID. W. H. Stevens, J. M. Pepper, and M. Lounsbury. Can. J. Chem. 30, 529-40(1952). C.A. 46, 9958b.

Decarboxylation rates are given for thermal reaction at 155° and 200°, and reaction in neutral and acid media at 100°. Mass spectrometer analyses of evolved CO_2 show no isotope effect.

1242

THE EXCHANGE OF $OXYGEN^{18}$ BETWEEN OXYGEN GAS AND CERTAIN METALLIC OXIDES. E. R. S. Winter and G. Houghton. Mass Spectrometry (Institute of Petroleum, London), 127-40(1950). C.A. 46, 9972c.

The kinetics of the exchange of O^{18} between the gas phase and the surface of metallic oxides has been investigated for γ-Al_2O_3, MgO, ThO_2 and Cr_2O_3 at various temperatures.

1243

ENRICHMENT OF THE HEAVY ISOTOPES OF CARBON AND OXYGEN BY FRACTIONAL DISTILLATION OF CARBON MONOXIDE. T. F. Johns, H. Kronberger, and H. London. Mass Spectrometry (Institute of Petroleum, London) 141-7, (1950). C.A. 46, 9972d.

It was found that CO near its triple point has a vapor-pressure ratio of about 1.01 for $C^{12}O^{16}/C^{13}O^{16}$ and of about 1.008 for $C^{12}O^{16}/C^{12}O^{18}$. Use was made of this in a 32-ft tower in which CO was distilled at temperatures between the triple point and the boiling point. About 0.4 g of C^{13} is produced per day by using 40 watt boiler power and 10 gallons of liquid N.

1244

THE TRITIUM ISOTOPE OF HYDROGEN OF MASS 3. REVIEW AND BIBLIOGRAPHY. P. Verzaux. J. phys. radium 13, 94-106 (1952). C.A. 46, 9997g.

A review of history, methods of preparation, disintegration, β-spectrum, determination, nuclear reactions and nuclear properties of T together with its applications as a tracer given. 79 references.

1245

MECHANISM OF HYDROGEN ELECTRODE OF MERCURY. ELECTROCHEMICAL MECHANISM. Juro Horiuchi, Tominaga Keii, and Kozo Hirota. J. Research Inst. Catalysis, Hokkaido Univ. 2, 1-72(1951). C.A. 46, 10010d.

Using statistical-mechanical and general reaction rate

theory concepts, the isotopic separation factor for the electrolysis of water at a Hg electrode was calculated to be 3.3 at 19° and 2.5 at 100° as compared with the experimental value of 3.1 at both temperatures.

1246

ISOTOPIC EXCHANGE REACTIONS OF ZINC CHELATE COMPLEXES. Don C. Atkins, Jr. and Clifford S. Garner. J. Am. Chem. Soc. 74, 3527-9 (1952). C.A. 46, 11003b.

The exchange of Zn^{65} between $Zn(OAc)_2$ and Zn chelate complexes was investigated. All exchanged completely within 0.5 minutes except Zn phthalocyanine. The possibility that the rapid exchange was induced by the chemical separation of the reactants was not eliminated.

1247

CATALYTIC DEUTERATION OF ORGANIC COMPOUNDS. I. DEUTERATION AND DISPROPORTIONATION. J. Bell and S. J. Thomson. J. Chem. Soc. 572-5(1952). C.A. 46, 10114a.

Deuterations of organic compounds by D_2O in Pt-catalyzed exchange reactions in AcOH at 120° are described. Relatively little exchange takes place with saturated compounds but unsaturated compounds undergo considerably greater exchange as well as disproportionation and isomerization.

1248

ENRICHMENT OF GASEOUS ISOTOPES IN BOUNDARY RANGE BETWEEN KNUDSEN AND POISEUILLE FLOW. H. D. Beckey and W. E. Groth. Naturwissenschaften 38, 558 (1951). C.A. 46, 10734e.

Gaseous isotopes can be separated by a diffusion process through a capillary tube.

1249

VAPOR PRESSURE OF ISOTOPIC SUBSTANCES. I. BORON TRICHLORIDE. M. Green and G. R. Martin. Trans. Faraday Soc. 48, 416-21(1952). C.A. 46, 10736e.

Natural BCl_3 was investigated in a packed fractionating column of high efficiency to determine the relative volatilities of the isotopic moleculars. An equilibrium constant of 0.9982 ± 0.0002 was determined for the exchange $B^{10}Cl_3$ (liq) + $B^{11}Cl_3$ (g) ⇌ $B^{11}Cl_3$ (liq) + $B^{10}Cl_3$ (g) and compared with a value of 1.014 predicted from a statistical calculation. The B^{10} concentration was determined by measuring the slow neutron transmission of standard samples.

1250

CARBON-OXYGEN EXCHANGE IN CHEMISORBED CARBON MONOXIDE. R. P. Eischens and A. N. Webb. J. Chem. Phys. 20, 1048-9 (1952). C.A. 46, 10775e.

A mixture of $C^{13}O$ and CO^{18} was chemisorbed on Fe and then progressively desorbed at temperatures from -78 to 160°. The desorbed gas was analyzed for $C^{13}O^{18}$ with a mass spectrometer to determine whether the C is desorbed with the same O to which it was bonded before adsorption. The results indicate that a significant intermolecular O exchange occurs at temperatures as low as -33°; at 120-160° equilibrium is almost attained within a pumping time of 52 hours. The desorbed gas collected at 120-160° contained almost 50% CO_2; this gas was in isotopic equilibrium with the CO.

1251

IONIC HYDRATION: AN ISOTOPIC FRACTIONATION TECHNIQUE. Harold M. Feder and Henry Taube. J. Chem. Phys. 20, 1335-6(1952). C.A. 46, 10797h.

The connection between ionic hydration and fractionation of the O isotopes of H_2O has been investigated. Enrichment of CO_2 by the reaction H_2O^{18} (l) + $CO_2(g)^{16}$ = H_2O^{16} (l) + CO^{16} O^{18}(g) was measured at 4 and 25° in various chloride and perchlorate solutions. The enrichment effect varies with ionic charge, radius, and type in a qualitatively reasonable way.

1252

CATALYSIS ON EVAPORATED FILMS. I. THE EFFICIENCY OF DIFFERENT METALS FOR THE REACTION BETWEEN AMMONIA AND DEUTERIUM. C. Kemball. Proc. Roy. Soc. (London) A214, 413-26(1952). C.A. 46, 10820f.

The exchange reaction between NH_3 and D_2 has been followed on evaporated metal films of Pt, Rh, Pd, Ni, W, Fe, Cu, and Ag by means of a mass spectrometer. In all cases NH_2D was the initial product. The energies of activation varied from 5.2 kcal/mole for Pt to 14.1 kcal/mole for Ag and can be correlated with the work functions of the metals. The catalysis of the exchange reaction by films of oxidized Cu, W, Ni, and Zn was also investigated.

1253

MASS-SPECTROMETRIC DETERMINATION OF THE HYDROGEN-TRITIUM EQUILIBRIUM. H. C. Mattraw, C. F. Pachucki, and Leon M. Dorfman. J. Chem. Phys. 20, 926(1952). C.A. 46, 10865d.

The equilibrium constant of the reaction $H_2 + T_2 \rightleftharpoons 2HT$ has an average experimental value at 28° of 2.87 ± 0.06. The theoretical value is 2.57 at 25°.

1254

DISPROPORTIONATION IN DEUTERIATED AMMONIA. D. F Stedman. J. Chem. Phys. 20, 718-21(1952). C.A. 46, 10890e.

Infrared absorption spectra indicate that in NH_3 containing equal molar proportions of D and H, the proportions of the various species appear to depart very seriously from what would be expected if all configurations are equally probable.

1255

THERMODYNAMIC EFFICIENCY OF CONTINUOUS ISOTOPE SEPARATION PROCESSES. G. Dickel. Z. physik Chem. 197, 197-227(1951). C.A. 46, 10916h.

The very low efficiency of all present-day separation methods is due both to mechanical losses and to irreversible processes concomitant with the separation procedure. A calculation is made of these latter thermodynamic losses. A general formula is derived for the thermodynamic efficiency of separation methods based on diffusion and exchange processes. Applied to the special cases of thermodiffusion and pressure diffusion, this formula reveals a well-defined maximum in the efficiency curves, which depends on the dimensions of the apparatus. A comparison with experimental data, while confirming the basic results of the calculation, shows that the efficiency of existing methods is 100 times as low as the maximum attainable according to the theory.

1256

CONCENTRATION OF $OXYGEN^{18}$ BY CHEMICAL EXCHANGE. Worthy T. Boyd and Robert R. White. Ind. Eng. Chem. 44, 2202-7 (1952). C.A. 46, 10918c.

A study of a system for O^{18} concentration using the exchange reaction between dissolved CO_2 and H_2O to which NH_3 has been added. The enriched CO_2 is withdrawn from the top of a packed reflux column and reduced with H_2 over a catalyst

to form methane and H_2O, the latter being condensed and returned to the column as the reflux. The effect of NH_3 concentration, temperature and pressure on the concentration of O^{18} and its rate of production was determined. Results are given in terms of separation factor or relative volatility and the height of column packing equivalent to an equilibrium stage.

1257

INTERCHANGE OF FISSION-PRODUCT BROMINE WITH CARRIER BROMINE. Andrew F. Stehney and Nathan Sugarman. J. Chem. Phys. 20, 629-31(1952). C.A. 46, 10925i.

Experiments on the interchange of the fission products 2.4-hr Br^{83} and 55.6-sec Br^{87} with carrier bromine have been performed. Essentially the same degree of interchange is effected by the following chemical procedures: carrier added as BrO_3^- and reduced by H_2S; carrier added as BrO_3^- and reduced by excess carrier Br^-; and carrier added as Br^- to HCl and irradiated uranium metal dissolved.

1258

A DEUTERIUM ELECTROLYSIS PLANT. J. T. Lloyd. J. Sci. Instruments 29, No. 5, 164-5(1952). C.A. 46, 10965a.

An apparatus for conducting D_2 from an electrolysis cell to a receiver through a Hg-covered sintered glass dish is described.

1259

SOME APPLICATIONS OF DEUTERIUM AND OF HEAVY OXYGEN TO THE CHEMISTRY OF SILICON. I. G. Khaskin. Doklady Akad. Nauk S.S.S.R. 85, 129-32(1952). C.A. 46, 10999a.

No isotopic exchange was observed between $HSiEt_3$, $HSiPh_3$, or $HSi(OEt)_3$ and D_2O, EtOD, or Et_2ND, even on 146 hours heating at 118° with solutions of acids or bases in D_2O or EtOD. Exchange was observed of O^{18} between compounds of the type R_3SiOH and acid or basic solutions of H_2O at 100° after times of 1-5 hours. Silica gel dries at 400° exchanges both the O of the structural H_2O, and the nonhydroxyl O when heated in a sealed tube with H_2O^{18}. No D exchange was found at 100° between $Si(OCOMe)_4$ and AcOD. In the presence of AcONa exchange does occur.

1260

ISOTOPE EFFECTS IN THE EXCHANGE REACTION BETWEEN UNCOMPLEXED CARBONATE-BICARBONATE IONS AND CARBONATE-BIS-ETHYLENEDIAMINE-COBALT (III) ION. Peter E. Yankwich and John E. McNamara. J. Chem. Phys. 20, 1325(1952). (AECU-2074). C.A. 46, 11004b.

The exchange reaction, $Co(en)_2C^nO_3^+ + HC^xO_3^- = HC^nO_3^- + Co(en)_2C^xO_3^+$ where x is 13 or 14 and n represents the normal mixture of stable carbon isotopes, has been studied at 25.0°. The equilibrium constants found are: C^{13} exchange $0.99_1 \pm 0.01_4$; C^{14} exchange $0.99° \pm 0.01_8$. The average ratio of rates of exchange was $1.03_3 \pm 0.02_8$, the lighter isotope exchanging the more rapidly.

1261

AN EXCHANGE STUDY OF TRIS(5,6-DIMETHYL 1, 10-PHENANTHROLINE-) COMPLEXES OF FERROUS AND FERRIC IRON. L. Eimer and A. I. Medalia. [nd.] 25p. (BNL-1022). NSA 6, 85.

Electron-transfer exchange reactions of ferrous and ferric phenanthroline have been studied by a tracer technique using Fe^{55} and Fe^{59}. It is concluded that, with an extraction technique of separation, complete exchange is found between ferroin-5,6 and ferriin-5,6 within 15 sec at 0° at concentrations of 2.1×10^{-5} formal in each species.

1262

THE SEPARATION OF ISOTOPIC MIXTURES BY MEANS OF ULTRASONIC RADIATION: SUMMARY REPORT. C. A. Boyd, J. O. Hirschfelder and C. F. Curtiss. Jan. 3, 1951. 37p. (NP-3486). NSA 6, 286.

Section I summarizes a literature survey and presents all of the known treatments of the effect of sound on mixtures. Section 2 presents the theoretical treatment of isotope separations by ultrasonic radiation. Section 3 reports the verification here of experiments which have been discussed in the literature and have been described as producing separation. In the case of separation in liquid solutions it was found that the effects were due to thermal diffusion rather than ultrasonic separation, and this is also apparently true in the case of gas diffusion. Additional experimental work, coupling ultrasonics with the electrolytic separation of hydrogen and deuterium, was found to decrease the separation factor rather than increase it.

1263

THE ELECTROLYTIC SEPARATION OF LITHIUM ISOTOPES. J. I. Hoover and G. E. Holloway. Nov. 2, 1951. 9p. (NRL-3897). NSA 6, 946.

The lithium isotopes were separated by the electrolysis of molten $LiNO_3$ utilizing regeneration of the salt at the electrode as a reflux mechanism. The ratio of Li^7 to Li^6 was increased from its normal value of 12.7 to 21.22 in about 200 hr of running at low current density. The method is simple and could be adapted to continuous operation.

1264

SEPARATION OF STABLE ISOTOPES, p. 244-71 of THE ROLE OF ENGINEERING IN NUCLEAR ENERGY DEVELOPMENT; THIRD ANNUAL OAK RIDGE SUMMER SYMPOSIUM AUGUST 27 TO SEPTEMBER 7, 1951. Manson Benedict. Dec. 1951. (TID-5031 p. 244-271). NSA 6, 1282.

A list of the isotopes of principal technical interest and the processes which have been used to separate the isotopes are given. The processes described are mass spectrometer, molecular distillation, electrolysis, gaseous diffusion, mass (or sweep) diffusion, thermal diffusion, chemical exchange, and gas centrifuge. Some of the novel characteristics of isotope separation plants are mentioned, with a few general conclusions regarding isotope separation.

1265

THERMAL DIFFUSION WITH BORON TRIFLUORIDE. W. W. Watson, J. O. Buchanan, and F. K. Elder, Jr. [nd.] Decl. Feb. 25, 1947. 9p. (NP-3662). NSA 6, 2129.

1266

EXCHANGE BETWEEN LABELLED HALOGENS AND CERTAIN INORGANIC HALIDES, PROGRESS REPORT. Rowland E. Johnson. [nd.] 9p. (ORO-61). NSA 6, 2596.

HCl solutions containing Cl^{36} were oxidized with MnO_2 in H_2SO_4. The Cl_2^{36} so obtained exchanged completely with $TeCl_4$ in the vapor phase in 5 minutes. A half time of exchange of 3 sec. or less at room temperature was found for Cl_2^{36} and $TeCl_4$ in benzene solution. Exchange experiments between PCl_5 and Cl_2^{36} in CCl_4 solution

showed about 20% exchange in 10 sec. at room temperature. Exchange between Cl_2^{36} and CCl_4 showed a first-order dependence on the amount of light, with a half time of exchange of 5 hr when illuminated by a carbon arc at room temperature.

1267
SEPARATION OF ISOTOPES BY CHEMICAL EXCHANGE IN THERMAL DIFFUSION COLUMNS; ANNUAL PROGRESS REPORT. W. P. Senett, R. W. Pierce, F. Gollob and T. I. Taylor. Aug. 20, 1951. 46p. (NYO-624). NSA 6, 3253.

Preliminary work is described in a study of the concentration of isotopes by chemical exchange in thermal diffusion columns. Experiments on thermal diffusion of the individual and mixed components of the $CO-CO_2$ and $NO-NO_2$ systems are summarized. Included is a discussion of the theory of the separation of isotopes by chemical exchange in thermal diffusion columns.

1268
A REVIEW OF THE PROPERTIES OF DEUTERIUM COMPOUNDS: ANNUAL BIBLIOGRAPHY—1946. Lawrence M. Brown and Charles W. Beckett. May 1, 1952. 40p. (NBS-1527). NSA 6, 4417.

The first of a series of annual bibliographies of published research on the isotopes of hydrogen and their compounds compiled from Chemical, British, and Physics Abstracts for the year 1946. The bibliography is supplemented by a compound and a subject index. The arrangement parallels that of a similar bibliography compiled by Kimball for the period 1932 to 1945 inclusive.

1269
A REVIEW OF THE PROPERTIES OF DEUTERIUM COMPOUNDS: ANNUAL BIBLIOGRAPHY—1947. Lawrence M. Brown and Charles W. Beckett. June 1, 1952. 61p. (NBS-1631). NSA 6, 5325.

One of a series of annual bibliographies of published research on the isotopes of hydrogen and their compounds compiled from Chemical, British, and Physical Abstracts for the year 1947. The bibliography is supplemented by a compound and a subject index. The arrangement parallels that of a similar bibliography compiled by Kimball for the period 1932 to 1945 inclusive.

1270
A REVIEW OF THE PROPERTIES OF DEUTERIUM COMPOUNDS: ANNUAL BIBLIOGRAPHY—1948. Lawrence M. Brown and Charles W. Beckett. July 21, 1952. 78p. (NBS-1685). NSA 6, 5326.

One of a series of annual bibliographies of published research on the isotopes of hydrogen and their compounds compiled from Chemical, British, and Physics Abstracts for the year 1948. The bibliography is supplemented by a compound and a subject index. The arrangement parallels that of a similar bibliography compiled by Kimball for the period 1932 to 1945 inclusive.

1271
EQUILIBRIUM TIME FOR A SQUARE CASCADE. D. W. Burton. June 30, 1952. 139p. (K-925). NSA 6, 5423.

The report contains a table of equilibrium times for short square plants. This equilibrium time is defined by the relation, if T is the equilibrium time,

$$\frac{x(N,T)-x(0,T)}{x(N,\infty)-x(0,\infty)} = 1-\epsilon$$

where ϵ has the values 0.02, 0.01, 0.005. The numerator is the difference between the top-stage concentration and the bottom-stage concentration at time T. The denominator is the same difference at steady-stage. In the appendices the mathematical treatment is shown, and for the simple case of no top or bottom sampling drums, it is also shown that the equilibrium time derived by a linear problem differs slightly from the equilibrium time derived from a more exact equation. Thus the table can be used for the complete range of concentrations.

1272
A REVIEW OF THE PROPERTIES OF DEUTERIUM COMPOUNDS: ANNUAL BIBLIOGRAPHY—1949. L. M. Brown, J. M. Goldstein, and C. W. Beckett. Aug. 1, 1952. 74p. (NBS-1721). NSA 6, 5997.

One of a series of annual bibliographies of published research on the isotopes of hydrogen and their compounds compiled from Chemical, British, and Physics Abstracts for the year 1949. The bibliography is supplemented by a compound and a subject index. The arrangement parallels that of a similar bibliography compiled by Kimball for the period 1932 to 1945 inclusive.

1273
A REVIEW OF THE PROPERTIES OF DEUTERIUM COMPOUNDS: ANNUAL BIBLIOGRAPHY—1950. Lawrence M. Brown, Jack M. Goldstein, John L. Park and Charles W. Beckett. Sept. 1, 1952. 112p. (NBS-1777). NSA 6, 6552.

One of a series of annual bibliographies of published research on the isotopes of hydrogen and their compounds compiled from Chemical, British, and Physics Abstracts for the year 1950. The bibliography is supplemented by a compound and a subject index. The arrangement parallels that of a similar bibliography compiled by Kimball for the period 1932 to 1945 inclusive.

1274
ISOTOPES. Jacob Bigeleisen. Ann. Rev. Phys. Chem. 3, 39-56 (1952). C.A. 47, 11f.

This literature review for the calendar year 1951 covers studies of the physical state and chemical properties of matter affected by the nuclear mass. The phases discussed are mass measurements, abundances, separation, effects on phase equilibrium, effects in chemical equilibria, effects in chemical kinetics, effects on mass spectra, and shifts in atomic and molecular spectra. 129 references.

1275
THE CHEMISTRY OF THE ISOTOPES OF OXYGEN. Malcolm Dole. Chem. Revs. 51, 263-300(1952). C.A. 47, 12d.

A review with 121 references is presented.

1276
DISSOLVING VELOCITY OF METALS IN DEUTERIO-ELECTROLYTES. I AND II. Jomar Brun. Acta Chem. Scand. 5, 1402-4 (1951); Kgl. Norske Videnskab. Selskab. Forh. 24, 114-17, 118-21 (1951). C.A. 47, 34d and 9112g.

Ni dissolved more rapidly in HCl than DCl. Zinc dissolved more slowly in D containing acids than in the H containing acid of equal concentration. Fe and Cu corrode more slowly in D_2O than in H_2O, while for Al the opposite is true. High purity Al wire dissolved half as rapidly in D_2SO_4 (99%) as in

H_2SO_4. The opposite was true with DCl and HCl. Solution of Al in KOD was slower than in KOH. Mild steel and pure Fe dissolved more slowly in DCl than HCl.

1277

MEASURING DIFFERENCES IN O^{18} CONTENT OF SILICATE ROCKS. Peter Baertschi and H. Schwander. Helv. Chim. Acta 35, 1748-51(1952). C.A. 47, 78c.

The silicate is made to react with C at 2000° in a high-vacuum resistance furnace, and the CO produced is passed through a double-collector mass spectrometer the O^{18}/O^{16} ratio being determined within ± 0.06%.

1278

VAPOR PRESSURE OF He^3-He^4 MIXTURES BELOW THE λ-POINT. H. S. Sommers, Jr. Phys. Rev. 88, 113-27 (1952). C.A. 47, 372f.

The He^3 concentrations ranged up to 80% for the vapor phase and 13% for the liquid phase and the temperature interval was 1.30-2.18°K. On the basis of classical solution theory, the mutual repulsive potential energy should lead to a separation into two liquid phases near 0.7°K.

1279

MECHANISM OF THE EXCHANGE BETWEEN ALKYL HALIDES AND METAL HALIDES. M. B. Neĭman, G. V. Maksimova, and Yu. M. Shapovalov. Doklady Akad. Nauk S.S.S.R. 85, 1289-92(1952). C.A. 47, 388h.

The mechanism of the exchange reaction $RX + MX^* \rightleftharpoons RX^* + MX$ is discussed where R = alkyl, M = metal and X = halogen. Three possible paths are proposed and rate laws derived.

1280

MASS AND RELATIVE ABUNDANCE OF ISOTOPES. Alfred O. Nier. p.137-56 of Annual Review of Nuclear Science, Vol. I. Stanford, California. Annual Reviews Inc. 1952. C.A. 47, 409f.

Isotopic masses and abundances determined in 1950 by various methods are reviewed. New methods of mass analysis are described. 87 references.

1281

ELECTROMAGNETIC SEPARATION OF STABLE ISOTOPES. C. P. Keim. p.263-93 of Annual Review of Nuclear Science, Vol. I. Stanford, California. Annual Reviews Inc. 1952. C.A. 47, 409g.

Calutron separation of isotopes, ion sources, isotope collectors, charge materials for production of ions, operation procedures, chemical purification of separated isotopes, chemical and mass analysis of separated isotopes, number of isotopes processed and enriched in the calutron, and uses of stable isotopes are reviewed. 215 references.

1282

CHEMICAL SEPARATION OF STABLE ISOTOPES. G. H. Clewett. p.293-300 of Annual Review of Nuclear Science, Vol. 1. Stanford, California. Annual Reviews Inc. 1953. C.A. 47, 409h.

1283

HYDROGEN EXCHANGE OF SATURATED HYDROCARBONS UNDER INFLUENCE OF SULFURIC ACID. V. N. Setkina, D. N. Kursanov, O. D. Sterlingov, and A. L. Liberman. Doklady Akad. Nauk S.S.S.R. 85, 1045-8 (1952). C.A. 47, 851f.

The hydrocarbons were mixed with D-enriched H_2SO_4 in molar ratios of 1:1 to 1:3 and shaken at 22-5°. Results are given for various saturated hydrocarbons. Generally very little exchange occurs with hydrocarbons having only primary and secondary C atoms; those with tertiary C atoms react rapidly and all H atoms participate.

1284

EFFECT OF ISOTOPIC SUBSTITUTION ON THE COLLISION PROPERTIES OF THE CARBON DIOXIDE MOLECULE. E. W. Becker and W. Beyrich. J. Phys. Chem. 56, 911-13(1952). C.A. 47, 929i.

The collision properties of symmetrically and unsymmetrically substituted CO_2 molecules have been investigated by means of the thermal diffusion method. A difference of 70° was found between the thermal-diffusion reversing temperatures of the pairs $O^{16}C^{13}O^{16}/O^{16}C^{12}O^{16}$ and $O^{16}C^{12}O^{17}/O^{16}C^{12}O^{16}$, the partner of the common $O^{16}C^{12}O^{16}$ being equal in mass but different in symmetry. The difference may be due to the quantum-mechanical symmetry effect expected from theory.

1285

ISOTOPIC EXCHANGE BETWEEN THE VALENCE STATES OF MERCURY. Richard L. Wolfgang and Richard W. Dodson. J. Phys. Chem. 56, 872-6(1952). C.A. 47, 930b.

The rate of exchange between Hg^{2+} ion and the Hg_2^{2+} ion was found to be immeasurably fast in perchloric acid solutions using radioactive Hg^{203}. In the presence of cyanide ion the rate was slowed.

1286

ISOTOPE EXCHANGE REACTION OF FLUORINE WITH HALOGEN FLUORIDES. Richard B. Bernstein and Joseph J. Katz. J. Phys. Chem. 56, 885-8(1952). (AECU-1904; UAC-5051). C.A. 47, 953d.

The rates of exchange of ClF_3, BrF_5 and IF_7 with F_2 were measured for temperatures from 25-300° using F^{18}. At room temperature the exchange is essentially zero but reaches equilibrium within a few minutes at the higher temperature. The exchange was found to be essentially homogeneous and mechanisms postulated.

1287

THEORY OF ELECTRON EXCHANGE REACTIONS IN AQUEOUS SOLUTION. W. F. Libby. J. Phys. Chem. 56, 863-6(1952). C.A. 47, 970d.

Quantum mechanics and the Franck-Condon principle are applied to exchange equilibria. Catalysis of electron exchange by complexing of the exchanging ions is discussed.

1288

CATALYSIS OF THE CEROUS-CERIC ELECTRON EXCHANGE BY FLUORIDE. H. C. Hornig and W. F. Libby. J. Phys. Chem. 56, 869-71(1952). C.A. 47, 970h.

At −14.5°, with no F^- present, the half time is nearly 4 hours. The addition of 10^{-6}M F^- doubles the exchange rate.

1289

ISOTOPIC COMPOSITION OF OXYGEN IN MINERALS OF SKARN ORIGIN. A. P. Vinogradov and E. I. Dontsova. Doklady Akad. Nauk S.S.S.R. 85, 1341-3(1952). C.A. 47, 1014b.

Fe-bearing minerals of skarn origin have a higher content of O^{18} than sedimentary minerals.

1290

THE SEPARATION OF ISOTOPES BY FRACTIONAL DISTILLATION. I. FRACTIONATING COLUMNS FOR THE ENRICHMENT OF THE HEAVY ISOTOPES OF OXYGEN IN WATER. I. Dostrovsky, D. R. Llewellyn, and B. H. Vromen. J. Chem. Soc. 3509-17(1952). C.A. 47, 1434g.

The construction and operation of a number of improved fractionating columns designed for the enrichment of the heavy isotopes of O in H_2O are described. These columns have been in operation for several years and are capable of producing per day, 200 ml of 0.6% H_2O^{18} or 50 ml of 1.7% H_2O^{18} or 20 ml of 3.2% H_2O^{18}. Several of these columns have been operating with efficiencies equivalent to 400-600 theoretical plates.

1291

THE SEPARATION OF ISOTOPES BY FRACTIONAL DISTILLATION. II. DETERMINATION OF PARAMETERS FROM PRODUCTION DATA. VALUE OF THE UNIT PROCESS SEPARATION FACTOR FOR THE $H_2^{16}O-H_2^{18}O$ SYSTEM. I. Dostrovsky, J. Gillis, D. R. Llewellyn, and B. H. Vromen. J. Chem. Soc. 3517-24(1952). C.A. 47, 1434h.

Application of the theory of fractional distillation to the data obtained in the production of enriched isotopic materials makes it possible to derive simultaneously the values for the unit process separation factor, α, and the effectiveness of the column for the system used. A graphical method is presented which facilitates the derivation of such information from experimental data. The values of the unit process separation factor have been determined from the results of fractionation of water; for $H_2O^{16}-H_2O^{18}$ $\alpha = 1.0065$; and for H_2O-HDO, $\alpha = 1.038$.

1292

ISOTOPIC EXCHANGE REACTIONS IN ACETIC ACID AND ACETIC ANHYDRIDE. Ersel A. Evans, J. L. Huston, and T. H. Norris. J. Am. Chem. Soc. 74, 4985-91(1952). C.A. 47, 1472d.

Rapid exchange occurs between radiocarbon-labeled NaOAc and solvent HOAc. Rapid exchange occurs between HoAc and dissolved $Pb(OAc)_4$ and $Pb(OAc)_2$ and between Ac_2O and dissolved $Pb(OAc)_4$. Slow exchange occurs between HOAc and Ac_2O and between Ac_2O and dissolved AcCl. Appreciable heterogeneous exchange occurs between solid NaOAc and Ac_2O. No electronic exchange occurred in 4 hours at 80° between $Pb^*(OAc)_4$ and $Pb(OAc)_2$ in HOAc.

1293

EXCHANGE REACTIONS OF SULFUR ATOMS IN POLYSULFIDES. E. N. Gur'yanova, Ya. K. Syrkin, and L. S. Kuzina. Doklady Akad. Nauk S.S.S.R. 86, 107-10(1952). C.A. 47, 1475f.

A mixture of inactive Et_2S_4 and tagged Et_2S_3 (EtSS*SEt) was heated 2 hours at 95-100° under N_2. Analysis of the products showed the Et_2S_4 to have become radioactive almost to equilibrium on the basis of 2S atoms exchanged in Et_2S_4. The exchange proceeded according to EtSS*SEt + Et_2S_4 = Et_2S_3 + EtSSS*SEt. In inorganic polysulfides all the S atoms were found to be equivalent by decomposition of tagged Na_2S_2, Na_2S_3, and Na_2S_4.

1294

A COMPARISON OF THE MAGNITUDES OF THE ISOTOPE INTERMOLECULAR EFFECTS IN THE DECARBOXYLATIONS OF MALONIC-1-C^{14} ACID AND MALONIC-2-C^{14} ACID AT 154°. Gus A. Ropp and Vernon F. Raaen. J. Am. Chem. Soc. 74, 4992-4(1952). C.A. 47, 1476d.

By a method involving measurement of the rate of change with time of the logarithm of the specific activity of unchanged malonic acid, the isotope effect, k_{14}/k_{12}, in the decarboxylation of malonic-2-C^{14} acid at 154° has been shown to have a value of 0.929. For decarboxylation of malonic-1-C^{14} acid under the same conditions the value of k_{14}/k_{12} was found to be 0.939.

1295

EQUILIBRIUM BETWEEN PROTIUM, DEUTERIUM AND TRITIUM IN THE SYSTEM: HYDROGEN-ACETIC ACID; ISOTOPIC FRACTIONATION FACTORS IN A CATALYTIC HYDROGENATION. Maxwell Leigh Eidinoff, Joseph E. Knoll, David K. Fuknshima, and T. F. Gallagher. J. Am. Chem. Soc. 74, 5280-4(1952). C.A. 47, 1477f.

Isotopic distribution coefficients in the equilibria at 25°C of H_2 + AcOH'(l) → HH' + AcOH(l) have been measured, where H' refers to deuterium and tritium. Equilibrium constants were calculated for the corresponding gas reactions. This isotopically equilibrated hydrogenation system was used in the presence of Pt catalyst to saturate the double bond in methy 3 α-acetoxy-Δ''-cholenate. The results indicate that the exchange between dissolved and carboxyl hydrogen at the catalyst surface is rapid relative to the hydrogenation steps. Relative to the hydrogen gas composition the heavier isotopes are preferentially incorporated into the compound undergoing hydrogenation by a factor of 1.10 and 1.26 for deuterium and tritium respectively. Relative to the carboxyl hydrogen composition protium is preferentially incorporated by a factor of 3.31 and 5.42 with respect to deuterium and tritium, respectively.

1296

EXCHANGE OF Br^{80} ATOMS WITH BROMOÖLEFINS; INDUCED REARRANGEMENT OF THE BROMOPROPENES. Russell R. Williams, Jr., William H. Hamill, Harold A. Schwarz, and Elliott J. Burrell. J. Am. Chem. Soc. 74, 5737-9(1952). C.A. 47, 1503c.

It has been found that various bromoölefins, present to the extent of a few mole per cent in ethyl bromide or bromobenzene during neutron bombardment, undergo an efficient isotopic exchange reaction with the nascent Br^{80}. The ratio of the rates of such exchange with allyl bromide and α, β-di-bromoethylene has been measured over a range of temperatures. Isomerization also occurs among the three bromopropenes.

1297

THE SIGNIFICANCE OF ISOTOPIC REACTIONS IN RATE THEORY. Henry Eyring and F. Wm. Cagle, Jr. J. Phys. Chem. 56, 889-92(1952). C.A. 47, 2021g.

The general theory of the isotopic effect on reaction rates is developed in terms of the absolute rate theory. From a knowledge of the partition function of the reacting components the separation factor can be calculated. Examples are given for the separation of H and D by the electrolysis of water and by the hydrolysis of Al_4C_3. The dehydration of formic acid containing C^{14} and C^{13} with H_2SO_4, the oxidation of $MeC^{14}O_2H$ and the dissociation of CCl_3H and CCl_3D are treated.

1298

THE EFFECTS OF ISOTOPIC SUBSTITUTIONS ON THE RATES OF CHEMICAL REACTIONS. Jacob Bigeleisen. J. Phys. Chem. 56, 823-8(1952). C.A. 47, 2021i.

After a review of the theory, the theoretical values of the reaction rates of several intra-and intermolecular reactions were calculated. Good agreement was obtained with published experiments when the broken bonds contained: C^{12}, C^{13}, C^{14}, N^{14}, N^{15}, O^{16}, and O^{18}. Discussed are: The decarboxylation of malonic acid, the dehydration of oxalic acid, the deammoniation of phthalamide and base-catalyzed reactions of the carbonyl group like the hydrolysis of Et benzoate, the Cannizarro reaction of benzaldehyde, the benzoin condensation, and the benzilic acid rearrangement.

1299

THE KINETICS OF THE EUROPIUM (II)-EUROPIUM (III) EXCHANGE REACTION. Dale J. Meier and Clifford S. Garner. J. Phys. Chem. 56, 853-7(1952). C.A. 47, 2023e.

The exchange between Eu(II) and Eu(III) in the presence of ClO^- and Cl^- was studied by means of a radioactive Eu tracer. The exchange is of 1st order in Eu(II), Eu(III), and Cl^- concentration. The rate determining step is believed to be an electron-transfer process between hydrated Eu^{++} and a hydrated $EuCl^{++}$ ion pair.

1300

THE EXCHANGE REACTION BETWEEN THE TWO OXIDATION STATES OF IRON IN ACID SOLUTION. Joseph Silvermann and R. W. Dodson. J. Phys. Chem. 56, 846-52 (1952). C.A. 47, 2023g.

The rate of exchange between Fe^{2+} and Fe^{3+} in $HClO_4$ and HCl solutions was measured at an ionic strength of

0.55f between 0° and 20° by counting the radiation of Fe^{55} in the chemically separated reaction products. Good agreement was obtained with the results of Linnenbom and Wahl (C.A. 43, 8272a) and Betts, et. al. (C.A. 45, 2317a).

1301

ELECTRON-TRANSFER PROCESSES AND THE OXIDATION-REDUCTION REACTIONS OF HEXACYANOFERRATE(III) ION IN AQUEOUS SOLUTION. Arthur W. Adamson. J. Phys. Chem. 56, 858-62(1952). C.A. 47, 2023i.

A general correlation between the rate of exchange of di-and trivalent ions and their magnetic moments is established. The electron exchange is slow for ion pairs of high magnetic moments, especially if there is a large difference in their absolute values.

1302

ISOTOPES. J. Bigeleisen, p.221-39 of ANNUAL REVIEW OF NUCLEAR SCIENCE, Vol. 2. Stanford, California. Annual Reviews Inc. 1953. C.A. 47, 2045d.

1303

NITROGEN ISOTOPES IN CHEMISTRY. B. A. Geller and G. P. Miklukhin. Uspekhi Khim. 21, 808-23 (1952). C.A. 47, 2053d.

Critical review with 95 references.

1304

ENRICHMENT OF ISOTOPES BY DIFFERENCE IN RATES FOR IRREVERSIBLE ISOTOPIC REACTIONS. Richard B. Bernstein. J. Phys. Chem. 56, 893-6(1952). C.A. 47, 2053e.

In a competitive isotopic reaction the over-all separation $S = (k/k^*)$, where k/k^* is the ratio of isotopic rate constants and N is the equivalent number of stages. $N = -\ln(1-f)$, where f is the fraction reacted. Experimental data on the pyrolysis of nickel carbonyl in a flow system and malonic acid in a static system give semi-quantitative confirmation of this result. A continuous flow method is proposed and discussed.

1305

PREPARATION OF RADIOACTIVE SODIUM METAL BY EXCHANGE OF $SODIUM^{23}$ AND $Na^{22}Cl$. Norman H. Nachtrieb, John A. Weil and Edward Catalano. J. Am. Chem. Soc. 74, 264 (1952) C.A. 47, 2054e.

Metallic radioactive Na was prepared by the reaction $Na^{23}(l) + Na^{22}Cl(s) \rightarrow Na^{22}(l) + Na^{23}Cl(s)$.

1306

THE ISOTOPE EFFECT IN THE DECOMPOSITION OF OXALIC ACID. A. Fry and M. Calvin. J. Phys. Chem. 56, 897-900(1952). (UCRL-1565). C.A. 47, 2055c.

The isotope effect in the decarboxylation of oxalic acid has been measured with both C^{13} and C^{14}. The results indicate a somewhat larger isotope effect in both cases than would be expected upon a simple mass-rate theory.

1307

ISOTOPE EFFECTS: REACTION AT THE CARBONYL GROUP. F. Brown and D. Alma Holland. Can. J. Chem. 30, 438-42(1952). C.A. 47, 2149h.

It is shown that benzophenone containing the $C^{14}O$ group reacts with 2,4 dinitrophenylhydrazine more than does ordinary benzophenone. The ratio of the rate constants is 1.099 ± 0.11 at 27.8°.

1308

THE EXCHANGE OF WATER BETWEEN $Co(NH_3)_5H_2O^{+++}$ AND SOLVENT. Aaron C. Rutenberg and Henry Taube. J. Chem. Phys. 20, 825-6(1952). C.A. 47, 2581a.

The half time for exchange is independent of salt concentration and of acidity over a range of these variables and is 24.5 hours at 27°. The half time is increased by SO_4^{2-}. The equilibrium quotient $[Co(NH_3)_5H_2O^{18\,3+}]$ $[H_2O]/[Co(NH_3)_5H_2O^{3+}]$ $[H_2O^{18}]$ was measured as 1.019 ± 0.001.

1309

DISPROPORTIONATION IN DEUTERIATED AMMONIA. Jacob Bigeleisen. J. Chem. Phys. 20, 1495-6(1952). C.A. 47, 2587d.

The results of Stedman (C.A. 46, 10890e) indicate that there is a marked deviation from statistical distribution of the H and D among the various isotopic species in deuteriated NH_3. These results are questioned on the basis of discrepancies between calculated and experimental equilibrium constants and other information. The disproportionation equilibrium reported by Stedman cannot be accepted as an exception to the rule of the geometric mean.

1310

SEPARATION OF ISOTOPES BY GASEOUS DIFFUSION. W. Groth and P. Harteck. Z. physik. Chem. 199, 114-24 (1952). C.A. 47, 3108a.

Diffusion coefficients in the principal component of all combinations of H_2, D_2, Ne, A, Kr, and Xe consisting of 1% of one gas with 99% of another were calculated by the Chapman-Enskog theory; values are tabulated, and the relative variation with mass ratios of the diffusing gases is graphed. Experimental results on 1% D_2 in 99% H_2, He, Ne, A, Kr, and Xe and 1% H_2, He, Ne, A, Kr, and Xe in 99% D_2 are presented.

1311

THERMAL DIFFUSION IN ISOTOPIC MIXTURES IN THE CRITICAL REGION F. E. Caskey and H. G. Drickamer. J. Chem. Phys. 21, 153-6(1953). C.A. 47, 3640g.

Thermal-diffusion ratios have been measured for the system $C^{14}O_2-CO_2$ in the temperature range −15° to +50° and to 160 atmospheres pressure. One isotherm at −15° has also been measured for the system $CH_4-CH_3H^3$ Results deviate completely from the predictions of the kinetic theory of Enskog and Chapman and correspond closely to the previous results for the xenon-ethane system. The thermodynamics of irreversible processes qualitatively predicts the results obtained.

1312

EQUILIBRIUM IN THE EXCHANGE OF DEUTERIUM BETWEEN AMMONIA AND HYDROGEN. Morris Perlman, Jacob Bigeleisen, and Norman Elliott. J. Chem. Phys. 21, 70-2 (1953). C.A. 47, 3667a.

Equilibrium in the reaction, $NH_3(g) + HD(g) = NH_2D(g) + H_2(g)$ was measured in the temperature range 210-295°K. The results were expressed by the relation $K = 0.972 \exp(509/T)$. The zero point energy difference between NH_3 and NH_2D was calculated to be 635 ± 3 cm^{-1}.

1313

ISOTOPIC EXCHANGE RATES AS A CRITERIA OF SURFACE HETEROGENEITY. R. P. Eischens. J. Am. Chem. Soc. 74, 6167-71(1952). C.A. 47, 3668g.

The exchange between gaseous CO and CO chemisorbed on iron has been studied with C^{14} tracer. The most weakly bonded CO exchanges the fastest. The exchange data show that the iron is heterogeneous. No C isotope effect was found in these experiments.

1314

KINETICS OF THE EXCHANGE OF $NITROGEN^{15}$ BETWEEN $NITROGEN^{15}$ PEROXIDE AND NITROGEN PENTOXIDE. Alexander R. Amell and Farrington Daniels. J. Am. Chem. Soc. 74, 6209-12(1952). C.A. 47, 3668i.

The rate of the exchange reaction $N^{15}O_2 + N_2O_5 \rightarrow NO_2 + N^{15}NO_5$ in the gas phase is determined at −9, 0, and 10° using chemical separations and a mass spectrometer. The

equation $k = 6.0 \times 10^{12} C^{-19,000/RT}$ describes the rate constant. The first step in the reaction is concluded to be $N_2O_5 \rightarrow NO_2 + NO_3$. Qualitative experiments show an increase in the rate of decomposition of N_2O_5 in the presence of gaseous reducing agents.

1315

A THEORETICAL EVALUATION OF THE NITROGEN ISOTOPE EFFECT IN THE THERMAL DEAMMONIATION OF PHTHALAMIDE. Jacob Bigeleisen. Can. J. Chem. 30, 443-7(1952). C.A. 47, 3821e.

It is estimated from theoretical considerations that N^{15}-phthalamide should liberate NH_3 more rapidly than N^{14}-phthalamide. The difference is estimated to be less than 3% in agreement with experiment.

1316

THE CONCENTRATION OF NITROGEN^{15} BY COUNTER-CURRENT GASEOUS EXCHANGE. Wm. Spindel. Univ. Microfilms (Ann Arbor, Mich.), Pub. No. 4616, 79 pp. Dissertations Abstracts 13, 18(1953). C.A. 47, 4154d.

1317

IODINE EXCHANGE BETWEEN SODIUM IODIDE AND ETHYL IODIDE IN ACETONITRILE AS SOLVENT: COMPARISON WITH VARIOUS RESULTS IN ETHANOL. Serge May and Bernard Giraudel. Compt. rend. 235, 953-5(1952). C.A. 47, 4177g.

The reaction rate is 20 to 35 times as great as in EtOH. The reaction is bimolecular as in EtOH with an activation energy of 18 kcal/mol compared with 19 to 21 kcal/mol in EtOH.

1318

KINETICS OF ISOTOPIC EXCHANGE REACTIONS BETWEEN IODIDE ION AND VARIOUS ALIPHATIC, CYCLIC, AND AROMATIC IODIDES. Serge May, Antonino Fava, and Bernard Giraudel. Compt. rend. 236, 286-8(1953). C.A. 47, 4177h.

By comparison with the relative simplicity of the bimolecular exchange reactions between iodide ion and various aliphatic and cyclic iodides, those involving aromatic iodides are found to be complex.

1319

THE VAPOR PRESSURE OF He^3-He^4 MIXTURES. Raymond A. Nelson and William Band. Phys. Rev. 88, 1431 (1952). C.A. 47, 4190g.

The saturated vapor pressures of He^3 and He^4 were calculated from theory.

1320

MODERN MASS SPECTROMETRY. G. P. Barnard. Institute of Physics (London) 324(1953). C.A. 47, 4207b.

Book.

1321

THE EXCHANGE OF HYDROGEN GAS WITH LITHIUM AND SODIUM BOROHYDRIDES. W. G. Brown, L. Kaplan, and K. E. Wilzbach. J. Am. Chem. Soc. 74, 1343-4(1952). C.A. 47, 4686b.

The direct exchange of solid borohydrides with H provides a simple route to the isolation of isotopic compounds. The exchange occurs at a convenient rate with $LiBH_4$ at 200° and $NaBH_4$ at 350°.

1322

STABILITY OF COMPLEX COMPOUNDS AND EXCHANGE REACTIONS. A. A. Grinberg and L. E. Nikol'skaya. Zhur. Priklad. Khim. 24, 893-903(1951). C.A. 47, 4709a.

Experimental measurements were made of rates of isotopic exchange with solutions of $[Pt(CN)_4]^{--}$ vs $(CN^*)^-$; $[PtCl_4]^{--}$ vs $(Cl^*)^-$: $[PtBr_4]^{--}$ vs $(Br^*)^-$; and $[PtI_4]^{--}$ vs $(I^*)^-$. Exchange was observed in all these systems but with very different rates. The times necessary to obtain equilibrium distribution of the activity were for CN^- 5, I^- 25, Br^- 40 minutes while with Cl^- only 11% exchange was achieved in 60 minutes. Mechanisms are discussed.

1323

ISOTOPE ENRICHMENT BY THE PHOTOEXCITATION OF SPECIFIC ISOTOPES. C. C. McDonald and H. E. Gunning. J. Chem. Phys. 20, 1817 (1952). C.A. 47, 4748h.

Dry air saturated with Hg vapor at 25° and 8 mm pressure was irradiated with light from a Hg^{198} electrodeless discharge tube operated at 150°. Mass spectrometer analysis of the HgO formed showed changes in the % of various isotopes present.

1324

METHODS OF INCREASING THE EFFICIENCY OF THERMAL DIFFUSION COLUMNS. W. W. Watson. Z. Physik 133, 272-5(1952). (NYO-3020). C.A. 47, 4756h.

Experience with construction details and operation of thermal diffusion columns for isotope separation is cited and recommendations are made for the improvement of their efficiency.

1325

NONRADIOGENIC ISOTOPES IN GEOLOGY: A REVIEW. Earl Ingerson. Bull. Geol. Soc. Am. 64, 301-73(1953). C.A. 47, 4810a.

An extensive, detailed review is presented on the relation of isotopic conpositions of numerous elements to their geologic origin, processes of isotopic fractionation in native, and geological problems to which stable isotopes may be applied. ~250 references.

1326

ISOTOPE SEPARATION BY RADIOFREQUENCY ELECTRIC FIELD. Nobuhiko Yamamuro. J. Phys. Soc. Japan 6, 411-13(1951). C.A. 47, 5188g.

Li isotopes were separated by applying a radiofrequency field to an ion beam initially uniformly accelerated. An ion current of 2.7×10^{-8} amp of Li^7 was obtained with small-size low-cost apparatus.

1327

EXCHANGE REACTIONS OF Co^{60} BETWEEN SOLID COBALT COMPOUNDS AND SOLUTIONS. W. Buser, W. Feitknecht, and V. Imobersteg. Helv. Phys. Acta 25, 618-21 (1952). C.A. 47, 5229c.

The observed rates depended on the crystal structure of the compounds studied.

1328

ELECTROMAGNETIC SEPARATOR FOR THE ISOTOPES OF THE LIGHT AND MEDIUM-MASS ELEMENTS. René Bernas. J. phys. radium 14, 34-42 (1953). C.A. 47, 5263e.

A magnetic separator was used to separate the isotopes of Zn, Sb, and Hg. With a 60° magnetic field and a hot-cathode source between 10 and 100 mg were obtained in 24 hours.

1329

MEASUREMENT OF ISOTOPIC RATIOS AND ITS POSSIBLE APPLICATIONS TO VOLCANOLOGY. J. Noetzlin. Bull. volcanol. 12, 115-25(1952). C.A. 47, 5322d.

H from volcanic rock and hot springs gave normal isotopic ratios. The S^{32}/S^{34} ratio was higher in 2 samples of non-volcanic origin than in 6 samples of volcanic origin.

1330

STUDIES ON ISOTOPES—PART I—THE ISOTOPIC COMPOSITION OF WATER WHICH HAS BEEN ENRICHED IN HEAVY ISOTOPES BY FRACTIONATION. H.A.E. Mackenzie and A. M. Milner. J. S. African Chem. Inst. 4, 57-62 (1951). C.A. 47, 5742d.

An attempt has been made to obviate the need for determining experimentally the individual contributions of HDO and

H_2O^{18} to the excess density of water samples which have been enriched in heavy isotopes by fractionation. The theory leads to the conclusion that the platage of a fractionating column is greater for the separation of H_2O^{16} and H_2O^{18} than it is for the separation of H_2O and HDO. By introducing a single parameter, whose value is determined empirically into the theory of the enrichment process, it is possible to calculate the composition of water which is derived from natural water by distillation processes only, provided that its density is known.

1331

STUDIES ON ISOTOPES. PART II. THE APPROACH TO ISOTOPIC EQUILIBRIUM DURING FRACTIONAL DISTILLATION WITH APPRECIABLE HOLD-UP IN THE STILLPOT. H.A.F. Mackenzie and P. N. Malherbe. J. S. African Chem. Inst. 4, 63-8(1951). C.A. 47, 5742d.

A modification of Urey's theory (Rep. Progress Phys. 6, 48(1939)) of the approach to isotopic equilibrium during fractional distillation, which can be employed in cases where there is appreciable hold-up in the stillpot is shown to yield an adequate and useful respresentation of the facts.

1332

STUDIES ON ISOTOPES. PART III. THE PERFORMANCE OF STAINLESS STEEL GAUZE RING PACKING IN THE ISOTOPIC FRACTIONATION OF WATER. H. A. E. Mackenzie and P. N. Malherbe. J. S. African Chem. Inst. 4, 69-78 (1951). C.A. 47, 5742d.

The characteristics of 1/16 in., 100 mesh stainless steel gauze rings have been studied in a laboratory rectifying column for enriching H_2O^{18} and HDO. A H.E.T.P. of as little as 1.5 in. in the case of oxygen isotopes has been achieved.

1333

STUDIES IN ISOTOPES. PART IV. CATALYSIS OF ISOTOPIC EXCHANGE BETWEEN GASEOUS OXYGEN AND LIQUID WATER. H.A.E. Mackenzie and A. M. Milner. J. S. African Chem. Inst. 4, 79-83(1951). C.A. 47, 5742d.

No appreciable exchange occurs between oxygen and liquid water in the presence of metallic oxides or hydroxides, or of organic substances capable of entering into oxidation-reduction reactions. Exchange does take place in the presence of H_2O_2 and of substances which catalyze the decomposition of H_2O_2. Catalase is one such substance and since this enzyme exists in all green plants, the fact that oxygen produced during photosynthesis has the same isotopic composition as the water of the plant can no longer be accepted as proof that the mechanism of photosynthesis involves the production of oxygen solely from the water.

1334

KINETICS OF ISOTOPIC EXCHANGE REACTIONS. III. INFLUENCE OF IONIC STRENGTH ON THE RATE OF EXCHANGE BETWEEN CARBONATE ION AND CARBONATOTETRAMMINE COBALTIC COMPLEX ION. D. R. Stranks. Trans. Faraday Soc. 48, 911-15(1952). C.A. 47, 5773g.

The rate determining step in the C^{14} exchange between CO_3^{--} and $Co(NH_3)_4CO_3^+$ at low CO_3^{--} concentrations involves reaction between $Co(NH_3)_4HCO_3.H_2O^{2+}$ and H_2O (the aquation mechanism), and at higher CO_3^{--} concentrations reaction between the former ion and the bicarbonate ion also occurs (the ionic mechanism).

1335

THE EXCHANGE REACTION BETWEEN COBALTOUS AND COBALTIC IONS IN PERCHLORIC ACID SOLUTION. Norman A. Bonner and John P. Hunt. J. Am. Chem. Soc. 74, 1866(1952). C.A. 47, 5773h.

At low Co concentrations the rate of electron transfer between Co(III) and Co(II) ions is measurable by means of a nonprecipitation method.

1336

HOMOGENEOUS CATALYTIC HYDROGENATION. I. ACTIVATION OF MOLECULAR HYDROGEN BY SOLUTIONS OF CUPROUS ACETATE. Sol Weller and G. A. Mills. J. Am. Chem. Soc. 75, 769-77(1953). C.A. 47, 5778g.

The rate of hydrogenation of quinone in quinoline solution at 100° as catalyzed by cuprous acetate was studied. The rate determining step is believed to be the formation of a cuprous ion dimer with hydrogen to form a complex in which hydrogen is dissociated. Mixtures of H_2 and D_2 showed no appreciable exchange during reduction. However, HD was formed with solutions of reduced cupric acetate. Hydrogen-deuterium exchange is believed to occur indirectly through the medium of a H donor which is probably aniline present as an impurity.

1337

A SURVEY OF CALUTRON CHARGE MATERIALS FOR STABLE ISOTOPE SEPARATIONS. C. P. Keim. Nucleonics 10, No. 8, 29-31(1950). (AECD-3309; Y-822) C.A. 47, 5813f.

The best charge materials, source-oven temperature ranges, and collector materials used in calutron separation of the isotopes of Li, Be, B, C, N, O, Mg, Si, S, Cl, K, Ca, Ti, V, Cr, Fe, Ni, Cu, Zn, Ga, Ge, Se, Br, Rb, Sr, Zr, Mo, Ag, Cd, In, Sn, Sb, Te, Ba, La, Ce, Nd, Sm, Hf, W, Re, Hg, Tl, and Pb are tabulated.

1338

TEMPERATURE COEFFICIENT OF THE INTERMOLECULAR CARBON ISOTOPE EFFECT IN DECARBOXYLATION OF NORMAL MALONIC ACID. Peter E. Yankwich, R. L. Belford, and Gideon Fraenkel. J. Am. Chem. Soc. 75, 832-5(1953). (AECU-2186). C.A. 47, 5816d.

The intermolecular carbon isotope effect in the decarboxylation of isotopically normal malonic acid has been measured in 80% aqueous H_2SO_4 in the range 56 to 129°. The results are not in agreement with predictions based on the simplified model of Bigeleisen. The temperature coefficients of the corresponding oxygen effects (O^{17} and O^{18}) have been found to be negligible. It is concluded that the mechanism of decarboxylation in 80% H_2SO_4 is similar to that in dilute solution, as reported by Hall.

1339

THE CONTINUOUS ISOTOPIC ENRICHMENT BY CASCADES. Robert Walen. Rec. trav. inst. recherches structure matiere (Belgrade) 1, 35-67(1952). C.A. 47, 5824f.

A continuous system for isotopic enrichment is discussed. The theory of cascade separators is applied to a chain of electrolysis cells for the production of heavy water.

1340

EXCHANGE BETWEEN THE TRIS(5,6-dimethyl-1,10-phenanthroline) COMPLEXES OF IRON(II) AND IRON(III). Lois Eimer and A. I. Medalia. J. Am. Chem. Soc. 74, 1592-3(1952). C.A. 47, 5838e.

Of 7 complex phenanthrolines tris (5,6-dimethyl-1, 10-phenanthroline) was most suitable for studying exchange reactions of Fe(II) and Fe(III).

1341

THE EXCHANGE REACTION BETWEEN DEUTERIUM AND AMMONIA ON THE SURFACE OF METAL POWDERS. Joel R. Gutmann. J. Phys. Chem. 57, 309-12(1953). C.A. 47, 6233h.

The reaction was studied on Fe and Ni powders between 210° and 319°.

1342

ON THE CONCENTRATION OF THE LIGHT ARGON ISOTOPES A^{36} IN THE RESIDUAL GAS OF THE AMMONIA SYNTHESIS. K. Clusius, H. Meyer, H. H. Bühler, and E. Schumacher. Helv. Chim. Acta 36, 350-3(1953) C.A. 47, 6267c.

Commercial N obtained by rectification of liquid air and used for ammonia synthesis, contains a small quantity of A with 0.37 ± 0.01% A^{36}, while atmospheric A has only 0.33% of this isotope.

1343

KINETICS OF RAPID ELECTRODE REACTIONS. III. ELECTRON-EXCHANGE REACTIONS. J.E.B. Randles and K. W. Somerton. Trans. Faraday Soc. 48, 937-50(1952). C.A. 47, 6280b.

Oxidized and reduced forms of the reacting substance were both present in the aqueous solution. The rates of a number of electron-exchange reactions at Hg and other noble metal electrodes were determined. Limiting factors appeared to be the structural change in the reactant and any hinderance to close approach to the electrode surface. The frequency factor with respect to inorganic electron-transfer reactions at a Hg electrode normally fell within the range 10^3-10^5 cm/sec. The value of the rate constant is lower than this in all cases where structural change accompanies the electron-transfer process, heats of activation from 5 to 10 kcal/mole being common.

1344

KINETICS OF RAPID ELECTRODE REACTIONS. IV. METAL-ION-EXCHANGE REACTION AT AMALGAM ELECTRODES. J.E.B. Randles and K. W. Somerton. Trans. Faraday Soc. 48, 951-5(1952). C.A. 47, 6280b.

The rate constants k and the heats of activation ΔH were investigated for the dilute metal amalgam and aqueous metal ion reactions; Tl^+, Cd^{2+}, Pb^{2+}, Zn^{2+}, Cu^{2+}, $CuEn_2^{2+}$, Bi^{3+}, Na^+, K^+, and Cs^+. A dilute amalgam dropping electrode was used to obtain a reproducible and uniform electrode surface.

1345

ISOTOPIC EFFECT IN THE ELECTROMIGRATION OF THE CATIONS IN HALIDES. Alfred Klemm. Z. Naturforsch 6a, 487-8(1951). C.A. 47, 6281e.

The cation mobilities in molten LiCl, $ZnCl_2$, $CdCl_2$, TlCl and AgI determined previously (C.A. 41, 6809c; 42, 1500h; 43, 2862f) are found to fit a theoretical relation derived in this article.

1346

CONCENTRATION OF THE LIGHT ZINC ISOTOPES BY ELECTROLYTIC TRANSFERENCE IN MOLTEN ZINC CHLORIDE. A. Klemm, H. Hintenberger and A. Lunden. Z. Naturforsch. 6a, 489-94 (1951). C.A. 47, 6281f.

The cell carbon-Pb-$PbCl_2$/$ZnCl_2$/Cl_2/carbon$^+$ was electrolyzed for 3 days with 230 ma (current density 4.27 amp/cm^2) at a temperature of 650°, the resulting displacement of the Zn ion relative to the Cl ion being 430 cm. At the boundary between the $PbCl_2$ and $ZnCl_2$ the Zn isotopic ratio was shifted to the light isotopes. A separation factor of 3.19 was obtained for the Zn^{64}-Zn^{70} isotope pair between the best sample (59 mg of Zn) and the natural isotopic mixture. The mass effect $\mu = \Delta W/W/\Delta m/m$ for the ionic transport velocity W and isotope mass m was determined as —0.078 for Zn isotopes in $ZnCl_2$.

1347

CONCENTRATION OF Li^6 BY ELECTROLYTIC TRANSFERENCE IN MOLTEN LiCl. A. Klemm. Z. Naturforsch 6a, 512 (1951). English translation AEC-tr-2195. C.A. 47, 6281g.

An apparatus is sketched in which molten LiCl was electrolyzed between graphite electrodes for 4.2 days with a 0.5-amp current. The inner diameter of the separation tube was 5.6 mm. After the decomposition, 1.0 g of LiCl was recovered from the cathode space and mass analyzed. The Li^6 concentration was 16.1 ± 0.3% as contrasted to 7.3% in natural Li, separation factor of 2.4.

1348

EXCHANGE OF SULFUR BETWEEN PERSULFATE AND SULFATE IONS. Heinz Elkeles and Cyrill Brosset. Svensk Kem. Tidskr. 65, 26-9(1953). C.A. 47, 6298d.

It is shown with the aid of S^{35} that S exchange does not take place between persulfate and sulfate ions in cold acid solution.

1349

ABSENCE OF CHROMIUM EXCHANGE IN SOLID CHROMIC CHROMATE. A. H. W. Aten, Jr., H. Steinber , D. Heymann, and A. Fontijn. Rec. trav. chim. 72, 94 (1953). C.A. 47, 6739f.

In the precipitation and re-dissolving of chromic chromate less than 1% exchange occurs between Cr^{+3} and CrO_4^{-2}.

1350

TRACER STUDIES ON THE EXCHANGE REACTIONS OF SOME OXYGEN ACIDS OF SULFUR. Herman B. van der Heijde. Rec. trav. chim. 72, 95-6(1953). C.A. 47, 6743a.

A description of some orienting experiments on exchange of S^{35} between labelled H_2SO_3 and dithionous acid or their ions at different pH levels and 15-25°.

1351

THE HYDROGEN EXCHANGE IN AQUEOUS SOLUTIONS OF SODIUM FORMATE. L.D.C. Bok and M. D. Cohen. J. S. African Chem. Inst. [N.S.], 4, 37-50(1951). C.A. 47, 6744f.

Between 160° and 215° a 1st-order exchange occurs between the H atoms of HCOONa and water which is not appreciably dependent on heterogeneous catalysis, and which is much slower than is the corresponding reaction of AcOK. Energies of activation and k values are given.

1352

THE RATE OF H EXCHANGE IN AQUEOUS SOLUTIONS OF AMINOACETIC ACID. L.D.C. Bok and L. G. Mitchell. J. S. African Chem. Inst. [N.S.] 4, 51-5(1951). C.A. 47, 6744h.

The hydrogens of aminoacetic acid and those of the water solvent are exchanged at 140-160° by a 1st-order reaction whose rate, k, far exceeds the corresponding reaction of AcOK. k values are given.

1353

KINETICS OF TWO EXCHANGE REACTIONS INVOLVING DIBORANE. P. Calvin Maybury and W. S. Koski. J. Chem. Phys. 21, 742-747 (1953). C.A. 47, 6745h.

The kinetics of the exchange between D and diborane were studied over a temperature range 25-75°.

1354

THE GEOCHEMISTRY OF THE STABLE CARBON ISOTOPES. Harmon Craig. Geochim. et Cosmochim. Acta 3, 53-92(1953) C.A. 47, 6837b.

Several hundred samples of C from various geologic sources have been analyzed in a new survey of the variation of the C^{13}/C^{12} ratio in nature. Mass spectrometric determinations were made on the instrument developed by Urey and his coworkers which determines variations to ± 0.01% of the ratio. The range of variations in the ratio is 4.5%. Terrestrial organic C and carbonate rocks constitute two well-defined groups, the carbonates being richer in C^{13} by some 2%. Marine organic C lies in a range intermediate between these groups. Atmospheric CO_2 is richer in C^{13} than was formerly believed. Fossil wood, coal, and limestones show no correlation of C^{13}/C^{12} ratio with age. The origin of graphite cannot be determined from C^{13}/C^{12} ratios.

1355

OXYGEN EXCHANGE BETWEEN NITRIC ACID AND WATER – PART I. C. A. Bunton, E. A. Halevi and D. R. Llewellyn. J. Chem. Soc. 4913-16(1952) C.A. 47, 7297i.

The exchange of O atoms between HNO_3 and H_2O has been followed by using O^{18} as an isotopic tracer. At low acid concentration the reaction is highly dependent upon "nitrous acid", but at higher nitric acid concentrations a reaction is observed in the absence of "nitrous acid". The reaction rate increases rapidly with increasing concentration of nitric acid. The mechanism of the exchange is discussed in Part II (J. Chem. Soc. 4917-24(1952)).

1356

OXYGEN EXCHANGE BETWEEN NITRIC ACID AND WATER. II. A CORRELATION OF OXYGEN EXCHANGE WITH AROMATIC NITRATION. C. A. Bunton and E. A. Halevi. J. Chem. Soc., 4917-24(1952). C.A. 47, 7298a.

Nitrations were made at 0° and approximately 40 mole % HNO_3. The rate of nitration was 1st-order with respect to the organic compound. This was compared with the rate of O exchange by defining a formal 1st-order rate constant. As the reactivity of the compound increased, the rate tended to approach the rate of O exchange and changed from 1st order to zero order. It is postulated that the rate of O exchange is a limiting value for nitration and a mechanism is proposed.

1357

FORMULATION OF ISOTOPIC SPLITTING IN TERMS OF THE RECIPROCAL KINETIC ENERGY MATRIX. William J. Taylor. J. Chem. Phys. 21, 763-4(1953). C.A. 47, 7309d.

Expressions for calculation of isotopic shifts in vibration frequencies from the normal modes of vibration of the non-isotopic molecule are derived and interpreted.

1358

THEORETICAL DELIVERY OF A SPIRAL THERMODIFFUSION COLUMN. Paul Renaud. Compt. rend. 236, 1555-7(1953). C.A. 47, 7832h.

An apparatus 50 cm in diameter is designed to deliver 100 g/day of 80% HCl^{37} by thermodiffusion. Calculations are made by classical equations using certain simplifying hypotheses and replacing the unknown velocity of thermodiffusion of HCl by that calculated for CH_4.

1359

ISOTOPE EFFECT IN THE ELECTROLYTIC MIGRATION OF ZINC IONS IN MOLTEN ZINC BROMIDE. Alfred Klemm, Einar Lindholm, and Arnold Lunden. Z. Naturforsch. 7a, 560-4(1952). C.A. 47, 7864i.

The light Zn isotopes were concentrated at the boundary between molten $PbBr_2$ and $ZnBr_2$ by electrolytic transport for 2.4 days at 140 ma current, 2.75 amp/cm^2 current density, 2 meters shift of Br relative to Zn, and 500°. The mass effect $\mu = -0.111$ between Zn^{64} and Zn^{66} agrees with the prediction of a semiempirical equation. The theory and previous measurements are considered briefly.

1360

PHOTOCHEMICAL ENRICHMENT OF MERCURY^{202}. Murray Zelikoff, Leonard M. Aschenbrand, and Peter Wyckoff. J. Chem. Phys. 21, 376(1953). C.A. 47, 7903e.

Hg in a stream of H_2O vapor or N_2 was photochemically enriched in Hg^{202} by exposure to unreversed Hg resonance radiation from an electrodeless discharge tube containing 91% Hg^{202}. Mercuric oxide deposited in a thermal precipitator through which the reaction mixture passed after exposure to the lamp. At low H_2O (or $H_2O + N_2$) pressure enrichment of natural Hg from 29.7% Hg^{202} to 35.5% Hg^{202} was observed. At high pressures (20 mm H_2O + 740 mm N_2) no enrichment was observed which was attributed to pressure broadening of the absorption line.

1361

PRECONCENTRATION OF HEAVY WATER IN ELECTROLYSIS PLANTS. Bartolomeo Orsoni. Proc. XIth Intern. Congr. Pure Appl. Chem. (London) 5, 1057-63(1947) C.A. 47, 7918c.

D_2O can be concentrated by a series of cells with continued electrolysis and recombination. Thermodynamics and calculation of cell size ratios are given with considerable mathematical detail.

1362

VAPOR-LIQUID EQUILIBRIA IN He^3-He^4 SOLUTIONS. J. C. Morrow. Phys. Rev. 89, 1034-7 (1953). C.A. 47, 8441e.

Recent measurements of the vapor pressures of He^3-He^4 liquid solutions are used to evaluate the solution nonideality.

1363

SALT AND ACID EFFECTS ON THE THALLOUS-THALLIC EXCHANGE REACTION. Richard W. Dodson. J. Am. Chem. Soc. 75, 1795-7(1953). C.A. 47, 8484h.

The thallous-thallic exchange reaction in $HClO_4$-$NaClO_4$ mixtures was studied at 50° over an ionic strength and acid concentration ranging independently from 0.5 to 6.0M.

1364

EXCHANGE OF ISOTOPIC OXYGEN AMONG VANADIUM PENTOXIDE, GASEOUS OXYGEN, AND WATER. W. C. Cameron, A. Farkas, and L. M. Litz. J. Phys. Chem. 57, 229-38(1953). C.A. 47, 8491f.

The exchange of O^{18} (1.3 to 1.6%) was measured by mass spectrometric analyses in the systems V_2O_5-O, V_2O_5-H_2O, and V_2O_5-H_2O-O in the temperature range 400-500°. It is proposed that the activation process in the exchange of O atoms involves either the dissociation of O molecules or the loosening of the V-O bonds.

1365

PRELIMINARY STUDY OF POSSIBLE PROCESSES TO PREPARE HEAVY WATER. H. Perperot. Mem. poudres 32, 429-36 (1950). C.A. 47, 8544c.

Heavy water cannot be concentrated from hydrated salts. A mixture of H and D over moist activated C reacted to replace the H of H_2O with D, resulting in a higher concentration of D_2O.

1366

THE C^{14} ISOTOPE EFFECT IN THE DECARBOXYLATION OF NAPHTHYL AND PHENYLMALONIC ACIDS. A. Fry and M. Calvin. J. Phys. Chem. 56, 901-5(1952). (UCRL-1564). C.A. 47, 8653f.

The isotope effect on the decarboxylation of certain substituted malonic acids has been measured with C^{14} carboxyl-labeled malonic acids. The effect indicates a ratio of cleavage rates for C^{14}-C^{12} of about 1.1, which is considerably larger than simple mass effect would predict.

1367

THE REACTIONS OF METHYL RADICALS WITH THE HYDROGEN ISOTOPES. E. Whittle and E. W. R. Steacie. J. Chem. Phys. 21, 993-9(1953). C.A. 47, 9121i.

The photolysis of acetone has been studied in the temperature range 130 to 420°. Measurements have been made of the rates of most of the possible reactions of CH_3 and CD_3 radicals with hydrogen, deuterium, and deuterium hydride. Activation energies and steric factors are reported. The results are discussed in terms of isotope effects with particular reference to the deuterium hydride reactions.

1368

CONVERSION OF ORTHO-PARA HYDROGEN BY CUPROUS ACETATE IN QUINOLINE. W. K. Wilmarth and Max K. Barsh. J. Am. Chem. Soc. 75, 2237-42(1953). C.A. 47, 9124h.

The exchange of D with a solution of cuprous acetate in quinoline was observed.

1369

BOND TYPE IN CERTAIN COBALT COMPLEXES. I. EXCHANGE REACTIONS. B. West. J. Chem. Soc. 1952, 3115-22. C.A. 47, 9202e.

The exchange reactions of Co^{++} ions with complexes of Co(II) and Co(III) were examined in pyridine or water solutions.

1370

ISOTOPIC EXCHANGE BETWEEN THE VALENCE STATES OF MERCURY. R. L. Wolfgang and R. W. Dodson. J. Phys. Chem. 56, 872-6(1952). (BNL-1126) C.A. 47, 9306.

The exchange reaction between Hg(I) and Hg(II) in perchlorate solutions has been investigated using picrolonic acid as a precipitant. Complete exchange was found within the time required for separation, in agreement with earlier measurements, and in accord with calculations on the rate of the reversible dismutation of mercurous ion.

1371

ISOTOPIC ENRICHMENT BY MIGRATION IN A SOLID SUBJECTED TO AN ELECTRIC FIELD. Marius Chemla and Pierre Sue. Compt. rend. 236, 2397-9(1953). C.A. 47, 9706d.

A mixture of the radioactive isotopes Na^{22} and Na^{24} in NaCl and KCl crystals is forced to migrate under the action of an electric field. The crystals are then cut into successive layers, and the quantaties of Na^{22} and Na^{24} are measured in each. After a migration an enrichment of Na^{24} of 10 to 20% is observed in the deepest layers.

1372

THE EXCHANGE OF VANADIUM(II) AND VANADIUM (III) IONS IN PERCHLORIC AND SULFURIC ACID SOLUTIONS. Wm. R. King, Jr. and Clifford S. Garner. J. Am. Chem. Soc. 74, 3709-10 (1952). C.A. 47, 9726h.

The rate of electron exchange in the V(II)-V(III) system was measured in $HClO_4$. Exchange was complete within 1-5 minutes.

1373

EQUILIBRIUM IN THE EXCHANGE OF HYDROGEN BETWEEN PHOSPHINE AND WATER. Ralph E. Weston, Jr., and Jacob Bigeleisen. J. Chem. Phys. 20, 1400-2(1952). (BNL-1147) C.A. 47, 9728e.

The exchange equilibrium $PH_2D(g) + H_2O(l) = PH_3(g) + HDO(l)$ was measured by 25° by use of dilute H_2SO_4 and buffer solutions as a catalyst. From the data and the vapor pressures of H_2O and HDO the constant for the reaction with gaseous water is calculated to be 1.52 at 25°. The equation $K_g = 0.781e^{198/T}$ is developed to describe the reaction up to 500°K. This is in good agreement with calculations made from spectral data.

1374

CLUSTER THEORY OF THE SATURATED VAPOR PRESSURE OF HELIUM ISOTOPE MIXTURES. Wm. Band and Raymond A. Nelson. Phys. Rev. 90, 744-7 (1953). C.A. 47, 9751c.

The cluster-avalanche theory of saturated vapor is developed for the isotopes He^3 and He^4 and for mixtures of the two isotopes.

1375

ISOTOPE SEPARATION WITH A CONTINUOUSLY OPERATING SEPARATION TUBE. Erwin David. Z. Physik 134, 377-96(1953). C.A. 47, 9805g.

The Clusius-Dickel separation tube process is the simplest method of isotope separation for material which can be converted to an applicable gas form. A continuously operating arrangement is suggested by which the most convenient radius is given to the tube by a continuous, fine control variation.

1376

ISOTOPIC EXCHANGE REACTIONS BETWEEN ALKYL POLYSULFIDES AND MERCAPTIDES. Antonino Fava and Antonio Iliceto. Ricerca Sci. 23, 839-40(1953). C.A. 47, 9814c.

Disulfides containing 1 atom of S^{35} rapidly exchange S atoms with RS^- at room temperature in absolute EtOH. Mercaptans exchange very slowly in absolute EtOH but measurably in 25% aqueous EtOH. No exchange occurs between monosulfides and mercaptides.

1377

SEPARATION OF ISOTOPIC IONS BY COUNTERCURRENT ELECTROMIGRATION. Samuel L. Madorsky and Aubrey K. Brewer. U. S. Patent 2,645,610 July 14, 1953. C.A., 47, 10374a.

In addition to previously reported separation of K isotopes (C.A. 41, 336i, 3692c) U isotopes are separated by a countercurrent electromigration process. In a "short" experiment with $UO_2(NO_3)_2$ containing 0.72% U^{235}, a 2.8% increase in U^{235} was obtained.

1378

SULFUR ISOTOPE FRACTIONATION IN NATURE AND GEOLOGICAL AND BIOLOGICAL TIME SCALES. H. G. Thode, J. Macnamara, and W. H. Fleming. Geochim. et Cosmochim. Acta 3, 235-43(1953) C.A. 47, 10426d.

The sulfur isotope content of marine sulfide and sulfate deposits, as found in limestone and shales covering a wide range of geological ages has been investigated. The maximum spread in the S^{32}/S^{34} ratio at present is about 7% or about the fractionation expected if thermodynamic equilibrium were established between SO_4^{--} and H_2S. The biological sulfur cycle in nature provides a mechanism for this exchange which appears from the data to have begun about 700 to 800 million years ago. Since that time the sulfides have been depleted and the sulfates enriched in the heavy isotopes of sulfur.

1379

NATURAL VARIATIONS IN THE ISOTOPIC CONSTITUTION OF SILICON. John H. Reynolds and J. Verhoogen. Geochim. et Cosmochim. Acta 3, 224-34(1953) C.A. 47, 10426f.

The isotopic concentration of silicon in minerals and rocks has been examined. The variation in isotopic constitution of silicon is small (the maximum difference encountered in the ratio Si^{30}/Si^{28} being 3 per mil) indicating presumably a relatively simple geochemical history involving few opportunities for exchange with gas phases or aqueous solutions. Differences are reported and interpreted in the light of chemical and geologic knowledge.

1380

FRACTIONATION OF NATURALLY OCCURRING ISOTOPES IN CO_2 EXCHANGE IN GREEN PLANTS. Peter Baertschi. Helv. Chim. Acta 36, 773-81(1953). C.A. 47, 10638d.

Quantitative measurements were made of C isotopes in the respiration of germinating beans and in the assimilation of CO_2 by the seedlings. No isotopic fractionation was observed in respiration. $C^{12}O_2$ in assimilated faster at 25-30° with a factor of 1.026 ± 0.001 compared to $C^{13}O_2$.

1381

A METHOD OF CONCENTRATING He^3–He^4 MIXTURES. K. R. Atkins, J. C. Findlay, D. R. Lovejoy and W. H. Watson. Can. J. Phys. 31, 679(1953). C.A. 47, 10930g.

He^3 in He^4 can be concentrated from 2% to 64% in a single operation by flowing through a very small leak (Pt wire sealed in a pyrex capillary).

1382

THE VAPOR PRESSURES OF THE DEUTEROMETHANES. George T. Armstrong, F. G. Brickwedde, and R. B. Scott. J. Chem. Phys. 21, 1297-8(1953). C.A. 47, 10932g.

Vapor pressures and triple points are given for the four deuterium derivatives of methane in the solid and liquid states. The temperature range covered is 70 to 112°K.

1383
FREE RADICAL-INITIATED O^{16}-O^{18}-H_2O^{16} EXCHANGE REACTION IN AQUEOUS SOLUTION. Edwin J. Hart, Sheffield Gordan, and Dwight A. Hutchison. J. Am. Chem. Soc. 74, 5548-9 (1952). C.A. 47, 10972g.
A γ-ray-initiated chain conversion of isotopically enriched OO^{18} to normal dissolved O_2 was found in alkaline solutions.

1384
THE EXCHANGE REACTION BETWEEN HYDROGEN CHLORIDE AND ALUMINUM CHLORIDE. Monte Blau, Wm. T. Carnall, and John E. Willard. J. Am. Chem. Soc. 74, 5762-3 (1952). C.A. 47, 10972i.
$AlCl_3$ synthesized in situ, and commercial $AlCl_3$ exchange with HCl at room temperature in 5 minutes. The rate of exchange of HCl gas is faster than that of CH_2Cl_2 but other halogenated methanes show much faster exchange. Detectable exchange occurs between HCl gas and $AlCl_3$ at −80°.

1385
A PERTURBING FACTOR ON THE KINETICS OF THE HOMOGENEOUS HYDROGEN-DEUTERIUM EXCHANGE REACTION. G. Boato, G. Careri, A. Cimino, E. Molinari, and G. G. Volpi. Nuovo cimento 10, 993-4(1953). C.A. 47, 10973b.
Lack of reproducibility in the reaction rate in a quartz vessel at 614° and 30 mm. Hg is due to diffusion of air through the vessel.

1386
INTRAMOLECULAR CARBON ISOTOPE EFFECTS IN THE DECARBOXYLATION OF MALONIC ACID AND BROMOMALONIC ACID. Peter E. Yankwich and Edward C. Stivers. J. Chem. Phys. 21, 61-6(1953). (AECU-2146(Rev.)) C.A. 47, 10975c.
The intramolecular isotope effects in the decarboxylation of C^{13} and C^{14} carboxyl-labeled malonic and bromomalonic acids have been determined. The observed C^{13} effects are in agreement with the results of other investigators; the C^{14} effects are in partial agreement with earlier published results of one of the authors. The ratio of C^{14} to C^{13} effects is found to be near 3.6.

1387
INTRAMOLECULAR CARBON ISOTOPE EFFECTS IN THE DECARBOXYLATION OF MALONIC ACID AND BROMOMALONIC ACID. Peter Yankwich and Edward C. Stivers. J. Chem. Phys. 21, 61-6(1953). (AECU-2146) C.A. 47, 10975d.
The intramolecular isotope effects in the decarboxylation of C^{13} and C^{14} carboxyl-labeled malonic and bromomalonic acids have been determined. The observed C^{13} effects are in agreement with the results of other investigators; the C^{14} effects are in partial agreement with earlier published results of one of the authors. The ratio of C^{14} to C^{13} effects is found to be near 3.6.

1388
CONCENTRATION OF THE HEAVY NITROGEN ISOTOPE — CONCENTRATING EFFICIENCY OF THE PACKED COLUMN AND ITS LIQUID HOLD-UP DETERMINED BY RADIOACTIVE COBALT. Ryohei Nakane. Repts. Sci. Research Inst. (Japan), 28, 276-88(1952). C.A. 47, 11022g.
The maximum efficiency for concentrating N^{15} using the NH_3 (gas)−NH_4^+ (aqueous) exchange system in a packed column 110 cm long and 10 mm in diameter gave a separation factor of 1.63.

1389
CONCENTRATION OF HEAVY NITROGEN ISOTOPE (SUPPLEMENT). Ryohei Nakane. Repts. Sci. Research Inst. (Japan) 28, 413-14(1952). C.A. 47, 11022i.
Cohen's formula used in the calculations was found to be in error. Gas boundary coefficients were calculated anew.

1390
A MODIFIED ISOTOPIC-EXCHANGE RATE EXPRESSION. Rowland E. Johnson. J. Chem. Phys. 21, 1405-6 (1953). C.A. 47, 11029d.
A new isotopic exchange rate expression was derived from the common rate expression for isotopic exchange reactions by assuming that the total amount of activity of tracer remains constant because the tracer isotope is in secular or transient equilibrium with its parent. Theoretical uses and conditions of the new expression are discussed.

1391
ISOTOPE EXCHANGE REACTIONS OF CHROMIUM(III) COMPLEXES. William R. King, Jr. and Clifford S. Garner. J. Am. Chem. Soc. 74, 5534-6(1952). C.A. 47, 11065c.
Exchange of Cr^{51} between hexoaquochromium(III ion and three Cr(III) complexes, tris-(ethylenediamine)-chromium(III) ion, hexakis-(urea)-chromium(III) ion, and the neutral complex, trifluorotriaquochromium(III), has been investigated in nitric acid solutions. The results suggest that the three complexes would be suitable compounds for the Szilard-Chalmers recoil separation of radioactive Cr.

1392
SEPARATION TUBE. X. THEORY OF THE QUANTITATIVE SEPARATION OF GAS MIXTURES. Ernst Schumacher. Helv. Chim. Acta 36, 949-61 (1953). C.A. 47, 11853c.
An auxiliary gas with suitable properties is added to the gas mixture. The behavior in the thermal-diffusion tube is treated theoretically in order to find optimum conditions for operation. Explicit calculations for the separation of A^{38} are given.

1393
THE SEPARATION TUBE, XI. QUANTITATIVE SEPARATION OF POLYCOMPONENT MIXTURES WITH AN AUXILLARY GAS. (SEPARATION OF KRYPTON AND XENON WITH SILICON TETRAFLUORIDE). Ernst Schumacher and Klaus Clusius. Helv. Chim. Acta 36, 961-8(1953) C.A. 47, 11853d.
To illustrate the principle the gas mixtures air-CO_2-Kr; Kr-SiF_4-Xe; air-CO_2-Kr-SiF_4-Xe, were studied in a three section tube (285 cm/section).

1394
THE SEPARATION TUBE. XII. PREPARATION OF PURE $ARGON^{36}$ AND ENRICHMENT OF $ARGON^{38}$ TO 90% WITH AN AUXILIARY GAS. Klaus Clusius and Ernst Schumacher. Helv. Chim. Acta 36, 969-84(1953) C.A. 47, 11853e.
The auxiliary gas was HCl. Separation factors of 49,000 and 14,300 were obtained for A^{36} and A^{38} respectively. The advantages of an added gas over the usual thermal diffusion separation procedure are discussed.

1394a
THE EFFECT OF ISOTOPIC SUBSTITUTION ON THE ENTROPY, ENTHALPY, AND HEAT CAPACITY OF IDEAL GASES. I. SYSTEMS IN THERMAL EQUILIBRIUM. II. CHEMICALLY REACTING SYSTEMS. Jacob Bigeleisen. J. Chem. Phys. 21, 1333-9 (1953). C.A. 47, 11855b.
The formulas of Bigeleisen and Mayer (C.A. 41, 5009h) for the free-energy difference between isotopic compounds are used to derive formulas for the similar differences in entropy, enthalpy, and heat capacity. Tables of these functions are presented. The analogous quantities in the thermodynamics of reaction rates are discussed.

1395

LIQUID HELIUM. III. A THEORY OF He^3-He^4 MIXTURE. Jiro Mikura. Busseiron Kenkyu No. 65, 65-89 (1953). C.A. 47, 11860h.

The vapor pressures of He^3 + He^4, their ratios of concentrations in gas and liquid phases, and the Henry constants are calculated and compared with the literature data.

1396

PRECIPITATE-ION EXCHANGE REACTIONS USING NICKEL^{63}. Geo. K. Schweitzer and Parker B. Baum. J. Am. Chem. Soc. 74, 6131-2 (1952). C.A. 47, 11881i.

The exchange of Ni(II) ions with Ni(II) in aqueous solution was investigated in the following insoluble compounds: $Ni_3(PO_4)_2$, $Ni_2P_2O_7$, NiS, $Ni(OH)_2$, Ni(II) hexacyanoironate(II), Ni(II) thiocyanate, bisdiphenylthiocarbazide Ni(II), bissalicylaldoxime Ni(II), bisdimethylglyoxime Ni(II). All except the last showed exchange in 60 minutes.

1397

REACTIONS WITH NITROGEN^{15}. VII. PROOF OF THE NITRATE ION IN LIQUID NITROGEN TETROXIDE. Klaus Clusius and Max Vecchi. Helv. Chim. Acta 36, 930-3(1953). C.A. 47, 11902c.

If $Me_4NN^{15}O_3$ is dissolved in liquid N_2O_4, quantative exchange of the nitrate ion occurs with the solvent. The mechanism is discussed.

1398

THE RATE OF DEUTERIUM EXCHANGE BETWEEN ETHANOL AND WATER. A REINVESTIGATION. Jack Hine and Cyrus H. Thomas. J. Am. Chem. Soc. 75, 739-40(1953). (AECU-2261) C.A. 47, 11912e.

W. J. C. Orr (Trans. Faraday Soc. 32, 1033(1936)) reported that the establishment of equilibrium between ethanol and water is a reaction of measurable rate. Other workers, however, found that equilibrium is established too rapidly to measure. Another check of Orr's work using his method for separating C_2H_5OH and D_2O was made. Equilibrium between water and the hydroxyl group of ethanol is established too rapidly to measure under the experimental conditions.

1399

ABSENCE OF RAPID EXCHANGE OF SULFUR ATOMS BETWEEN SULFATE AND PRESULFATE IONS. P. C. Riesebos and A. H. W. Aten, Jr. J. Am. Chem. Soc. 74, 2440(1952). C.A. 47, 11919e.

Exchange experiments on aqueous solutions containing $K_2S^{35}O_4$ and $K_2S_2O_8$ indicate the absence of rapid exchange between SO_4^{--} and $S_2O_8^{--}$ ions.

1400

ISOTOPIC EXCHANGE IN ELECTROCHEMICALLY IRREVERSIBLE SYSTEMS. THE SYSTEM ANTIMONITE-ANTIMONATE IN ALKALINE SOLUTION. Aldo Turco. Gazz. chim. ital 83, 231-8(1953). C.A. 47, 11923b.

The isotopic exchange in the system antimonite-antimonate was studied using radioactive Sb^{125}. At room temperature and in 1.8N. KOH solution there was no appreciable exchange, even after a long time.

1401

INTERMOLECULAR CARBON ISOTOPE EFFECT IN THE DECARBOXYLATION OF NORMAL MALONIC ACID IN QUINOLINE SOLUTION. Peter E. Yankwich and R. Linn Belford. J. Am. Chem. Soc. 75, 4178-82(1953). (AECU-2596) C.A. 47, 11923f.

Previous experiments on the C isotope effect in the decarboxylation of malonic acid in H_2SO_4 produced a strongly curvelinear plot of isotope effect vs the reciprocal of the temperature, whereas a linear plot is predicted by calculations based on the Bigeleisen model. In order to explain this discrepancy, isotope-effect results for malonic acid decarboxylation in quinoline solution are presented.

1402

PREDICTED ISOTOPIC ENRICHMENT EFFECTS IN SOME ISOTOPIC EXCHANGE EQUILIBRIA INVOLVING CARBON^{14}. D. R. Stranks and G. M. Harris. J. Am. Chem. Soc. 75, 2015-16(1953). C.A. 47, 12015b.

The equilibrium constants of 18 isotopic exchange reactions involving C^{12}-C^{14} exchange were computed at three temperatures by the methods of statistical thermodynamics. The predicted enrichments for some systems are approximately twice the values given for the system C^{13}/C^{12} (H. Urey, J. Chem. Soc. 562-81(1947)).

1403

CHLORINE ISOTOPE SEPARATION BY THERMAL DIFFUSION. A. Z. Kranz and W. W. Watson. Phy. Rev. 91, 1469-72(1953). (NYO-3025) C.A. 47, 12022f.

From "two-bulb experiments" the thermal diffusion constant, α, of HCl has been determined to be +0.010 at T_r = 685°K and −0.009 at T_r = 229°K. Memory effects of HCl in a mass spectrometer were eleminated by a special procedure. A 6.8 meter hot wire thermal diffusion column having an equilibrium separation factor of 7 was used to provide samples of HCl enriched to 94% HCl^{35} and 62% HCl^{37}.

1404

VAPOR PRESSURE RATIO OF $C^{12}O^{16}$ AND $C^{13}O^{16}$. T. F. Johns. Proc. Phys. Soc. (London) 66B, 808-9(1953). C.A. 47, 12023h.

Measurements have been made by direct determinations in the temperature range 68.2-81.2°K (liquid), and in the range 61.6-68.0°K (solid).

1405

THE RAPID SEPARATION OF HE^3 FROM HE^4 BY THE "HEAT FLUSH" METHOD. T. Soller, W. M. Fairbank, and A. D. Crowell. Phys. Rev. 91, 1058-60(1953). C.A. 47, 12030e.

A practical method is described for separating the He^3 which occurs in well He from the liquified mixture using the "heat flush" technique. Approximately 2 l/hr of liquid can be processed and the product is 0.5% He^3. This corresponds to an enrichment factor of 3×10^4.

1406

FRACTIONATION OF THE CARBON ISOTOPES IN DECARBOXYLATION REACTIONS. V. THE MECHANISM OF THE PYROLYSIS OF BARIUM ADIPATE. Jacob Bigeleisen, Aksel A. Bothner-By, and Lewis Friedman. J. Am. Chem. Soc. 75, 2908-10(1953) C.A. 47, 12034c.

A study of the fractionation of the carbon isotopes in the pyrolysis of barium adipate to form barium carbonate and cyclopentanone has been made. At 300° the fractionation factor is less than a few tenths of a per cent. In the pyrolysis of a mixture of barium adipate and $BaC^{14}O_3$ all the C^{14} remains in the $BaCO_3$. A mechanism is proposed to explain these results.

1407

EXCHANGE REACTIONS OF METHANE AND MONODEUTEROMETHANE WITH ATOMIC DEUTERIUM. D. W. Coillet and G. M. Harris. J. Am. Chem. Soc. 75, 1486-7 (1953). C.A. 47, 12083c.

The distribution of product deuteromethanes from the D + CH_4 and D + CH_3D reactions was determined by mass spectrometry. Reaction mechanisms and possible isotopes effects are discussed.

1408

THE KINETICS OF THE EXCHANGE REACTIONS BETWEEN IRON(II) ION AND THE FLUORIDE COMPLEXES OF IRON

(III). Jerome Hudis and Arthur C. Wahl. J. Am. Chem. Soc. 75, 4153-8(1953). C.A. 47, 12089e.

The rate of the iron(II)–iron(III) exchange in solutions at 0.5 ionic strength, was measured under varying conditions of F^- concentration, nature of surface and temperature. The exchange is not affected by ordinary diffuse light and is independent of the nature of the surface. As F^- concentration increases, the second-order rate constant increases to a maximum and then decreases. The experimental data best fit these equations when 4 reaction paths are considered.

1409

ANNUAL PROGRESS REPORT ON SEPARATION OF ISOTOPES BY CHEMICAL EXCHANGE IN THERMAL DIFFUSION COLUMNS. W. P. Senett, R. W. Pierce, F. Gollob, and T. I. Taylor. July 1, 1952. 56p. (NYO-625). NSA 7, 2272.

Progress is reported on chemical exchange effects in thermal diffusion columns, kinetics and catalysis of the isotopic exchange of C^{13} between CO and CO_2, construction of new exchange column for H-D systems, modification of mass spectrometer for the determination of D in H and conversion of water to H for D analysis; study of pressure gradient in binary diffusion at relatively high pressure, and isotopic enrichment of Li salts by thermal diffusion in an aqueous medium.

1410

A BIBLIOGRAPHY OF RESEARCH ON THE PROPERTIES OF THE ISOTOPES OF MOLECULAR HYDROGEN. Abraham S. Friedman and Charles W. Beckett. Mar. 15, 1953. 103p. (NBS-2266). NSA 7, 2846.

A bibliography of published research and unclassified government reports on the H^2 and H^3 isotopes of molecular hydrogen for the period 1932 to 1952.

1411

THE DIFFUSION-DISTILLATION PROCESS FOR THE SEPARATION OF ISOTOPES; ANNUAL REPORT. C. W. Williamson. Mar. 1, 1953. 33p. (SO-3252). NSA 7, 2847.

The feasibility of separating isotopes by diffusion through an inert gas barrier is discussed. Theoretical methods of calculation are developed, design factors are discussed, and an actual system designed. Results obtained to date are included along with total separation factor, separation factor per stage, and average stage efficiency. A comparison of 4 methods of gaseous diffusion for isotope separation is given. Results on C and O isotope separation using CH_3OH are reported.

1412

SEPARATION OF ISOTOPES BY MASS DIFFUSION-UNEQUAL DIFFUSION COEFFICIENTS. J. J. Keyes, Jr. July 30, 1952. Decl. with deletions Apr. 6, 1953. 18p. (AECD-3518) NSA 7, 3147.

Equations for the determination of the stage enrichment factor and the screen area for the ideal of zero back pressure are derived. The equations are valid only for small concentrations of one of the isotopes.

1413

A COMPILATION OF VAPOR PRESSURE DATA OF DEUTERIUM COMPOUNDS. George T. Armstrong. Feb. 24, 1953. 56p. (NBS-2306). NSA 7, 4069.

Published data on vapor pressures of deuterium compounds are tabulated and compared with those of the corresponding normal H compounds.

1414

THE SEPARATION OF ISOTOPES BY DIFFUSION-DISTILLATION; TOPICAL REPORT. C. W. Williamson July 1, 1953. 64p. (SO-3253). NSA 7, 5042.

A general discussion and theoretical treatment of the separation of isotopes by the diffusion-distillation method. Experimental apparatus is described and design details given. Experimental results are compared with calculated theoretical values. Results are presented on the separation of Cl isotopes using o-dichlorobenzene, and the separation of tin isotopes using tin tetraethyl. Final isotopic analysis of the tin samples has not yet been reported.

1415

RAPID ESTIMATES OF LIMITS FOR NET TRANSPORTS AND EQUILIBRIUM TIME. J. Shacter. August 3, 1953. 19p. (K-1044). NSA 7, 5580.

Assuming a binary, stagewise isotopic separation process, equations are given which can be used to estimate ranges of operating time needed to achieve "steady-state" conditions. The case of startup is emphasized for enriching sections with a single product stream and a defined separation factor. It is shown that a final steady state can never be achieved without some relaxation in production rate during the transient period; that the final rate of approach to steady state at total reflux of an "ideal" cascade is approximately 1/2 of its initial rate; and that a minimum-equilibrium time cascade is generally a shorter and wider plant than the minimum-enriched-holdup plant, whether square or tapered (ideal). Large feed rates, fed near matching concentrations in the cascade, are suggested as a means of minimizing cascade equilibrium times. It is suggested that product removal be initiated as soon as product concentrations are attained.

1416

KINETICS OF THE EXCHANGE OF NICKEL-ETHYLENEDIAMINE TETRAACETATE ION WITH NICKELOUS ION. Charles M. Cook, Jr., and F. A. Long. August 26, 1953. 22p. (BNL-1547). NSA 7, 5707.

The rate of exchange of hydrated Ni^{+2} with the Ni of Ni ethylenediamine tetraacetate ion has been studied by use of radioactive Ni. The rate law is found to be $R = k_1(Ni^{+2})(NiY^{-2})_0 + k_2(H^+)(Ni^{+2})(NiY^{-2})_0 + k_3(H^+)(NiY^{-2})_0 + k_4(H^+)^2(NiY^{-2})_0$ where $(NiY^{-2})_0$ refers to the gross concentration of the complex ion. Values of the rate constants have been determined at three ionic strengths, and possible exchange mechanisms are discussed.

1417

A STUDY OF THE SEPARATION OF H AND D DURING ENDOSMOTIC SOLVENT TRANSFER ACROSS CATION-EXCHANGE MEMBRANES. J. A. Marinsky and W. E. Katz. March 10, 1953, Decl. May 5, 1953. 44p. (AECD-3556; NYO-3922). NSA 7, 5737.

Experiments have been performed to determine the degree of separation of H and D effected by a cation-exchange resin membrane during endosmotic water transfer. The ratio of H_2O to D_2O transferred was

greater than the ratio of H_2O to D_2O in the solution from which the transfer occurred but the separation factor did not exceed 1.07. Economic production of D_2O by this method cannot be predicted.

1418

ACID-BASE EXCHANGE REACTIONS IN LIQUID HYDROGEN SULFIDE. T. H. Norris and Robert C. Smith. 1951. 13p. (AECU-2657). NSA 7, 5918.

S^{35} was used to study the rate of exchange between the solvent, liquid H_2S, and the three solutes S, As_2S_3, and P_4S_{10}, the first exchange was investigated with and without added triethylamine, the last two with added amine only. Exchange occurs in all cases (all at room temperature) as follows: (1) $S-H_2S$, half time 123 hr; (2) $S-H_2S-Et_3N$, half time 30 min; (3) $As_2S_3-H_2S-Et_3N$, complete in time of experiment; (4) $P_4S_{10}-H_2S-Et_3N$, 30 to 33% exchange in 12 to 16 minutes, complete exchange within 10 hr.

1419

A REVIEW OF THE PROPERTIES OF DEUTERIUM COMPOUNDS: ANNUAL BIBLIOGRAPHY--1951. L. M. Brown and A. S. Friedman. Aug. 1, 1953. 112p. (NBS-2529). NSA 7, 5954.

One of a series of annual bibliographies of published research on the isotopes of hydrogen and their compounds compiled from Chemical, British, and Physics Abstracts for the year 1951. The bibliography is supplemented by a compound and a subject index. The arrangement parallels that of a similar bibliography compiled by Kimball for the period 1932 to 1945 inclusive.

1420

A REVIEW OF THE PROPERTIES OF DEUTERIUM COMPOUNDS. Annual Bibliography—1952. Lawrence M. Brown and Abraham S. Friedman. March 15, 1954. 129p. (NBS-3144).

A bibliography for the year 1952.

1421

CONCENTRATION OF NITROGEN^{15} BY CHEMICAL EXCHANGE BETWEEN NO_2 AND NO; SEMIANNUAL PROGRESS REPORT FOR PERIOD FROM JUNE 15, 1952 TO JANUARY 15, 1953. W. Spindel, E. H. Malclaren, R. H. Johns, R. P. Lanni, G. W. Reynolds, and O. E. Lanford. [nd] 9p. (AECU-2656). NSA 7, 6149.

The proposed method would consist of flowing liquid NO_2 down a packed column, chemically converting it to NO at the bottom, and passing the NO up the column. Exchange should lead to a concentration of N^{15} at the bottom end of the column. Cu, Zn and other metals do not appear promising as reducing agents for NO_2 and future attempts at reduction will be made with liquids or by electrolysis.

1422

A CRITICAL REVIEW OF THE LITERATURE RELATING TO THE VAPOR PRESSURE OF AMMONIA AND TRIDEUTEROAMMONIA. George T. Armstrong. June 30, 1953. 38p. (NBS-2626). NSA 7, 6396.

By comparison and critical evaluation of the vapor-pressure data of NH_3, the triple point is found to be 195.46°K and 45.58 mm Hg: the boiling point, 239.78°K; the critical point, 405.6°K and 112.4 atm. $Log_{10}P(mm) = 9.98379-1627.22\ (1/T)$ represents the vapor pressure of solid NH_3. $Log_{10}P(mm) = 9.95028-1473.17\ (1/T)-0.0038603T$ represents the vapor pressure of the liquid below 250°K. After critical evaluation of the vapor-pressure data of ND_3, the triple point is found to be 199.0°K and 48.22 mm; the boiling point 242.26°K and the critical temperature, 405.4°K. $T\ log_{10}P_D/P_H = -1.75-4513.7\ (1/T)$ represents the vapor-pressure ratio of ND_3 and NH_3 in the solid region. $T\ log_{10}P_D/P_H = 14.86-6731.9\ (1/T)$ represents the ratio in the liquid region. 67 references.

1423

PHOTOCHEMICAL SEPARATION OF ISOTOPES. PROGRESS REPORT COVERING THE PERIOD APRIL 1, 1952 TO JUNE 30, 1952. David Z. Robinson, Robert O'B. Carpenter and M. Kent Wilson. Aug. 29, 1952. 30p. (NP-4834; AD-6184). NSA 7, 6543.

Experimental work on monoisotopic lamps for use in separating Li isotopes involved studies of various coatings for the lamp interiors to prevent Li attacks on the silica of the ordinary electrodeless discharge lamp. Results from ten separate experiments with Hg and H_2O vapor are discussed. An enrichment of Hg^{198} from 10% to 12% was indicated.

1424

A NEW METHOD OF ISOTOPE ENRICHMENT IN THE TRANSITION REGION BETWEEN KNUDSEN AND POISSEUILLE FLOW. H. D. Beckey and W. E. Groth. Z. Naturforsch. 7a, 474-80 (1952); (English translation, see AEC-tr-1884). C.A. 48, 50i.

Gaseous isotopes can be separated by a diffusion process through a capillary tube, with a diameter of the order of magnitude of the mean free path of the gas and with the ends at different temperatures. The lighter isotope is concentrated at the cooled end, the heavier at the heated end (negative effect). The actual apparatus consists of 100 parallel capillary tubes, cooled to 80°K at one end and heated to 320°K at the other. Pressure and time dependence of the effect were investigated with H_2-D_2 and He-Ne mixtures.

1425

THERMAL CONCENTRATION OF CARBON ISOTOPES WITH CARBON MONOXIDE GAS. Hajime Sakata, Kazuhisa Matsuda, and Eiichi Takeda. J. Phys. Soc. Japan 8, 313-17(1953). C.A. 48, 51a.

A hot-wire thermal diffusion column was used for the enrichment of CO. The ratio of the separation factors ($C^{13}O^{16}/C^{12}O^{16}$) at the 2 ends of the column was studied as a function of pressure of CO and found to be a maximum value of 5.85 at 53.7 cm of Hg and 1050°K. The ratio increased at higher temperatures. The thermal separation ratio was estimated to be 0.427 at 421°K.

1426

CONCENTRATION OF HEAVY NITROGEN ISOTOPE. III. Asao Sugimoto, Ryohei Nakane, Tsunao Watanabe, Shohei Isomura, and Kozo Morishita. Repts. Sci. Research Inst. (Japan) 29, 81-7(1953). C.A. 48, 51c.

With a 2-step tower from aqueous NH_4NO_3 (10 moles/l) flowing at 10 cc/min in the 1st step and 1 cc/min in the 2nd step at 20° under a pressure of 90 mm increasing to 200 mm at the bottom of the 1st step tower and 245 mm at at the bottom of the 2nd-step tower, N^{15} was concentrated to 16.1 at.% in 1148 hours. The slow concentration was due mainly to large hold-up in the boiler and cooling system and the shortness of the exhaust tower.

1427

ESTIMATING INTERSTAGE FLOW IN A SEPARATING CASCADE WITH A BY-PASSING REFLUX STREAM. J. Shacter. 1952. p.3-12 (K-943). C.A. 48, 410e.

To define the complete separating capacity of a square section of a gaseous diffusion cascade or a plate column used for fractionation of a binary mixture such as isotopes, the only quantities required are the two variables, X, the stage separation factor, and Ψ, the interstage or molar stage flow. Methods of determining X and Ψ are given.

1428

THE PHOTOCHEMICAL SEPARATION OF ISOTOPES. Bruce H. Billings, W. J. Hitchcock, and Murray Zelikoff. J. Chem. Phys. 21, 1762-6(1953). C.A. 48, 454d.

A photochemical method of separating Hg isotopes using a monoisotopic resonance lamp is described. A Hg^{198} lamp was used to excite Hg atoms which reacted with water vapor to produce HgO. An enrichment factor of 1.5 for Hg^{198} was obtained in the first experiments. The analysis of the isotopes was undertaken by the use of multilayer dielectric Fabry-Perot interferometers.

1429

ENRICHING STABLE ISOTOPES ELECTROMAGNETICALLY. C. P. Keim. J. Appl. Phys. 24, 1255-61(1953). C.A. 48, 464c.

The natural stable isotopes of 43 elements, comprising 177 different nuclides, have been enriched; the goal is to enrich 257 isotopes of 59 elements. The isotopic enrichments, the operation of the production mass spectrographs including a listing of best charge materials, a brief review of the chemical and analytical problems, a tabulation of the best compounds of the separated isotopes for mass spectrometer analyses, and a listing of some of the major uses of separated isotopes have been included in this survey of the electromagnetic isotope separation program.

1430

THE EXCHANGE REACTION OF HYDROGEN AND TRITIUM. L. M. Dorfman and H. C. Mattraw. J. Phys. Chem. 57, 723-5(1953) (KAPL-900) C.A. 48, 465c.

The rate of the H-T exchange reaction $H_2 + T_2 = 2HT$ initiated by the T β-radiation has been investigated at room temperature using a mass spectrometer for mass analysis. The runs cover a pressure range of 59.0 to 399.9 mm with T pressures between 33.2 and 147.7 mm. The progress of the reaction may be represented by the equation: $HT_\infty - HT_t = HT_\infty e^{-kt}$ where HT_∞ and HT_t denote the concentrations of HT at equilibrium and time t: k is a constant. The initial rate of exchange has been calculated from $(d\,HT_t/dt)_{t=0} = k\,HT_\infty$. Half times of 260 to 818 minutes have been obtained. The fraction of the β energy absorbed has been estimated, and G values of as high as 450 molecules/100 e.v. have been obtained indicating the reaction to be a chain process. The initial rate of formation of HT is directly proportional to the product of the pressure and the square root of the absorbed intensity.

1431

THE CARBON-ISOTOPE EFFECT IN THE ACID HYDROLYSIS OF UREA. John A. Schmitt and Farrington Daniels. J. Am. Chem. Soc. 75, 3564-6(1953). C.A. 48, 1125d.

Urea containing approximately 1% each of C^{13} and C^{14} was subjected to acid hydrolysis at 100° in phosphate buffer. The relative rates of decomposition were determined by mass spectrometric analysis of the CO_2 evolved at different time intervals during the reaction. The C^{12}-urea is hydrolyzed 10.1% faster than the C^{14}-urea and 5.5% faster than the C^{13}-urea. The ratio of these values agrees with theory.

1432

ISOTOPE EFFECTS IN CHEMICAL REACTIONS. P. E. Yankwich, p.235-49 of ANNUAL REVIEW OF NUCLEAR SCIENCE, Vol. 3, Stanford, California. Annual Reviews Inc. 1953. C.A. 48, 1164i.

Progress reported through the calendar year 1952 in investigations of the effect of isotopic substitution on the rates and equilibria of chemical reactions is reviewed. The discussions concern the isotopes of H, C, N, O, S, and Hg. 79 references.

1433

INTRAMOLECULAR ISOTOPE EFFECTS IN THE REACTIONS OF BENZONIC-α-C^{14} ANHYDRIDE. Vernon F. Raaen and Gus A. Ropp. J. Chem. Phys. 21, 1902-3(1953) C.A. 48, 1171a.

The intramolecular isotope effect was investigated by studying the distribution of C^{14} between the benzonic acid and the ethyl benzoate formed during ethanolysis and also the distribution of C^{14} during the reaction of the anhydride with p-aminotoluene. No temperature effect was found in the range 30-138° and agreement with theoretical values was poor.

1434

OPTIMAL FLOW IN FRACTIONATING COLUMNS FOR ISOTOPE SEPARATION. I. Dostrovsky, J. Gillis and B. H. Vromen. Bull. Research Council Israel 2, No. 1, 68-9 (1952). C.A. 48, 1733f.

Since the separating efficiency of packed columns is inversely proportional to the flow rate but the enrichment of rare isotopes is directly proportional to the flow rate, there is an optimum flow rate giving a maximum enrichment of isotope. By the use of simplifying assumptions a transcendental equation relating optimal flow with enrichment is reduced to an approximate solution. Plots of flow vs. enrichment for assumed values of transfer coefficient, column length, production rate, and separation factor show maximal values of enrichment at optimum flow rates.

1435

RELATIONS BETWEEN MOMENTS OF INERTIA AND ROTATION FREQUENCIES OF ISOTOPIC MOLECULES. L. M. Sverdlov. Doklady Akad. Nauk S.S.S.R. 88, 249-52 (1953) (NSF-tr-12) C.A. 48, 1741a.

Sum rules are derived for moments of inertia, for rotational constants, and for rotational frequencies of isotopic molecules.

1436

THE MECHANISM OF ELECTRON TRANSFER IN SOLUTION. Henry Taube, Howard Myers, and Ronald L. Rich. J. Am. Chem. Soc. 75, 4118-19 (1953). C.A. 48, 1776d.

1437

THE HOMOMOLECULAR EXCHANGE OF OXYGEN. W. H. Johnston and C. J. O'Shea. J. Chem. Phys. 21, 2080(1953). C.A. 48, 1780g.

No thermal exchange was observed between O_2 molecules in a sample containing 25% O^{18} after storage at room temperature for 5 months. A photochemical exchange with half-time of 102 hours and a quantum yield of 125 was observed using a GE AH-4 Hg arc lamp.

1438

THE MECHANISM OF EXCHANGE OF HYDROGEN GAS AND AQUEOUS ALKALI. W. K. Wilmarth, June C. Dayton and J. M. Flournoy. J. Am. Chem. Soc. 75, 4549-53(1953) NP-4335; U-23786 C.A. 48, 1780i.

The conversion of para-hydrogen in aqueous alkali is a homogeneous nonphotochemical process with a rate that is 1st-order with respect to both H gas and OH^- ion concentration. The rate constant in the temperature region 80-110°

A study of the fractionation of the carbon isotopes in the pyrolysis of barium adipate to form barium carbonate and at a slightly slower rate under comparable conditions. The mechanism is discussed in terms of a solvated hydride ion as an intermediate.

1439

OZONE CATALYSIS OF ISOTOPE EXCHANGE BETWEEN MOLECULAR OXYGEN SPECIES. Richard A. Ogg, Jr. and Wm. T. Sutphen. J. Chem. Phys. 21, 2078(1953). C.A. 48, 1785b.

Samples of gaseous O containing approximately 30 at. % O^{18} at moderate pressure in sealed glass bulbs showed no significant change in the mass ratios 34/32 and 36/34 in two years. The O^{18} isotope exchange between molecular O and O_3 was extremely slow with partial pressures of O_3 from 30 to 150 mm., with O pressures of approximately 30 mm, and a temperature of 0°. However, equilibrium in the reaction $O^{16}O^{16} + O^{18}O^{18} = O^{16}O^{18}$, in the presence of O_3, was attained in 10 minutes. The addition of chemically indifferent gases appeared to be without effect on the rate of the equilibration process, but to cause a marked enhancement of the O^{18} exchange between O_3 and O. The following mechanism was proposed: $O_3 = O + O_2$, $O + O_2 = O_3$ and $O + OO^{18} = OO + O^{18}$.

1440

CHLORINE-PHOTOSENSITIZED ISOTOPE EXCHANGE BETWEEN MOLECULAR OXYGEN SPECIES. Richard A. Ogg, Jr. J. Chem. Phys. 21, 2078-9(1953). C.A. 48, 1785d.

Gaseous O containing 30 at. % O^{18} underwent a Cl-photosensitized exchange between the molecular O species when exposed to the unfiltered radiation from a GE H-4 Hg bulb. After irradiation for several hours the product of mass ratios 34/32 and 34/36 was reduced from about 100 to 30. The rate appeared to depend on the 1st power of the light intensity and the temperature coefficient was appreciably negative in the 0-100° range. The absolute magnitude of the quantum yield was very much less than unity. A mechanism was proposed.

1441

KINETIC EVIDENCE FOR THE GAS-PHASE EXISTENCE OF THE PEROXY RADICALS NO_4 AND NO_3. Richard A. Ogg, Jr. J. Chem. Phys. 21, 2079(1953). C.A. 48, 1785f.

Highly enriched O_2 underwent changes in isotopic constitution on mixing with the vapor of isotopically normal N_2O_5. The rate of exchange was not affected by the initial addition of NO_2. A mechanism is proposed.

1442

OXYGEN EXCHANGE BETWEEN NITRIC ACID AND WATER. PART III. CATALYSIS BY NITROUS ACID. C. A. Bunton, E. A. Halevi and D. R. Llewellyn. J. Chem. Soc. 2653-7(1953) C.A. 48, 1785g.

The exchange was followed by means of O^{18} tracer at 0°. The exchange is effected by concentrations of HNO_2 as low as 2×10^{-3} mole %. The kinetic order changed as the HNO_3 concentration increased from 8 to 24 mole % from 1st to 2nd order, and then as HNO_3 was further increased, it declined to again approximately a 1st-order reaction. Mechanisms are postulated to explain these observations.

1443

TEMPERATURE INDEPENDENT FACTOR IN THE RELATIVE RATES OF ISOTOPIC THREE CENTER REACTIONS. Jacob Bigeleisen and Max Wolfsberg. J. Chem. Phys. 21, 1972-4 (1953). C.A. 48, 1848i. (Errata, J. Chem. Phys. 22, 1264 (1954).

It is shown that the theoretical equation for the ratio of the rate constants of isotopic molecules is essentially independent of whether the crossing of the barrier is treated as a translation or a vibration. The temperature-independent factor in this equation is evaluated for the case of substitution or displacement reactions. Calculations are presented for several cases involving the isotopes of C where there is simultaneous bond rupture and bond formation.

1444

CARBON-ISOTOPE CONSTITUTION OF SOME ACETIC ACIDS. Peter E. Yankwich and Albert L. Promislow. J. Am. Chem. Soc. 75, 4881-2(1953). C.A. 48, 1849a.

The C isotope ratios (C^{13}/C^{12}) of the CO_2 obtained from $MeNH_2$ (R_M) and from the total combustion of commercial AcOH(R_D) [prepared by the process $(CH_2)_2 \rightarrow EtOH \rightarrow AcH \rightarrow AcOH$] were $R_M = 0.010793 + 0.000002$; $R_D = 0.010789 + 0.000001$. It is concluded that in the air oxidation process most of the difference in isotopic constitution of the AcOH, C atoms arose antecendent to the oxidation of the aldehyde groups.

1445

THE EFFECT OF NITRATE-ION AND AMMONIA ON THE ELECTROLYTICAL SEPARATION OF HYDROGEN-DEUTERIUM ISOTOPES. Jolanda M. Hojman. Bull. Inst. Nuclear Sci. "Boris Kidrich" (Belgrade) 3, 121-6 (1953). C.A. 48, 1852a.

The presence of NO_3^- in the electrolyte did not change the separation factor, whereas it was increased by the electrochemical oxidation of NH_3.

1446

QUINONE-HYDROQUINONE EXCHANGE REACTIONS. II. DUROQUINONE AND DUROHYDROQUINONE EXCHANGE IN BUFFERED METHANOL SOLUTION. Askel A. Bothner-By. J. Am. Chem. Soc. 75, 728-30(1953). C.A. 48, 1992c.

A study has been made of the exchange reaction at 25° between duoquinone and durohydroquinone-α-C^{14} in MeOH saturated with K biphthalate (pH 6.15). The exchange reaction proceeded at a measurable rate with a half-life in the order of minutes.

1447

THE KINETICS OF THE ISOTOPIC EXCHANGE REACTIONS BETWEEN NaI AND: o-HOC_6H_4I AND o, m, AND p-$CH_3C_6H_4I$. Serge May, Bernard Giraudel, and Jacques Regnault. Compt. rend. 237, 613-15 (1953). C.A. 48, 2455h.

The exchange reactions were studied in CH_3CN and 2-octanol.

1448

THE HYDROGEN-DEUTERIUM EXCHANGE REACTION ON ZINC OXIDE CATALYSTS. E. Molinari and G. Parravano. J. Am. Chem. Soc. 75, 5233-7(1953). C.A. 48, 2457g.

The H_2-D_2 exchange reaction was investigated on ZnO samples, whose semiconductivity was modified by the introduction of foreign cations into the ZnO lattice.

1449

RATE OF THE ELECTRON-TRANSFER EXCHANGE REACTION BETWEEN MANGANATE AND PERMANGANATE IONS. John C. Sheppard and Arthur C. Wahl. J. Am. Chem. Soc. 75, 5133-4 (1953). C.A. 48, 2554i.

The exchange starting with either tagged MnO_4^{--} or MnO_4^- was followed by the separation method of Bonner and Patratz (C.A. 45, 6879i).

1450

EFFECT OF ISOTOPIC SUBSTITUTION ON ORGANIC REACTION RATES. Gus A. Ropp. Nucleonics 10, No. 10, 22-7 (1952). C.A. 48, 2559b.

A review is given of the effect on the organic reaction rate caused by the substitution of one isotope of C, N, or O for another. Intermolecular and intramolecular isotope effects of various organic reactions are given for C^{13}, C^{14}, N^{15} and O^{18} in terms

of the specific reaction rate of the normal molecule and the specific reaction rate of the labeled molecule, both experimental and theoretical values. Data also include reactions in which no isotope effect was found. 50 references.

1451
THERMODYNAMICS OF TRANSPORT PROCESSES IN IONIC MIXTURES AND THEIR USE IN ISOTOPE-CONTAINING SALTS AND METALS. Alfred Klemm. Z. Naturforsch. 8a, 397-400(1953). C.A. 48, 3111h.

From isotope-separation experiments it is found that in salts the friction of two isotopic cations in motion against each other is greater than the friction in the motion of the total cations against that of the total anions. Quantitatively, it is found that $Z^{-}r^{++}Z^{+}r^{+-} = 2.3$, where Z^{+} and Z^{-} are the valences of the cations and anions respectively and r is the coefficient of friction.

1452
HYDROGEN-ISOTOPE EXCHANGE BETWEEN ANTHRACENE AND SULFURIC ACID. V. Gold and F. A. Long. J. Am Chem. Soc. 75, 4543-47(1953). C.A. 48, 3116h.

The H isotope exchange between H_2SO_4 and anthrancene proceeds more rapidly at the meso-positions than at the other positions. The kinetics of D loss from the 9-position of anthracene by the action of H_2SO_4 have been followed by experiments on the 2-phase system, $CCl_4-H_2SO_4$. The velocity of the exchange reaction increases steeply with acidity. The kinetic results are analyzed on the basis of a model of the reaction which associates the yellow color of a solution of anthracene in H_2SO_4 with a conjugate acid of anthracene in which a proton is added at a meso-position.

1453
NONEXCHANGE OF OXYGEN BETWEEN WATER AND SOME COMPOUNDS OF NITROGEN. F. T. Bonner and Jacob Bigeleisen. J. Am. Chem. Soc. 74, 4944-5 (1952). C.A. 48, 3117a.

Attempts were made to detect O exchange between water and N_2O, water and hyponitrite ion, and water and nitrohydroxylamite ion over a wide range of pH. No exchange was found.

1454
THE MECHANISM OF THE EXCHANGE OF HYDROGEN GAS WITH SOLUTIONS OF POTASSIUM AMIDE IN LIQUID AMMONIA. W. K. Wilmarth, and June C. Dayton. J. Am. Chem. Soc. 75, 4553-6(1953). (NP-4339; U-23788). C.A. 48, 3119d.

Preliminary work shows that the rate of conversion of para-hydrogen by liquid NH_3 solutions of K amide is proportional to the concentrations of NH_2^- ion and para-hydrogen. The specific rate constant at $-50°$ is 7.7×10^9 1/mole minute. D gas exchanges with these solutions at approximately the same rate, and HD has been established as the initial product.

1455
CHANGING THE ISOTOPE ABUNDANCE IN MERCURY. E. Haeffner. Nature 172, 775-6(1953). C.A. 48, 3159g.

Passing d.c. (3.40 v) for 2000 hours through Hg resulted in accumulation of the light isotope at the anode. Changes in relative abundance amounted to about 3–4% for isotopes with mass numbers 198 and 204.

1456
FLUORINE EXCHANGE BETWEEN FLUOSILICIC AND HYDROFLUORIC ACID. A. H. W. Aten, Jr., and J. A. Bigot. Rec. trav. chim. 72, 1002 (1953). C.A. 48, 3766g.

Exchange of F^{18} (from HF or a fluoride) with inactive H_2SiF_6 in solution (pH 0.5 or 1) at room temperature was complete after 5 minutes.

1457
THE UNCATALYZED EXCHANGE OF Cl^- AND $AuCl_4^-$. Ronald L. Rich and Henry Taube. J. Phys. Chem. 58, 1(1954). C.A. 48, 3771f.

The rate law for the exchange between $AuCl_4^-$ and Cl^- is $R = k_1(AuCl_4^-) + k_2(AuCl^-)(Cl^-)$. k_1 and k_2 are independent of acidity over a range 0.002 to 0.076M, but at lower acidities a correction term must be added. The values of E corresponding to the two paths are 4.5 and 16.5 kcalories, respectively. In the equation, $\log k = \log pz - 0.4343\ E/RT$, pz has a value of 10^3 $min.^{-1}$ for k_1 and 2×10^{14} 1. $mole^{-1}$ $min.^{-1}$ for k_2.

1458
THE INDUCED EXCHANGE OF Cl^{-1} AND $AuCl_4^-$. EVIDENCE FOR Au(II). Ronald L. Rich and Henry Taube. J. Phys. Chem. 58, 6-11 (1954). C.A. 48, 3771g.

The reduction of $AuCl_4^-$ by Fe^{++} induces a rapid exchange of Cl^- and $AuCl_4^-$. Under the conditions studied a turnover of Cl^- per Fe^{++} of the order of 10^4 was observed. Sn(II), Sb(III), and Au(I) are slow catalysts. V(IV) is fairly effective and a form of Au(II) is a very active catalyst.

1459
PHOTOCHEMICAL PROMOTION OF EXCHANGF REACTION OF CHLORINE BETWEEN CHLOROFORM OR CARBON TETRACHLORIDE AND AQUEOUS CHLORIDE SOLUTION. Juro Horiuchi and Kozo Tanabe. Proc. Japan Acad. 29, 254-9 (1953). C.A. 48, 3796b.

Ultraviolet radiation accelerates the Cl exchange between $CHCl_3$ and alkaline chloride solutions but has no effect upon the exchange with acid solutions. In contrast, ultraviolet radiation accelerates the exchange between CCl_4 and acid solutions, with no effect upon the exchange with alkaline solutions.

1460
A MULTIPLICATION EFFECT IN THE ENRICHMENT OF GERMANIUM ISOTOPES IN THE GAS CENTRIFUGE. V. Faltings, and F. Seehofer. Z. Electrochem. 57, 445-8 (1953). C.A. 48, 3806b.

A mixture of GeH_4 and H_2 was separated into 3 fractions in a gas centrifuge. Mass spectrographic analysis showed that the separation of Ge^{70} and Ge^{76} was twice as large as that predicted theoretically.

1461
THE CHEMISTRY OF ISOTOPES. A. I. Brodskii. Moscow, Akademiya Nauk S.S.S.R., 1952. 352p. (In Russian) (Book review AEC-tr-2166). C.A. 48, 3808i.

A systematization of the material on the physical and chemical properties, methods of investigation, means of producing and occurrence of isotopes, published in scientific literature up to 1951. Application of isotopes in chemical analysis and in the investigation of technological processes, the strength of the bonds between atoms and molecules, and the mechanisms of chemical reactions and biological processes.

1462
VARIATIONS OF $OXYGEN^{18}$ CONTENT OF WATERS FROM NATURAL SOURCES. S. Epstein and T. Mayeda. Geochim. et Cosmochim. Acta 4, 213-24 (1953)(In English). C.A. 48, 4149f.

The O^{18} content varies approximately 6% in surface marine waters. The low O^{18}/O^{16}

values were obtained from surface sea waters diluted with melt waters from ice fields, while sea waters of highest salinity were richest in O^{18}. The linear relation between O^{18} content and salinity for marine waters not diluted with melt water is explained by a multiple-stage distillation from surface waters which feed the ice regions.

1463
DEUTERIUM CONTENT OF NATURAL WATERS AND OTHER SUBSTANCES. Irving Friedman. Geochim. et Cosmochim. Acta 4, 89-103 (1953). C.A. 48, 4152a.

1464
DIFFUSION AND THERMAL DIFFUSION OF ISOTOPIC GASES. Eugene M. Holleran. J. Chem. Phys. 21, 2184-7 (1953). C.A. 48, 4272f.
Theoretical treatment of thermal diffusion constants applied to A and Ne isotopes.

1465
CARBON-14 ISOTOPE EFFECT IN THE EXCHANGE REACTION BETWEEN CARBON MONOXIDE AND PHOSGENE. D. R. Stranks. J. Chem. Phys. 21, 2232 (1953). C.A. 48, 4296b.
Experimental values for C^{14} isotope effects in some unidirectional reactions appear to be larger than those predicted from theory. Where $K = ([C^{14}OCl_2]/[COCl_2])\ ([C^{14}O)]/[CO])$, the following values of K were determined by 2 independent methods: at 10° 1.118 and 1.120, and at 405° 1.010 and 1.007. These values are compared with 1.116 and 1.011 calculated from isotopic partition function ratios.

1466
ENRICHMENT OF ISOTOPIC MOLECULES IN THE DIRECT-CURRENT GLOW DISCHARGE. II. MULTIPLICATION PROCESSES. CONCENTRATION OF HEAVY HYDROGEN. H. D. Beckey, W. E. Groth, and K. H. Welge. Z. Naturforsch. 8a, 556-62 (1953). C.A. 48, 4305h.
The dependence of the enrichment of H-D mixtures in D at the cathode of a d-c glow discharge on length and cross section of the discharge tube, current density, gas pressure, temperature, time, and tube-wall conditions has been investigated. Results are explained on the basis of a theory of multiplication of the primary processes involved in dissociation of the molecules and recombination of the atoms during axial flow in the discharge.

1467
HOMOMOLECULAR EXCHANGE OF NITROGEN IN A GLOW DISCHARGE. W. H. Johnston and R. M. Anstett. J. Chem. Phys. 22, 146 (1954). C.A. 48, 4307b.
A mass spectrometer was used to follow the approach to isotopic equilibrium in a mixture of N_2^{28}, N_2^{29}, and N_2^{30}. First-order rate laws were obtained in glow discharges at pressures of 2, 4, and 6 mm. No thermal exchange was noted in 1 month at room temperature or in 19 hours at 850°.

1468
ISOTOPIC EFFECT IN THE ELECTROLYTIC MIGRATION OF THE SILVER ION IN MOLTEN SILVER CHLORIDE. S. Floberg, A. Klemm, and C. Lang. Z. Naturforsch. 8a, 562-4 (1953). C.A. 48, 4337h.
The relative difference between the electrolytic migration velocities of the Ag isotopes with respect to the Cl ions in molten AgCl was found to be 0.0012. The resulting mass effect $\mu = 0.064 \pm 0.006$ confirms a previously derived expression.

1469
NONEQUIVALENCE OF CHLORINE ATOMS IN PHOSPHORUS PENTACHLORIDE. James Downs and Rowland E. Johnson. J. Chem. Phys. 22, 143-4 (1954). C.A. 48, 4901b.
The exchange between Cl^{36} and PCl_5 was measured in CCl_4 solution. Results agreed with the following: (1) 3 Cl atoms undergo rapid initial exchange; (2) the 3 equatorial atoms exchange rapidly, whereas, the 2 Cl atoms in the apical positions exchange slowly; (3) there is no rapid intramolecular exchange between apical and equatorial positions.

1470
SOME ISOTOPE-EXCHANGE REACTIONS IN NONAQUEOUS SYSTEMS. Dora Peschanski. J. chim. phys. 50, 634-9 (1953). C.A. 48, 4929d.
Exchange between $Fe(ClO_4)_2$ and $Fe^{59}(ClO_4)_3$ in EtOH is very rapid as in aqueous systems. Similarly $Hg(ClO_4)_2$ and $Hg_2(ClO_4)_2$ exchange rapidly in EtOH as in the aqueous system.

1471
ISOTOPIC EXCHANGE BETWEEN Hg(I) AND Hg(II) IN AQUEOUS SOLUTIONS. Dora Peschanski. J. chim. phys. 50, 640-6 (1953). C.A. 48, 4939a.
Isotopic exchange for Hg(I) and Hg(II) is retarded by the presence of chloride or chlorate ions in aqueous systems. Calculation of the velocity of exchange gives excellent agreement when exchange is considered as occurring between free $Hg(CN)_2$ and Hg(I) in the system $Hg(CN)_2 + Hg(ClO_4)_2 + Hg(I)$. The "induced" exchange is proportional to the concentration of free Hg(II).

1472
THE SEPARATION OF ISOTOPES BY A COUNTER-CURRENT GASEOUS EXCHANGE COLUMN. I. TRANSPORT EQUATION AND OVER-ALL SEPARATION. Kunihiko Kogoshi. Bull. Che. Soc. Japan 26, 288-93 (1953). C.A. 48, 4943e.
The transport equation is derived for the case of 2 different gases both containing a common element with 2 isotopes of the common element. The assumption is made that the equilibrium of the isotopic exchange reaction holds only in a sharply defined region in which the temperature is above T_b. Above T_b the exchange reaction is rapid compared with the diffusion process whereas below T_b the converse is true. The equilibrium separation factor is derived from the transport equation.

1473
THE SEPARATION OF ISOTOPES BY A COUNTER-CURRENT GASEOUS EXCHANGE COLUMN. II. EXPERIMENTAL TESTS OF THE THEORY. Kunihiko Kogoshi. Bull. Chem. Soc. Japan 26, 311-16 (1953). C.A. 48, 4943f.
The separation of C^{12} and C^{14} by means of a hot-wire countercurrent gaseous exchange column using CO_2, and CO was used to test the theory derived in Part I. Separation efficiencies were measured at various wire temperatures between 570° and 1170°. Experimental values show the dependence of over-all separation on the wire temperature and support the theoretical derivation.

1474
KINETICS OF ISOTOPE-EXCHANGE REACTIONS OF FLUORINE WITH SOME HALOGEN FLUORIDES. Richard M. Adams, Richard B. Bernstein, and Joseph J. Katz. J. Chem. Phys. 22, 13 (1954). C.A. 48, 4943g.

Kinetic data on the isotope-exchange reaction of F with ClF_3, BrF_5, and IF_7 were obtained with F^{18} tracer in the range 181-257°. The mechanism is suggested to be either heterogeneous catalysis or a combination of the heterogeneous mechanism with a homogeneous gas-phase exchange.

1475
RATE OF EXCHANGE OF CERTAIN AMINES AND ALCOHOLS. Jack Hine and Cyrus H. Thomas. J. Am. Chem. Soc. 76, 612 (1954). C.A. 48, 4943i.

Exchange of D was too rapid to measure between the following pairs. $EtNH_2$ and $C_7H_{15}NH_2$; tert-BuOH and di-tert-butylisopropylcarbinol; $EtNH_2$ and tert-AmOH.

1476
FRACTIONATION OF THE CARBON ISOTOPES IN DECARBOXYLATION REACTIONS. VI. COMPARISON OF THE INTERMOLECULAR ISOTOPE EFFECTS OF A PAIR OF ISOTOPIC ISOMERS. Jacob Bigeleisen and Max Wolfsberg. J. Chem. Phys. 21, 2120-1 (1953). C.A. 48, 4944f.

Theoretical considerations show that malonic acid—$2C^{14}$ should decarboxylate precisely twice as fast as the isotopic isomer malonic acid—$1C^{14}$ liberates $C^{14}O_2$. The calculations are supported by the experimental data of Ropp and Raaen. It is shown that these experiments are consistent with a C^{14} isotope effect twice that of the C^{13} one.

1477
FRACTIONATION OF ISOTOPES BY DISTILLATION OF SOME ORGANIC SUBSTANCES. D. C. Bradley. Nature 173, 260-1 (1954). C.A. 48, 5584a.

The experimental data of Baertschi et al (Nature 171, 1018 (1953) on the change in volatility of $CHCl_3$, CCl_4, CH_3OH, and C_6H_6 caused by substituting C^{13} for C^{12}, Cl^{37} for Cl^{35}, or O^{18} for O^{16} are attributed to two opposing effects. These effects are a mass-entropy effect and an intermolecular attraction effect.

1478
KINETICS OF THE ISOTOPIC EXCHANGE REACTION BETWEEN CARBON MONOXIDE AND CARBON DIOXIDE. T. Hayakawa. Bull. Chem. Soc. Japan 26, 165-72 (1953). C.A. 48, 5617c.

The exchange between $C^{12}O$ and $C^{13}O_2$ was studied. The probable mechanism adopted was a bimolecular exchange between the 2 substances adsorbed on the quartz vessel.

1479
FREE RADICAL INITIATED $O^{16}O^{18}$-H_2O^{16} EXCHANGE REACTION IN AQUEOUS SOLUTION. Edwin J. Hart, Sheffield Gorden, and Dwight A. Hutchison. J. Am. Chem. Soc. 75, 6165-9 (1953). C.A. 48, 5617d.

A γ-ray-initiated chain exchange reaction of isotopically enriched dissolved O^{16}/O^{18} was found with normal O of the H_2O in alkaline solutions.

1480
RAPID EXCHANGE BETWEEN IODINE AND STANNIC IODIDE IN CARBON TETRACHLORIDE AT 0°. Milton Kahn and Arthur J. Freedman. J. Am. Chem. Soc. 76, 929-30 (1954). C.A. 48, 5619f.

Rapid exchange takes place between SnI_4 and Iodine in CCl_4 at 0° in a dark-red light. Complete exchange took place in less than 7 seconds.

1481
ISOTOPIC EXCHANGE REACTIONS OF NEPTUNIUM IONS IN SOLUTION. I. THE Np(V)-Np(VI) EXCHANGE. Donald Cohen, J. C. Sullivan, and J. C. Hindman. J. Am. Chem. Soc. 76, 352-4 (1954). C.A. 48, 5639g.

The isotopic exchange reaction between NpO_2^+ and NpO_2^{++} was measured in 1M $HClO_4$ at 0 and 10°. At 0° k = 29 l/mole/sec. The activation energy is 8.3 kcal/mole and the entropy of activation is -24 cal/deg/mole. Results are discussed in terms of a homogeneous electron transfer mechanism.

1482
CHANGE OF THE ISOTOPIC ABUNDANCE RATIO WITHIN A SPHERE DUE TO DIFFUSION. J. T. Bracken and F. E. Senftle. J. Appl. Phys. 25, 267-8 (1954). C.A. 48, 5659h.

Theory.

1483
DETERMINATION OF THE RELATIVE OXYGEN ISOTOPE RATIOS IN SILICATE ROCKS AND MINERALS. H. Schwander. Geochim. et Cosmochim. Acta 4, 261-91 (1953)(In German). C.A. 48, 5667i.

Results on O^{18}/O^{16} ratios from 70 minerals indicate that crystallization from magna fractionates the O isotopes, the first phases being richer in the heavier isotope. The O^{18}/O^{16} ratio increases, going from plutonic to metamorphic to sedimentary rocks with an over-all spread in values of 39%.

1484
THE THEORY OF ELECTRON-TRANSFER PROCESSES IN AQUEOUS SOLUTIONS. J. Weiss. Proc. Roy. Soc. (London) A222, 128-41 (1954). C.A. 48, 6233e.

A quantum mechanical theory is developed taking into account the role played by the solvent with particular reference to the Frank-Condon principle. The electron exchange in the ferrous-ferric system is particularly discussed and the case of cobaltous and cobaltic hexamine ions is considered.

1485
THE PRIMEVAL COSMIC ABUNDANCE OF DEUTERIUM. G. Boato. Phys. Rev. 93, 640-1 (1954). C.A. 48, 6243d.

The D/H ratio in the sun has been reported to be 1.6×10^{-6} or 2.5×10^{-8}. The D/H ratio in Lake Michigan water is 0.000148. Variations from this ratio are -13 to +5.5% in surface water, and -13 to +35% in carbonaceous meterorites. The low ratio in the sun is probably due to consumption of D in the sun by nuclear reactions. The primeval D/H ratio was probably somewhat less than 1/6500.

1486
THE RELATIVE DIFFERENCE IN H_2O^{18} CONTENT OF NATURAL WATER. Peter Baertschi. Helv. Chim. Acta 36, 1352-69 (1953). C.A. 48, 6622f.

The variation in 91 samples expressed in percentage of the ratio in the standard ranged from -7.1 to +18.0.

1487
CONCENTRATION OF HEAVY WATER BY MEANS OF FRACTIONAL DISTILLATION. Wolfgang Ehrenberg and Heinz Jaffke. Z. angew. Phys. 5, 375-6 (1953.) C.A. 48, 6747i (English

Trans. AERE-Lib/trans-469).

A series of fractional distillations of light water containing 5, 10, 25, and 50% D_2O are described in which a total separation of 1.30 was experimentally achieved.

1488

THE EXCHANGE EQUILIBRIA OF STABLE CARBON ISOTOPES IN MARINE SEDIMENTS. Sture Landergren. Z. Naturforsch. 8b, 537-41 (1953). C.A. 48, 6756a.

Determination of the C^{12}/C^{13} ratios in limestones, shales, and pelagic clays gave the following results:

>90 in organic C compounds, <90 in carbonate C, >89 in the carbonate phase in clays, and <89 in calcareous deposits.

1489

PREPARATION OF LIGHT WATER BY DISTILLATION-ITS COMPOSITION AND THE DENSITIES AND FRACTIONATION FACTORS OF ITS ISOTOPES. H. E. Watson. J. Appl. Chem. (London) 3, 556-63 (1953). C.A. 48, 6762g.

Distillation of water in a 40-ft packed column yielded water containing less than 8% of the normal O^{18} content. The distillation fractionation factor for H_2O^{18} and H_2O^{16} at 100° is greater than 1.0045, probably 1.0056; for H_2O^{17} it is probably 1.0028. An electrolytic fractionation factor of 1.03 was obtained for O^{18}.

1490

PRESSURE-VOLUME-TEMPERATURE RELATIONSHIPS OF LIQUID NORMAL DEUTERIUM. Abraham S. Friedman, Max Trzeciak and Herrick L. Johnston. J. Am. Chem. Soc. 76, 1552-3 (1954). C.A. 48, 6762i.

Compressibility factors of liquid normal D_2 were determined at pressures from 9 to 109 atmospheres and at temperatures between the triple and critical points of D_2. Data fit the equation

$$\left(\frac{\partial P}{\partial T}\right)_V = -14.1 + (665/V),$$

where P is in atmospheres, T in degrees absolute, and V in cc per mole.

1491

THE CHEMICAL ISOTOPE SEPARATION PROCESS AS A RECTIFICATION PROBLEM. E. W. Becker and K. Bier. Z. Naturforsch. 7a, 651-64 (1952). C.A. 48, 6868i.

The enrichment of C^{13} by the $HC^{13}N(g) + NaC^{12}N(aq) \rightleftharpoons HC^{12}N(g) + NaC^{13}N(aq)$ reaction was used as an example for developing the optimum operating conditions for single columns and column cascades. A four-stage separation cascade for a plant producing 0.18 mole/day of C containing 12% C^{13} is designed.

1492

RESULTS OF LOW-TEMPERATURE RESEARCH XII. ENRICHMENT OF LIGHT ISOTOPES OF ARGON BY RECTIFICATION. Klaus Clusius and Horst Meyer. Helv. Chim. Acta 36, 2045-56 (1953). C.A. 48, 6869a.

Natural A contains 0.337% A^{36}. The vapor pressure ratio of A^{36} to A^{40} at 83.8°K is calculated to be 1.006. A rectification apparatus is described which, with 130 theoretical plates, has a separating factor of 1.94 for A^{36} and permits production of 15 l/day of A containing 0.6% A^{36}.

1493

EXPERIENCE WITH A CHEMICAL EXCHANGE INSTALLATION FOR ENRICHMENT OF C^{13}. E. W. Becker, K. Bier, S. Scholz and W. Vogell. Z. Naturforsch. 7a, 664-8 (1952). C.A. 48, 6869a.

The construction of a four-stage separation plant to enrich C^{13} using the $HC^{13}N(g) + NaC^{12}N(aq) \rightleftharpoons HC^{12}N(g) + NaC^{13}N(aq)$ reaction is described. The plant produced 0.16 mole/day of C containing 12% C^{13} and reached production concentration in ~ 53 hours.

1494

THE EXCHANGE OF CHROMIUM BETWEEN CHROMIUM (II) AND CHROMIUM(III) IONS. H. van der Straaten and A. H. W. Aten, Jr. Rec. trav. chim. 73, 89-94 (1954). C.A. 48, 7405g.

Radioactive $CrCl_3$ and inactive $CrCl_2$ were mixed and the exchange of Cr was studied. The experiments indicated that the exchange is very rapid.

1494a

HEAVY WATER. A REVIEW OF PROCESSES AND PLANTS FOR LARGE-SCALE PRODUCTION. Patrick J. Selak and Joseph Finke. Chem. Eng. Progr. 50, 221-9 (1954). C.A. 48, 7444d.

Plants and processes for production of tonnage quantities of heavy are reviewed from the standpoint of flowsheet, process engineering, description of existing plants, and plant performance.

1495

EXCHANGE REACTIONS AND MAGNETIC SUSCEPTIBILITIES OF COMPLEX SALTS. I. SOME COMPLEX SALTS OF FERRIC IRON. H. C. Clark, N. F. Curtis, and A. L. Odell. J. Chem. Soc. 1954, 63-6. C.A. 48, 7477b.

The oxalates and malonates showed rapid exchange with C^{14}-labeled ligand ions; the ferricyanide showed exchange only at high acidities.

1496

EVIDENCE FOR A BRIDGED ACTIVATED COMPLEX FOR ELECTRON-TRANSFER REACTIONS. Henry Taube and Howard Myers. J. Am. Chem. Soc. 76, 2103-11 (1954). C.A. 48, 7946e.

Reactions of Cr^{++} and ions of the type $Co(NH_3)_5X^{++}$ takes place with quantitative transfer of X. This leads to an activated complex with X being bonded to Cr and Co simultaneously. Strong evidence is presented for the bridge mechanism for Fe(III) + Cr^{++} and electron exchange between Fe^{++} and Fe(III) species.

1497

SOME FRACTIONATION EFFECTS INVOLVING THE ISOTOPES OF HYDROGEN. Maxwell L. Eidinoff. Trans. N. Y. Acad. Sci. 16, 76-82 (1953). C.A. 48, 7953b.

A discussion of published data on chemical and biochemical reactions of H, D, and T, with 35 references.

1498

CATALYSIS ON EVAPORATED METAL FILMS. III. THE EFFICIENCY OF DIFFERENT METALS FOR THE REACTION BETWEEN ETHANE AND DEUTERIUM. J. R. Anderson and C. Kemball. Proc. Roy. Soc. A223, 361-77 (1954). C.A. 48, 7965g.

Catalyzed exchange reactions between ethane and deuterium were studied over evaporated films of W, Mo, Ta, Zr, Cr, V, Ni, Pt, Pd, Rh, Ru, Mg, Ag, Fe, and Co at elevated temperatures.

1499
CATALYSIS ON EVAPORATED METAL FILMS. IV. EXCHANGE BETWEEN PROPANE AND DEUTERIUM AND ISOBUTANE AND DEUTERIUM. C. Kemball. Proc. Roy. Soc. A223, 377-92 (1954). C.A. 48, 7965i.
Exchange reactions of propane and isobutane with deuterium on evaporated films of W, Rh, and Ni were studied with a mass spectrometer.

1500
THE ABSENCE OF EXCHANGE OF SULFUR ATOMS BETWEEN DITHIONITE AND THIOSULFATE AS WELL AS BETWEEN SULFATE AND TETRATHIONATE. Heinz Elkeles. Acta Chem. Scand. 7, 1012-13 (1953). C.A. 48, 7970g.
No exchange of radioactive S is found between $S_2O_3^{2-}$ ion, labeled with S^{35} in its outer S position, and $S_2O_4^{2-}$ ion in aqueous solution at pH 13 after 44 hours or at pH 6 after 1 hour. No exchange of S is found between labeled $S_4O_6^{2-}$ and inactive SO_4^{2-} ions in alkaline solution.

1501
THE EXCHANGE OF OXYGEN ISOTOPES BETWEEN WATER AND HYDRATED CHROMIC CHLORIDE. H. A. E. MacKenzie and A. M. Milner. Trans. of the Faraday Soc. 49, 1437-1443 (1953). C.A. 48, 7995b.
At isotopic equilibration O^{18} exists at a higher concentration in the water of hydration than in the solvent water.

1502
ISOTOPIC EXCHANGE REACTIONS IN LIQUID SULFUR DIOXIDE. III. THE CATALYZED SULFUR EXCHANGE BETWEEN THIONYL BROMIDE AND SULFUR DIOXIDE. Rolfe H. Herber, T. H. Norris, and J. L. Huston. J. Am. Chem. Soc. 76, 2015-18 (1954). C.A. 48, 8012e.
The addition of a number of ionic halides to the SO_2-$SOBr_2$ system produces a strong catalysis of S exchange. The catalysis is homogeneous, with exchange rates apparently first order in catalyst concentration and zero order in thionyl bromide concentration. $(CH_3)_4NBr$, RbBr, RbCl, CsBr, KBr, and KCl act as catalysts although the last two are limited by low solubility.

1503
EXCHANGE OF CHLORINE BETWEEN THE GREEN CHROMIUM(III) CHLORIDE AND CHLORIDE IONS. H. van der Straaten and A. H. W. Aten, Jr. Rec. trav. chim. 73, 157-60 (1954). C.A. 48, 8078h.
NaCl was irradiated with fast neutrons to produce Cl isotopes 34 and 39. A slight exchange occurred when 1.6 moles/l of $[CrCl_2(H_2O)_4]Cl\cdot H_2O$ was mixed with 2.2 moles/l of NaCl for 35 min. at 25°.

1504
CONCENTRATION OF HEAVY WATER. M. Romaniw. Belgium Patent 485,904, Mar. 16, 1949. (AEC-tr-1792). C.A. 48, 8080d.
A method for concentrating D_2O by alternate freezing and thawing is proposed.

1505
HEAVY WATER. Jomar Brun. Tidsskr. Kjemi, Bergvesen Met. 13, 156-61 (1953). C.A. 48, 8608c.
A review of the properties, separation, concentration, and analysis of D_2O. 21 references.

1506
MECHANISM OF HYDROGEN EXCHANGE AND SOME PROTOLYTIC REACTIONS IN SOLUTION. A. I. Brodskii. Zhur. Obshchei Khim. 24, 413-22 (1954); J. Gen. Chem. (U.S.S.R.) 24, 421-8 (1954)(Eng. translation). C.A. 48, 8621g.
Isotope exchange reactions of H in solutions are classified as rapid or slow depending on the presence or absence of unshared electron pairs on the atom with which the exchanging H atom is found. Rapid exchange takes place with NH, HO, SH, and HCl, etc., links. Slow exchange is typical of the CH link and no exchange occurs with the SiH link. The various mechanisms are discussed.

1507
KINETICS OF THE EXCHANGE OF CADMIUM BETWEEN AMALGAM AND CADMIUM SALT SOLUTIONS AT EQUILIBRIUM POTENTIAL. I. THE RATE LAW IN PERCHLORATE SOLUTIONS. Sture Fronaeus. Acta. Chem. Scand. 7, 764-73 (1953). C.A. 48, 8633h.
The exchange of Cd between liquid amalgams and $Cd(ClO_4)_2$ solutions was investigated using radioactive Cd^{115}. Inactive amalgam was allowed to squirt out forming droplets which passed through the radioactive solution. From the rate law obtained, it was shown that the diffusion of Cd ions through the Nernst diffusion layer is the rate-controlling factor for the exchange under the experimental conditions used.

1508
PILOT-EXPERIMENT FOR CONTINUOUS ISOTOPE SEPARATION. J. Hengevoss and R. Fleischmann. Z. Physik. 137, 265-73 (1954). C.A. 48, 8670a.
A thermal diffusion tube was operated with air as the trial gas.

1509
INFLUENCE OF THROUGHPUT IN THE SEPARATING EFFICIENCY OF CLUSIUS-DICKEL SEPARATING TUBES. Erwin David. Z. Physik. 137, 274-9 (1954). C.A. 48, 8670b.
The reduction in separating efficiency by the uniform flow of throughput is of significant importance for continuously operating installations of separating tubes. There is no reduction for an ideal separating tube; the experimentally found reduction is due to perturbations arising from the wire supports.

1510
CARBON-13 ISOTOPE EFFECT IN THE THERMODECOMPOSITION OF NICKEL CARBONYL. Richard B. Bernstein. J. Chem. Phys. 22, 710-13 (1954). C.A. 48, 9132g.
The C^{12}-C^{13} fractionation factor in the decomposition of gaseous $Ni(CO)_4$ was measured from 30 to 105° with samples of normal isotope abundance. Assuming that the rate-determining step is the rupture of a Ni-C bond, the rate constants were defined as: $Ni(CO)_4 = Ni(CO)_3 + CO$ (k_1), $Ni(CO)_3C^*O = Ni(CO)_3 + C^*O$ (k_2), $Ni(CO)_3C^*O = Ni(CO)_2C^*O + CO$ (k_3). The C^{12} enrichment of the first fraction of CO from decomposition gave over the temperature range studied, $k_1/(k_2 + k_3) = 1.0222 - 6.7 \times 10^{-5}$ t. The intramolecular and intermolecular isotope effects were defined as $k_3/3k_2$ and $k_1/4k_2$, respectively. The intramolecular effect had a value of 1.0345. The intermolecular constant was $k_1/4k_2 = 1.0481 - 6.7 \times 10^{-5}$ t.

1511
NON-EXCHANGE OF CHLORINE BETWEEN CHLORATE AND PERCHLORATE IONS. D. A. Lee. J. Am. Chem. Soc. 76, 2590-1 (1954). C.A. 48, 9161d.
In a water solution of 0.056N $KCl^{36}O_3$ and 0.056N $NaClO_4$, there is no exchange of Cl between chlorate and perchlorate ions at room temperature in 2 years. There is no exchange in 0.1N H_2SO_4 and 0.1N NaOH in 19.5 hours. Increasing the temperature to 99° did not increase the exchange rate in 1 hour.

1512
ELECTROMAGNETIC CONCENTRATION OF SAMARIUM. L. O. Love and W. A. Bell. Oct. 4, 1950. Decl. Feb. 1953. 31p. (AECD-3502). C.A. 48, 9230c.
Samples of all the known stable isotopes of Sm were prepared by electromagnetic concentration of $SmCl_3$.

1513
ELECTROMAGNETIC CONCENTRATION OF THE STABLE ISOTOPES OF MERCURY. L. O. Love and W. E. Leyshon. (AECD-3501) Aug. 23, 1951. Decl. Feb. 1953. 49p. C.A. 48, 9230d.
Operating details are given for the use of the calutron to produce Hg isotopes. Almost 10 g of Hg^{202} in better than 80% purity and 200 mg better than 98% purity was produced.

1514
A THERMAL METHOD FOR CONCENTRATING HEAVY WATER. E. Cerrai, C. Marchetti, R. Renzoni, L. Roseo, M. Silvestri, and S. Villani. Chem. Eng. Progr. Symposium Ser. 50 No. 11, 271-80 (1954). C.A. 48, 9757f.
A separating element is described which utilizes the temperature dependence of the deuterium exchange constants in H_2-H_2O systems. An ideal cascade with these elements is also examined, and the possible energy consumption is estimated. Some experimental results from a laboratory unit are given.

1514a
RADIOACTIVE EXCHANGE STUDIES ON THE TRANSFORMATIONS OF THE HYDRATES OF CALCIUM SULFATE. J. A. A. Ketelaar and D. Heijmann. Rec. trav. chim. 73, 279-86 (1954). C.A. 48, 9779g.
The exchange of sulfate ions labeled with S^{35} in solution with solid $CaSO_4 \cdot 2H_2O$ and $CaSO_4 \cdot 0.5H_2O$ was studied in saturated solutions at 80° containing H_3PO_4 of various concentrations.

1515
NONEXCHANGE OF CHLORINE BETWEEN CHLORIDE AND HEXACHLOROOSMATE(IV) IONS IN AQUEOUS SOLUTION. Linda L. Larson and Clifford S. Garner. J. Am. Chem. Soc. 76, 2180-1 (1954) C.A. 48, 9792f.
Chloride exchange in the chloride-hexachloroosmate(IV) system did not occur (within 5% experimental error) at temperatures up to 50° and times as long as 63 days. HNO_3 and H_2SO_4 solutions were used.

1516
HYDROGEN CHLORIDE - THE EXCHANGE REACTION BETWEEN TRITIUM HYDRIDE AND HYDROGEN CHLORIDE-RED HYDROGEN CHLORIDE, AN IMPURITY COLOR CENTER. Robert E. Martin. Univ. Microfilms (Ann Arbor, Mich.) Pub. No. 8052, 172 pp.; Dissertation Abstr. 14, 936 (1954). C.A. 48, 9793g.

1517
KINETICS OF THE EXCHANGE OF CADMIUM AMALGAM AND CADMIUM SALT SOLUTIONS AT EQUILIBRIUM POTENTIAL. II. THE INFLUENCE OF COMPLEX FORMATION. Sture Fronaeus. Acta Chem. Scand. 8, 412-19 (1954). C.A. 48, 9854i.
The bromide and iodide ions and NH_3 are selected as ligands and the concentrations of the different complexes in solution are known. In all cases the exchange rate was found to be diffusion controlled.

1518
KINETICS OF THE EXCHANGE OF HYDROGEN BETWEEN PHOSPHINE AND WATER: A KINETIC ESTIMATE OF THE ACID AND BASE STRENGTHS OF PHOSPHINE. Ralph E. Weston, Jr. and Jacob Bigeleisen. J. Am. Chem. Soc. 76, 3074-8 (1954). C.A. 48, 10411a.
The rate of approach to equilibrium in the H exchange between phosphine and water containing 3% D has been measured by following the uptake of D in the phosphine. Under conditions where the diffusion from the gaseous to the liquid phase is not rate-determining, the fraction of exchange as a function of time follows the usual McKay rate law.

1519
INTRAMOLECULAR CARBON ISOTOPE EFFECT ON THE DECARBOXYLATION OF NORMAL MALONIC ACID IN QUINOLINE SOLUTION. Peter E. Yankwich and R. Linn Belford. J. Am. Chem. Soc. 76, 3067-70. C.A. 48, 10411h.
Results at 86-138° are combined with earlier measurements and compared with theory.

1520
RATE OF ISOTOPIC EXCHANGE REACTIONS OF HYDROGEN IN BENZENE AND IN NAPHTHALENE UPON CATALYSIS BY A SOLUTION OF POTASSIUM AMIDE IN LIQUID DEUTERIATED AMMONIA. A. I. Shatenshtein and E. A. Izrailevich. Zhur. Fiz. Khim. 28, 3-10 (1954). C.A. 48, 10413c.
The activation energy for the exchange of H and D in C_6H_6(I) and $C_{10}H_8$(II) in the presence of a solution of KND_2(III) in ND_3 was determined by observation of the rate of exchange at various temperatures and III concentrations. Experimental values of the rate constant k are tabulated for I and II as functions of temperature and III concentrations. At 25° k for I is 4.4×10^{-5}, 5.7×10^{-5}, 8.6×10^{-5}, 1.8×10^{-4} and 4.2×10^{-4} sec.$^{-1}$ for III concentrations of 0.01, 0.014, 0.021, 0.059, and 0.19N, respectively. k for II is 5.9×10^{-4} sec.$^{-1}$ when the III concentration is 0.021N. Calculated activation energies for the exchange of H and D in I and II are 15.8 ± 0.5 and 14.2 kcal, respectively.

1521
MOBILITY OF HYDROGEN IN TOLUENE. N. M. Dykhno and A. I. Shatenshtein. Zhur. Fiz. Khim. 28, 11-13 (1954). C.A. 48, 10413d.
The rate of exchange of H and D in the Me group and in the ring of toluene in the presence of a solution of KND_2 in ND_3 was studied. For a KND_2 concentration of 0.05N and a temperature of 25°, the rate constants for exchange with the Me group and the ring are about 2×10^{-3} and 4×10^{-5} sec.$^{-1}$, respectively.

1522
CATALYSIS BY Pt(III) OF EXCHANGE REACTIONS OF $PtCl_4^{2-}$ AND $PtCl_6^{2-}$. Ronald L. Rich and Henry Taube. J. Am. Chem. Soc. 76, 2608-11 (1954). C.A. 48, 10414a.

The exchange of $PtCl_6^{2-}$ and Cl^- by a chain mechanism is initiated by light, catalyzed by $PtCl_4^{2-}$, inhibited by $Fe(CN)_6^{2-}$, $IrCl_6^{2-}$, and some reducing agents. The rate of exchange by non-chain paths is very slow. The exchange of $PtCl_4^{2-}$ and Cl^- is induced by Ce(IV) but not by Cl_2, the exchange of Pt between $PtCl_4^{2-}$ and $PtCl_6^{2-}$ is catalyzed by light and inhibited by $IrCl_6^{2-}$.

1523
ISOTOPIC EXCHANGE OF OXYGEN IN THE SYSTEMS: WATER-SILICA AND OXYGEN-SILICA. Dwight A. Hutchison. J. Chem. Phys. 22, 758-9 (1954). C.A. 48, 10414e.

Isotopic exchange in the silica-O system did not occur up to 1000°. The reaction $H_2O^{18} + SiO_2^{16} = H_2O^{16} + SiO^{16}O^{18}$ was carried out using 1.1% H_2O^{18} in silica tubes. Partial evidence was obtained of a homogeneous reaction between water and dissolved silica at 960°. At 750° the rate of the reaction was apparently controlled by a surface reaction.

1524
SEPARATION OF CHLORINE ISOTOPES BY ION-EXCHANGE CHROMATOGRAPHY. Tage Langvad. Acta Chem. Scand. 8, 526-7 (1954). C.A. 48, 10485h.

An attempt was made to separate chlorine isotopes with a strongly basic anion-exchange resin.

1525
PROPERTIES OF THE BORON HALIDES. IV. THE SEPARATION OF BORON BY THE THERMAL DIFFUSION OF BORON TRIFLUORIDE. B. A. Cooke, J. Hawes, and H. A. E. MacKenzie. J. S. African Chem. Inst. 7, 11-19 (1954). C.A. 48, 11134e.

A 10 ft stainless steel column with an annular space of radii 0.635 and 1.120 cm gave an equilibrium separation factor of 1.14 in less than 8 hours when operated at 55 cm pressure with a temperature gradient of 780° per cm and a power consumption of 980 watts.

1526
MOBILITY OF HYDROGEN IN TETRALIN. N. M. Dykhno and A. I. Shatenshtein. Zhur. Fiz. Khim. 28, 14-18 (1954). C.A. 48, 11139e.

The rate of exchange of H and D in tetralin in the presence of a solution of KND_2 in ND_3 was determined. For a KND_2 concentration of 0.05N and a temperature of 20° the rate constants for the aromatic ring and the α-methylene group are about 10^{-5} and 10^{-3} sec.$^{-1}$, respectively. No exchange was observed with the β-methylene group.

1527
THE EXCHANGE OF IODINE ATOMS BETWEEN IODINE AND METHYL IODIDE IN THE TEMPERATURE RANGE 150-375°. Douglas Clark, H. O. Pritchard, and A. F. Trotman-Dickenson. J. Chem. Soc. 1954, 2633-5. C.A. 48, 11162h.

The reaction of MeI vapor with radioactive I vapor was studied by a static method up to 250°, and in a flow pyrolysis apparatus at 375°.

1528
ACID-INDUCED HYDROGEN EXCHANGE IN BENZENE DERIVATIVES AS ELECTROPHYLIC AROMATIC SUBSTITUTION. Stig Olsson and Lars Melander. Acta Chem. Scand. 8, 523-5 (1954). C.A. 48, 11163e.

Toluene carrying tracer amounts of tritium in its ortho, meta, para and α positions, respectively, were shaken with 81.8% H_2SO_4 at 25° and the decay of the tritium content of the toluene measured as a function of time. The Me hydrogens do not exchange appreciably with the acid in 2 days. The relative exchange rates for tritium in the individual positions of toluene are o:m:p (32 ± 2): (1.00 ± 0.06): (29 ± 2). The trend of the curves indicates the heavy isotope prefers the position in the aromatic nucleus to that in the acid.

1529
SULFUR FRACTIONATION STUDIES AND THEIR RELATION TO GEOLOGICAL PROBLEMS. H. G. Thode. Trans. Can. Inst. Mining Met. 57 (in Can. Mining Met. Bull. 507, 463-5) (1954). C.A. 48, 11266a.

Considering S^{32} and S^{34}, the S^{34} content of S varies by about 8% depending on its origin. When the earth was formed the S abundance were about the same as in meteorites today, but terrestrial S became fractionated in geochemical and biologoical processes, sulfates being enriched and sulfides depleted in S^{34}. S formed in the muds at the bottom of lakes and seas by bacterial action is considerably depleted in S^{34} as compared with the source sulfate.

1530
THE GEOLOGICAL SIGNIFICANCE OF VARIATIONS IN THE ABUNDANCES OF THE ISOTOPES OF SILICON IN ROCKS. F. S. Grant. Geochim. et Cosmochim. Acta 5, 225-42 (1954). C.A. 48, 11266c.

Physical and chemical processes which may lead to variations in the isotopic content of rocks are discussed.

1530a
ISOTOPE EFFECT OF HYDROGEN AND MECHANISM OF AROMATIC SULFONATION. Ulla Berglund-Larsson and Lars Melander. Ankivi Kemi. 6, 219-29 (1953). C.A. 48, 11377i.

Bromobenzene-4-t was sulfonated with oleum and the ratio k_T/k_H was determined to be 0.55 ± 0.09 at 0°.

1531
THE ADSORPTION OF HYDROGEN AND DEUTERIUM ON NICKEL-SILICA CATALYSTS. G. C. A. Schuit. Proc. Intern. Symposium Reactivity of Solids, Gothenburg 1952, 571-81 (Pub. 1954). C.A. 48, 11869h.

H and D were adsorbed in varying sequence and under varying conditions on a reduced coprecipitated catalyst of the composition $3Ni\text{-}SiO_2$. The H/D ratios of the gaseous mixtures then desorbed from the catalysts are independent of the sequence of adsorption of the isotopes and contain H_2, D_2, and HD in the equilibrium amounts corresponding to the temperature of desorption.

1532
TRACER STUDIES IN LIQUID NITROSYL CHLORIDE. J. Lewis and R. G. Wilkins. Chemistry and Industry 1954, 634-5. C.A. 48, 11880h.

Isotopic exchanges of $N^{15}H_4Cl$ in liquid NH_3, SO_3^{--} in liquid $S^{35}O_2$, and $N^{15}O_3^-$ in

liquid N_2O_4 do not distinguish between self-ionization of the solvent and direct proton or oxide ion transfer. Complete Cl exchange was found for Me_4NCl^{36} in liquid NOCl. At -6° exchange was complete in 10 minutes.

1533
USE OF OXYGEN-ISOTOPE EFFECTS IN THE STUDY OF HYDRATION OF IONS. Henry Taube. J. Phys. Chem. 58, 523-8 (1954). C.A. 48, 11881b.
Largely a review of Taube's work in the field. Results are given for measurements of the salt effect exerted on the activity ratio of H_2O^{18} compared to H_2O^{16} in the liquid.

1534
SOME ASPECTS OF ISOTOPIC EXCHANGE. Rolfe H. Herber. J. Chem. Ed. 31, 359-61 (1954). C.A. 48, 11886b.
General principles of isotopic exchange investigations are discussed, including methods for calculation of the rate and activation energy of the exchange reaction.

1535
EXCHANGE REACTIONS OF SULFUR. E. N. Gur'yanova. Zhur. Fiz. Khim. 28, 67-72 (1954). C.A. 48, 11888c.
The exchange of S atoms was studied between the element (containing S^{35}) and diethyl trisulfide, di-p-tolyl trisulfide, thiourea, phenylthiourea, diphenylthiourea, 2-mercaptobenzothiazole, di-2-benzothiazolyl disulfide, di-2-benzothiazolylmonosulfide, Na diethyldithiocarbamate, and Ni diethyldithiocarbamate. The compounds, dissolved in various solvents, were mixed with equimolar amounts of tagged S and kept 5-22 hours at temperatures between 100 and 160°; the degree of exchange was determined after purification. Results are tabulated for each compound. The tendency toward S exchange of vulcanizing accelerators increases with their activity. The S atom of p-thiocresol does not exchange with SCl_2 or S_2Cl_2.

1536
ISOTOPE EXCHANGE WITH SOLIDS AS A TOOL FOR THE MEASUREMENT OF SELF-DIFFUSION. K. E. Zimen. Proc. Intern. Symposium Reactivity of Solids, Gothenburg 1952, Pt. 1, 85-92 (1954). C.A. 48, 11891i.
Two reactions are analyzed that occur in the course of isotope exchange in heterogeneous systems. These are exchange reaction in the boundary layers and the process of self diffusion. Criteria are developed to determine which is rate determining. The experimental set-ups used for the study of liquid-solid and gas-solid systems are described in detail.

1537
THE KINETICS OF THE BASE-CATALYZED DEUTERIUM EXCHANGE OF CHLOROFORM IN AQUEOUS SOLUTION. Jack Hine, Roy C. Peek, Jr., and Billy D. Oakes. J. Am. Chem. Soc. 76, 827-9 (1954). C.A. 48, 11893i.
The kinetics of the reaction of $CDCl_3$ with NaOH in homogeneous aqueous solution was studied by infrared measurements of the isotopic content of the chlorine compound. The reaction appeared to be only slightly subject to general base catalysis and was found to proceed very nearly half as fast as the analogous reaction of $CHCl_3$ with NaOD in D_2O solution.

1538
THE ISOTOPIC EXCHANGE BETWEEN SULFUR AND SULFUR MONOCHLORIDE. Antonino Fava and Lucio Salsilli. Ricerca sci. 24, 375-6 (1954). C.A. 48, 11912g.
A study was made of the exchange between S and S_2Cl_2 in dehydrated CCl_4. Reproducible results show that the exchange is first order with respect to both S and S_2Cl_2.

1539
THE ELECTRON-TUNNELING HYPOTHESIS FOR ELECTRON-EXCHANGE REACTIONS. Rudolph J. Marcus, Bruno J. Zwolinski, and Henry Eyring. J. Phys. Chem. 58, 432-7 (1954). C.A. 48, 11934e.
A treatment of the available data on the rates of electron exchange reactions. A theory of electron tunneling is proposed as pertinent to the interpretation of the mechanisms involved. A method is introduced for finding the most stable activated complex, and an approximate expression for the closest distance of approach is derived and related to various variables.

1540
EXCHANGE AND AQUATION STUDIES WITH THIOCYANATO COMPLEXES. Arthur W. Adamson and R. G. Wilkins. J. Am. Chem. Soc. 76, 3379-85 (1954). C.A. 48, 11969c.
The first-order aquation rate constants for the replacement of SCN by the H_2O for the complex ions $[Cr(NH_3)_5(SCN)]^{++}$ and $[Co(NH_3)_5(SCN)]^{++}$ in min.$^{-1}$ are $k = 1.17 \times 10^{13} \exp(-24,900/RT)$ and $k = 0.85 \times 10^{13} \exp(-26,800/RT)$, with $\Delta S^{\ddagger} = -7.8$ and -8.4 electrostatic units. The rate of exchange of $(SCN)^-$ with the $SC^{14}N$ complexes is slow compared to the rate of aquation.

1541
GEOLOGIC IMPORTANCE OF VARIATIONS IN STABLE ISOTOPIC ABUNDANCES. M. L. Jensen. Econ. Geol. 48, 161-76 (1953). C.A. 48, 11997f.
A review.

1542
THE ORIGIN OF NATIVE SULFUR DEPOSITS FROM ISOTOPE FRACTIONATION STUDIES. H. G. Thode, R. K. Wanless, and R. Wallouch. Geochim. et Cosmochim. Acta 5, 286-98 (1954). C.A. 48, 11998a.
Elemental S in Texas and Louisiana salt domes is depleted in S^{34} by 3.9% with respect to associated sulfates. Free S formed by bacterial reduction of sulfate in North African lakes shows a similar reduction in S^{34} by 3.9%. C^{13} in the calcite of the salt domes was depleted by 3.3 to 5.5% in comparison with standard limestone indicating the biological origin of the C. From these data, it is concluded that the large S deposits of the southwestern United States have been formed by living organisms.

1543
ISOTOPE EFFECTS DURING CATALYTIC HYDROGENATIONS. William A. Bonner and Clair J. Collins. J. Am. Chem. Soc. 75, 4516-18 (1953). C.A. 48, 12047f.
Isotope effects during the heterogeneous catalytic reductions of labeled olefin and carbonyl groups are reported.

1544
FRACTIONATION OF OXYGEN ISOTOPES DURING THE FORMATION OF METAL OXIDE FILMS. Malcolm

Dole and G. A. Lane. J. Chem. Phys. 22, 949-50 (1954). C.A. 48, 12508g.

Data are summarized for the isotope fractionation factors for the chemisorption of O on steel and Cu at room temperature. The separation factor for chemisorption of oxygen at room temperature on steel was 1.026 and on copper 1.061.

1545

THE CALCULATION OF EQUILIBRIUM CONSTANTS FOR SEVERAL EXCHANGE REACTIONS OF N^{15} BETWEEN OXY COMPOUNDS OF NITROGEN. W. Spindel. J. Chem. Phys. 22, 1271-2 (1954). C.A. 48, 12522h.

Equilibrium constants are calculated using vibrational frequencies for isotopic exchange reactions between NO, NO_2, NO_2^-, and NO_3^- at 25°C.

1546

KINETICS OF REACTIONS BETWEEN NEPTUNIUM IONS. NEPTUNIUM(IV)-NEPTUNIUM(VI) REACTION IN PERCHLORATE SOLUTION. J. C. Hindman, J. C. Sullivan, and Donald Cohen. J. Am. Chem. Soc. 76, 3278-80 (1954). C.A. 48, 12523g.

For the reaction Np(IV) + Np(VI) $\rightleftharpoons$ 2Np(V) in perchlorate media, the rate law for the forward reaction is given by $-d(Np^{4+})dt/dt = k_1^o(Np^{4+})(NpO_2^{++})(H^+)^{2-}$. At 25° and μ = 2.00, k_1^o = 2.69 moles/l. minute, ΔH^* = 24.6 kcal., ΔS^* = 17.8 cal./degree, and ΔF^* = 19.3 kcal. The effects of Np and H ion concentrations, ionic strength, and temperature were measured.

1547

THE EXCHANGE REACTION BETWEEN CHROMOUS AND CHROMIC IONS IN PERCHLORIC ACID SOLUTION. Anne Anderson and Norman A. Bonner. J. Am. Chem. Soc. 76, 3826-30 (1954). C.A. 48, 12523h.

The rate of the Cr(II)-Cr(III) exchange reaction was measured in $HClO_4$ solutions and shown to be 1st order in both ions. In 1.00 f $HClO_4$ the 2nd order rate constant is 0.440 f^{-1} $hr.^{-1}$ at 24.5°. The activation energy is 22 $\pm$ 2 kcal/mole. If data obtained by varying the H^+ concentration at approximately constant ionic strength are interpreted in terms of exchange reactions between Cr^{++} and the species Cr^{+++} and $Cr(OH)^{++}$, the 2nd order rate constants at 24.5° are $\leq$0.07 $f^{-1}hr.^{-1}$ and $\cong$ 2.5 x 10^3 $f^{-1}hr.^{-1}$, respectively.

1548

THE EXCHANGE REACTION BETWEEN IODINE AND METHYL IODIDE. H. Behrens and Alfred G. Maddock. J. Chem. Phys. 22, 1139 (1954). C.A. 48, 12524a.

When a mixture of I, CH_2I_2 and HI was added to a MeI-I (radioactive I^{131})mixture and the components of the mixture were separated by vacuum distillation at or below 20°, 92% of the activity was found in the MeI fraction, less than 1% in the HI, about 1% in the I, and 6% in the CH_2I_2. The half-time for the exchange reaction fell from 45 days at 300 mg of I/l to a few hours at 4 mg/l.

1549

ISOTOPIC EXCHANGE AND THE STRUCTURE OF TRICALCIUM PHOSPHATE. J. Govaerts. Anales real soc. espan. fis. y quim. (Madrid) 50B, 259-74 (1954); Bol. radiactividad (Madrid) 25, 1-23 (1952-3). C.A. 48, 12528b.

The exchange of phosphate ion between solid $Ca_3(PO_4)_2$ and Na_2HPO_4 in 0.16 and 0.013M aqueous solution was studied with P^{32}. Results were erratic. The exchange appears to proceed in 3 stages which have half lives of 16.7 min., 9 hours, and 222 days. Similar results were obtained in the exchange of Ca^{45} between $Ca_3(PO_4)_2$ and $CaCl_2$ solution. The mechanism is considered.

1550

ISOTOPES. W. M. Jones. Ann. Rev. Phys. Chem. 5, 91-118 (1954). C.A. 48, 12538b.

The enrichment, abundance, natural variations, properties, and methods for analysis of isotopes are reviewed. Applications in studies of rate processes and equilibrium systems, structure, atomic spectra and mass measurements are discussed. 210 references.

1551

DENSITY OF HEAVY WATER AND ELECTROLYTIC ENRICHMENT OF THE OXYGEN ISOTOPES. Pelle Isberg and Lennart Lundberg. Z. Naturforsch. 9a, 472-3 (1954). C.A. 48, 12575i.

The difference in density between heavy water obtained by combustion of D with atmospheric O was previously explained by an enrichment of O^{18} during the process. Mass spectrometric measurements of the ratios O^{17}/O^{16} and O^{18}/O^{16} in heavy water from Norway showed that the enrichment in O^{18} is too small to explain the differences in density. The correct density of heavy water (from the combustion of D) is given as d_{20}^{20} = 1.10735 $\pm$ 0.00001.

1552

EXPERIMENTAL CONTRIBUTION TO THE PROBLEM OF ISOTOPIC SEPARATION BY CHEMICAL MEANS. G. Wagner, A. Pelz, and M. J. Higatsberger. Monatsh. 85, 464-6 (1954). C.A. 48, 12576b.

Li_2CO_3 was precipitated from a concentrated solution of LiCl by the addition of concentrated solutions of Na_2CO_3 and $(NH_4)_2CO_3$. The Li_2CO_3 was recovered as LiCl for further precipitation. After many repetitions, 0.819 g of Li_2CO_3 containing enriched Li^7 was obtained. This was converted to $Li_2O \cdot Al_2O_3 \cdot 2SiO_2$ for mass spectroscopic analysis. The initial material had a Li^6/Li^7 ratio of 1/12.48 $\pm$ 0.04 and the final precipitate a ratio of 1/14.03 (both corrected by the ratio $(7/6)^{\frac{1}{2}}$.).

1553

ISOTOPY. Frederick Soddy. London: New World Publishers 1954. 36p. C.A. 48, 12578h.

1554

ISOTOPE GEOLOGY. Kalervo Rankama. Suomen Kemistilehti 26A, 257-71 (1953). C.A. 48, 12638f.

A short discussion of the principles underlying the geological applications of nuclear research. The principle uses in geology of various nuclides are reviewed and future possibilities of research in isotope geology are outlined.

1555

O^{18} ABUNDANCE IN FRESH WATER. Willi Dansgaard. Nature 174, 234-5 (1954). C.A. 48, 13291b.

Mass spectrometric tests of O^{18} in 109

fresh water samples from various parts of the world showed a decreased O^{18} abundance as the climate becomes colder.

1556
INFLUENCE OF STRUCTURE OF ALKYL IODIDES ON THE RATE OF THE ISOTOPIC EXCHANGE WITH IODINE IONS AND ATOMS. M. B. Neiman, B. A. Kuznetsov and Yu. M. Shapovalov. Doklady Akad. Nauk S.S.S.R. 92, 611-14 (1953). C.A. 48, 13371i.

The isotopic exchange of iodine from PrI(I) and Me_2CHI(II) with iodine ion of NaI in EtOH was studied. Exchange with (I) was 20-25 times faster than with (II). In cyclohexanol solution of iodine under Hg-lamp radiation exchange with (I) was 25 times slower than with (II).

1557
THE EXCHANGE REACTION BETWEEN SUBSTITUTED BENZYL IODIDES AND POTASSIUM IODIDE. II. p-NITROBENZYL IODIDE. E. Lee Purlee, Milton Kahn, and J. L. Riebsomer. J. Am. Chem. Soc. 76, 3796-8 (1954). C.A. 48, 13373e.

A measurable exchange has been observed in methanol and ethanol between the iodine atom in p-nitrobenzyl iodide and the iodide ion in potassium iodide. The exchange reaction was investigated over the temperature range 0 to 30.9°.

1558
THE EXCHANGE OF IODINE BETWEEN ORGANIC IODIDES AND INORGANIC IODINE IN AQUEOUS SOLUTION. H. van der Straaten and A. H. W. Aten, Jr. J. Am. Chem. Soc. 76, 3798-800 (1954). C.A. 48, 13377b.

Rates were measured for the 2nd-order I exchange reactions of iodoacetic acid, Na iodoacetate, and Me iodoacetate with I^- ions by means of I^{131}-labeled I^-. Rate constants and activation energies are given.

1559
EXCHANGE REACTIONS OF SOLID OXIDES. III. MAGNESIUM OXIDE. G. Houghton and E. R. S. Winter. J. Chem. Soc. 1954, 1509-16. C.A. 48, 13377f.

The exchange of O^{18} between the surface of MgO and O gas was studied from 370-510° at O pressures of 1-14 cm. Energies of activation are given and mechanisms discussed.

1560
EXCHANGE REACTIONS OF SOLID OXIDES. IV. ZINC OXIDE. J. A. Barnard, E. R. S. Winter, and H. V. A. Briscoe. J. Chem. Soc. 1954, 1509-16. C.A. 48, 13377g.

The exchange of O^{18} between the surface of ZnO and O gas was studied from 367-630° at O pressures of 1-25 cm. Activation energies are given and mechanisms discussed.

1561
EXCHANGE REACTIONS OF SOLID OXIDES. V. DISSOCIATION OF MOLECULAR OXYGEN AT OXIDE SURFACES: MAGNESIUM OXIDE AND ZINC OXIDE. E. R. S. Winter. J. Chem. Soc. 1954, 1522-7. C.A. 48, 13377i.

The reaction $O_2^{18} + O_2^{16} \rightleftharpoons 2O^{18}O^{16}$ takes place on the surfaces of ZnO and MgO at temperatures below the oxide-oxygen exchange temperature. The rate of reaction is proportional to the 1st power of the O pressure. Activation energies are given and the mechanism discussed.

1562
ALTERED PROPORTIONS OF ISOTOPES OF MOLECULAR NITROGEN AS EVIDENCE FOR A UNIMOLECULAR REACTION. M. Walser, J. George, and L. J. Bodenlos. J. Chem. Phys. 22, 1146 (1954). C.A. 48, 13378f.

In the formation of N_2 gas by the reaction of hypobromite with urea, the distribution of the 3 isotopic forms of molecular nitrogen is identical to the distribution of the 3 isotopic forms of the compound. This result is given as evidence for a unimolecular reaction.

1563
ISOTOPIC EXCHANGE REACTIONS IN TRIETHYLAMINE-LIQUID SULFUR DIOXIDE SOLUTIONS. IV. Rolfe H. Herber and T. H. Norris. J. Am. Chem. Soc. 76, 3849-50 (1954). C.A. 48, 13381e.

An addition compound which solidified at low temperatures was formed by the reaction of equimolar quantities of triethylamine and SO_2. The exchange rate of sulfur between the addition compound and liquid SO_2 was rapid and complete even at dry ice temperatures.

1564
HYDROGEN-DEUTERIUM EXCHANGE ON COPPER, SILVER, GOLD, AND ALLOY SURFACES. Richard J. Mikovsky, Michel Boudart and Hugh S. Taylor. J. Am. Chem. Soc. 76, 3814-19 (1954). C.A. 48, 13387c.

The catalytic activities of Cu, Ag, and Au foils, and of a Ag-Pb (0.69 atom %) alloy foil and of granular Ag catalysts were studied in the H-D exchange reaction. Activation energies and temperature ranges of activity were measured.

1565
COMPLEX CYANIDE - SIMPLE CYANIDE EXCHANGE SYSTEMS. Alan G. MacDiarmid and Norris F. Hall. J. Am. Chem. Soc. 76, 4222-8 (1954). C.A. 48, 13391a.

The rate of exchange of free cyanide (labeled either with C^{14} or N^{15}) with the following complex cyanides is found to increase with decrease of pH: $K_4Fe(CN)_6$(I), $K_3Co(CN)_6$(II), $Na_3Fe(CN)_5(H_2O)$(III). The exchange reaction is found to be light-accelerated with I, II, III, $K_3Cr(CN)_6$, and $Na_2Fe(CN)_5NO$. Exchange is found to be zero order with respect to the free cyanide concentration in the case of I, II, and $K_3Cr(CN)_6$.

1566
REACTIONS WITH NITROGEN^{15}. Klaus Clusius. Angew. Chem. 66, 497-506 (1954). C.A. 48, 13458e.

A comprehensive summary covering: characteristic features of N^{15} chemistry; synthesis of $N^{15}H_3$, $HN^{15}O_3$ and $HN^{15}O_2$; N^{15} analysis by means of spectroscopic bands; and results including decomposition, ring formation, constitution of diazo compounds and azides, proof of a new sextet transformation, nitrate ions in liquid N_2O_4, and chemical problems with pure N^{15} compounds. 25 references.

1567
PHENOMENON OF ISOTOPE SEPARATION INDUCED BY PASSAGE OF ELECTRIC CURRENT IN A MOLTEN METAL. Guy Nief and Étienne Roth. Compt. rend. 239, 162-4 (1954). C.A. 48, 13463f.

At 48°, a current of 2.52 amperes at 4.2 volts was passed for 248 hours through a

sample of molten Ga 188 mm long and 0.2 mm in diameter. The ratios of Ga^{69}/Ga^{71} present at the anode, at the cathode, and in the original material were 1.608 ± 0.005, 1.406 ± 0.065, and 1.510, respectively.

1568
SEPARATION OF ISOTOPES BY ELECTROLYTIC MIGRATION OF IONS. A. Klemm. Colloques intern. centr. natl. recherche sci. 39, Electrolyse C18-C24 (1952). C.A. 48, 13464a.
A review of the experimental methods of isotope separation by electrolytic migration. A theoretical explanation of the results in fused salts is developed. The published experimental data for enrichment of cations in pure fused LiCl, $ZnBr_2$, $ZnCl_2$, AgI, $CdCl_2$, and TlCl are compared with the theory and found to be in good agreement with it.

1569
THE PROBLEM OF OXYGEN ISOTOPES AND GEOCHEMISTRY, MEASUREMENT OF THE PALEO-TEMPERATURE, ETC. Yasuo Miyake. Kagaku no Ryôiki (J. Japan Chem.) 6, 222-7 (1952). C.A. 48, 13570c.
A review with 13 references.

1570
A REVIEW OF THE PROPERTIES OF DEUTERIUM COMPOUNDS. BIBLIOGRAPHY OF UNCLASSIFIED GOVERNMENT REPORTS: 1947-1952. L. M. Brown and A. S. Friedman. Sept. 1, 1953. 160p. (NBS-2492). NSA 8, 489.
A bibliography of reports pertaining to research on the isotopes of H and their compounds has been compiled largely from NSA, ADD, and Technical Information Pilot. The period covered is 1947 to Nov. 1952. The entries are arranged alphabetically by leading author and contain code symbols designating the subject matter involved. 943 references.

1571
PART 1. (EXPERIMENTAL). SEPARATION OF CATIONS BY AN ELECTROGRAVITATIONAL METHOD. PART 2. (THEORETICAL). A. EQUIVALENT CIRCUIT MODEL OF THE TRANSFERENCE CELL. B. THE TRANSFERENCE CELL: THERMODYNAMICS OF THE STEADY STATE. George W. Murphy. Jan. 1953. 66p. (ANL-5104). NSA 8, 501.
Because of the difference in mobility of two or more cations in solution, electrogravitational separations appear feasible. The NaCl-KCl binary mixture was first tested to study all the variables, and it was found that the separation offered promise for practical application. An attempt to separate Li^6 and Li^7 was unsuccessful as the method does not have sufficient resolving power. The apparatus is described briefly.

1572
KINETICS OF EXCHANGE AND DISPROPORTIONATION REACTIONS IN MERCURIC CYANIDE SOLUTIONS. Richard L. Wolfgang and Richard W. Dobson. (1953). 32p. (BNL-1632). NSA 8, 726.
The exchange of radioactive Hg between Hg^{++} and $HgCN^+$ ions has been measured and found to be slow. Mechanisms are discussed.

1573
METHODS OF MEASURING THE GASEOUS $B^{10}F_3$-$B^{11}F_3$ SEPARATION CHARACTERISTICS OF THERMAL DIFFUSION COLUMNS, AND THE VISCOSITY AND DIFFUSION COEFFICIENT DATA FOR BF_3. W. H. Denton. Mar. 1950. (AERE-G/R-511). NSA 8, 1625.

1574
KINETICS OF COMPLEX ISOTOPIC EXCHANGE REACTIONS. Arthur Kant. 1953, 18p. (BNL-1793). NSA 8, 3233.
The kinetics of the exchange of X between molecules of the type AX_n and BX, where the X atoms in AX_n are non-equivalent, is discussed. Equations are developed.

1575
A REVIEW OF THE REACTION KINETICS OF DEUTERIUM COMPOUNDS. I. DECOMPOSITION REACTION OF INORGANIC COMPOUNDS. L. M. Brown and A. S. Friedman. March 15, 1954. 83p. (NBS-3091). NSA 8, 3266.

1576
SEPARATION OF ISOTOPES. ANNUAL PROGRESS REPORT. W. P. Senett, F. Gollob, I. Stacy, G. Panson, R. W. Pierce, I. Chasalow, H. H. Kramer, F. Gould and T. I. Taylor. July 1, 1953. (NYO-6239). NSA 8, 3786.
The following sections are included: (1) chemical exchange effects in thermal diffusion columns (NO + NO_2), (2) hydrogen-deuterium separation by chemical exchange in thermal diffusion columns (restricted to design of a thermo-conductivity bridge), (3) kinetics and catalysis of the isotopic exchange of C^{13} between CO and CO_2, (4) kinetics of the exchange of deuterium between acetylene and water, (5) binary diffusion of similar or isotopic molecules in three component systems, and (6) the fractionation of lithium isotopes by thermal diffusion in aqueous solution (LiCl and $LiNO_3$).

1577
THE SEPARATION OF THE ISOTOPES OF BORON BY ISOTOPIC EXCHANGE EQUILIBRIUM. James F. Duncan. 1947? 18p. (AERE-C/R-107). NSA 8, 4359.
The chemical exchange method of separating isotopes is discussed from a theoretical standpoint and the conclusions applied to the separation of boron isotopes. Several chemical exchange systems are proposed for boron isotope separation. No experiments are reported.

1578
THE CONCENTRATION OF TRITIUM IN MIXTURES OF TRITIUM AND HYDROGEN USING PYROPHORIC URANIUM. C. Evans and E. J. Wilson, March 10, 1954. 8p. (AERE-I/M-31). NSA 8, 4654.
By virtue of the appreciable difference in vapor pressures of dissociation at any one temperature of uranium tritide and uranium hydride, a method has been evolved utilizing uranium in a pyrophoric state whereby tritium can be partially concentrated from a dilute mixture of tritium in hydrogen.

1579
HEAVY WATER. Enrico Cerrai. Energia Nucleare No. 5, 96-103 (1952). Dec. 20. NSA 8, 6112.
A review is given of the methods of separating heavy water.

1580
THE DIFFUSION-DISTILLATION PROCESS FOR THE SEPARATION OF ISOTOPES, SEMI-ANNUAL REPORT. J. H. Atkins. (SO-3256) April 1 (1954), 13p. NSA 8, 6245.

A separation of chlorine isotopes in ethylene chlorohydrin is reported with an efficiency of only 2% of that calculated.

1581
POLYTECHNIC INSTITUTE OF BROOKLYN FINAL REPORT COVERING THE PERIOD OCTOBER 1, 1948, to SEPTEMBER 30, 1949. Benjamin Post, William Senett, and Leopold May, 15p. (U-8049; ATI-206230). NSA 8, 6422.
A broad, general review of the "deuterium project" is reported. Data on deuterium overvoltage at mercury electrodes in heavy water are summarized.

1582
EXCHANGE REACTION OF GASEOUS BROMINE AND HYDROGEN BROMIDE. Wade L. Callender and Edwin O. Wiig. Oct. 11, 1954, 21p. (NYO-6635). NSA 8, 6943.
The rate of the exchange reaction between gaseous bromine and HBr at various partial pressures has been measured at room temperature and -16°, and at times of contact of 0.1 to 6.25 seconds in a flow system at atmospheric pressure with argon as a carrier gas. Reaction is rapid and both heterogeneous and homogeneous exchange is postulated.

1583
THE ISOTOPE EFFECT IN THE ELECTROLYTIC MIGRATION OF COPPER IONS IN FUSED CUPROUS CHLORIDE. A. Lunden and E. Berne. Naturforsch. 9a, 684-9 (1954). C.A. 49, 79e.
The migration of Cu was studied in fused CuCl electrolyzed in a special diaphragm cell with fused $PbCl_2$ as anolyte and a fused LiCl-KCl eutectic as catholyte. Samples were analyzed by neutron activation and Cu^{64} determination. Cu^{63} moved more rapidly toward the negative electrode and the change in concentration was found to agree with the change predicted on the basis of mass effects.

1584
HYDROGEN EXCHANGE OF SATURATED CARBOXYLIC ACIDS. V. N. Setkina and E. V. Bykova. Dolady. Akad. Nauk S.S.S.R. 92, 341-4 (1953). C.A. 49, 164c.
It was shown that carboxylic acids exchange only the α-H atom with the D of enriched H_2SO_4, and H_3PO_4.

1585
CHLORINE ISOTOPE EFFECT. Rosalie M. Bartholomew, F. Brown, and M. Lounsbury. Nature 174, 133 (1954). C.A. 49, 740b.
When tert-butyl chloride reacted with $AgNO_3$ in 98% EtOH at room temperature, the Cl^{35} compound reacted faster than the Cl^{37} compound. The ratio k^{35}/k^{37} was determined to be 1.007 ± 0.003 and 1.008 ± 0.001.

1586
A METHOD OF CONCENTRATING He^3-He^4 MIXTURES. K. R. Atkins and D. R. Lovejoy. Can. J. Phys. 32, 702-7 (1954). C.A. 49, 740b.
A method is described for the concentration of He^3 in He^3-He^4 mixtures by "superfluid filtration" based on the extremely rapid flow of superfluid He^4 through a small leak while He^3 remains behind. Concentration can be increased from 2 to 95% in a single filtration. The rate of processing is about 200 standard cc of the initial gas mixture per hour.

1587
CONCENTRATION OF HEAVY WATER. Jomar Brun and Gunnar Randers. Norweigian Patent 84,254, Sept. 20, 1954. C.A. 49, 754d.
Apparatus is shown diagrammatically in which D_2O is concentrated in a series of electrolytic cells, and in which the D_2O-enriched H_2O introduced at the 1st stage is obtained by fractional distillation using heat obtained by burning the gases generated in the electrolytic cells.

1588
ISOTOPIC COMPOSITION OF THE HYDROGEN PRODUCED BY THE ACTION OF IONIZING RADIATIONS ON AQUEOUS SOLUTIONS ENRICHED WITH HEAVY WATER. Patrick Kelly, Tyson Rigg, and Joseph Weiss. Chemistry and Industry 1954, 1291. C.A. 49, 1442c.
The separation factor $S = (H/D)_{gas}/(H/D)_{sol'n}$ for the irradiation of aqueous 0.8N H_2SO_4 solutions containing about 1 mole % D is given for various solutes. S for the irradiation of 2 x 10^{-3}M Ce^{4+}, 1 x 10^{-3}M Fe^{2+} and O_2 saturated 0.8N H_2SO_4 with 200 kv. X-rays are 1.94, 1.86, and 1.92, respectively. For the irradiation of 2 x 10^{-3}M Ce^{4+} with Ra γ-rays, s = 1.98. The observed s of about 2.0 leads to $E_H^o - E_D^o = 0.4$ kcal, where E_H^o and E_D^o represent the zero point energies of the O-H and O-D bonds in excited HOH and HOD molecules, respectively.

1589
THE CATALYTIC ACTIVITY OF BARIUM AND CALCIUM HYDRIDES. I. AN EXPLORATORY STUDY. Leon W. Wright and Sol W. Weller. J. Am. Chem. Soc. 76, 5305-8 (1954). C.A. 49, 1990g.
BaH_2 and CaH_2 were found to be moderately active for C_2H_4 hydrogenation, C_6H_{12} and iso-C_4H_{10} dehydrogenation, 1-C_5H_{10} double bond isomeration, and H_2 and C_2H_4-O_2 exchange reactions.

1590
THE CATALYTIC ACTIVITY OF BARIUM AND CALCIUM HYDRIDES. II. THE NATURE OF THE CATALYST. Sol Weller and Leon Wright. J. Am. Chem. Soc. 76, 5302-5 (1954). C.A. 49, 1990i.
The optimum catalytic activity of CaH_2 and BaH_2 for H_2-D_2 exchange and C_2H_4 hydrogenation is developed by evacuation at temperatures in the range 200-300°. Exposure of the activated catalyst to H at elevated temperature does not inhibit H_2-D_2 exchange at -78°, but it does deactivate the catalyst for C_2H_4 hydrogenation at -78°.

1591
THE RELATIVE ABUNDANCES OF HT AND HTO IN THE ATMOSPHERE. P. Harteck. J. Chem. Phys. 22, 1746-51 (1954). C.A. 49, 2133c.
A kinetic discussion of the HT and HTO formation in the atmosphere.

1592
DEUTERIUM ISOTOPE EFFECT IN THE REACTION OF WATER VAPOR WITH ZINC. Warren G. Henderson, Jr. and Richard B. Bernstein. J. Am. Chem. Soc. 76, 5344-6 (1954). C.A. 49, 2160g.
The fractionation factor, defined as the ratio of the specific rates of reaction of HOH and HOD with Zn, was 1.6 ± 0.1 at 400°. The temperature dependence of the factor over the range 295 - 415° was -0.0011 per degree.

1593
INTRAMOLECULAR CARBON-ISOTOPE EFFECT IN THE DECARBOXYLATION OF LIQUID MALONIC ACID NEAR THE MELTING POINT. Peter E. Yankwich and Albert L. Promislow. J. Am. Chem. Soc.

76, 4648-50. (1954). C.A. 49, 2161g.
Previous work is summarized and new data presented. In the reaction

$$\begin{array}{l} C^{13}OOH \xrightarrow{k_3} C^{13}O_2 + C^{12}H_3C^{12}OOH \\ H_2C^{12} \\ C^{12}OOH \xrightarrow{k_4} C^{12}O_2 + C^{12}H_3C^{13}OOH \end{array}$$

the best results give a ratio k_4/k_3 = 1.0292 ± 0.0007.

1594
CATALYSIS ON EVAPORATED METAL FILMS. V. REACTIONS BETWEEN CYCLIC HYDROCARBONS AND DEUTERIUM. J. R. Anderson and C. Kemball. Proc. Royal Soc. (London) A226, 472-89 (1954). C.A. 49, 2166e.
Catalytic exchange reactions were studied with the mass spectrometer between D and cyclopentane over Pd and cyclohexane over Rh, Pd, W, Pt, Ni, oriented Ni, and oriented Rh. Exchange only was observed with benzene over Ni but simultaneous exchange and deuteration with Pd. Simultaneous exchange and deuteration was found with cyclopropane and D over Rh. Cyclopropane exchanged most readily with D followed by cyclopentane, cyclohexane, than propane, isobutane and ethane.

1595
ISOTOPIC EXCHANGE BETWEEN DIFFERENT OXIDATION STATES IN AQUEOUS SOLUTION. C. B. Amphlett. Quart. Revs. 8, 219-249 (1954). C.A. 49, 2197c.
A review with 128 references.

1596
THE SEPARATION TUBE. XIII. PREPARATION OF THE HEAVY CARBON ISOTOPE C^{13} IN PURE STATE. Klaus Clusius and Hans H. Bühler. Z. Naturforsch. 9a, 775-83 (1954). C.A. 49, 2802b.
In the described sepn. app., heavy CH_4 with 55-70% $C^{13}H_4$ initial content is split into 2 fractions with 3-6% $C^{13}H_4$ and with 99.0-99.8% C^{13}-H_4. Despite the mass difference of one unit between $C^{12}H_4$ and $C^{13}H_4$ the pressure difference of their triple points is only 0.04 mm Hg, whereas $C^{13}H_3D$ of practically the same mass as $C^{13}H_4$ shows a triple-point pressure of 3.15 mm Hg less than the one of $C^{13}H_4$.

1597
VAPOR-PRESSURE STUDIES INVOLVING SOLUTIONS IN LIGHT AND HEAVY WATERS. I. THE APPARATUS AND THE DETERMINATION OF VAPOR PRESSURES AT 30° OF SOLUTIONS OF SODIUM AND POTASSIUM CHLORIDES IN ORDINARY WATER. Hilton A. Smith, Robert L. Combs, and John M. Googin. J. Phys. Chem. 58, 997-9 (1954). C.A. 49, 2828f.
A gas satn. method is described for detn. of the vapor pressures of solns. relative to the vapor pressure of water. Results for solns. of NaCl and KCl agreed with published values.

1598
VAPOR PRESSURE STUDIES INVOLVING SOLUTIONS IN LIGHT AND HEAVY WATERS. II. THE VAPOR PRESSURE OF HEAVY WATER AND THE SEPARATION FACTOR OF THE MIXED WATERS. Robert L. Combs, John M. Googin, and Hilton C. Smith. J. Phys. Chem. 58, 1000-1 (1954). C.A. 49, 2828g.
The vapor pressure of pure D_2O was determined in the range 10.00° to 55.00°. The vapor pressure and separation factor of H_2O-D_2O mixtures near 50% deuterium were determined in the same range.

1599
THE OXYGEN EXCHANGE OF CARBONATES; EXCHANGE WITH THE GASES OXYGEN AND CARBON DIOXIDE. A. V. Trofimov. Doklady Akad. Nauk. S.S.S.R. 96, 335-8 (1954). C.A. 49, 2834h.
Report of an exptl. study of the O exchange of powders of carbonates of Ba, Ca, and Na with gases and aq. solns. The exchange was observed by study of carbonates tagged with the isotope O^{18}. For the carbonates there are 2 types of exchange interactions, viz. (1) at. exchange which takes place, apparently, almost in pure form during interaction of carbonates with O-contg. gases at increased temps., but not exceeding the threshold of the heat of ionization of the mol.; and (2) exchange in aq. medium where there exists also an interaction of carbonate with the ions of the soln. Gases used for exchange were O_2 and CO_2.

1600
OXYGEN TRANSFER BETWEEN CARBON DIOXIDE AND CARBON MONOXIDE IN THE PRESENCE OF CARBON. A. A. Orning and E. Sterling. J. Phys. Chem. 58, 1044-7 (1954). C.A. 49, 2836a.
C^{14} was used as a tracer to study O transfer reactions between CO_2 and CO in the presence of several different carbons in the temp. range from 650° to 900°.

1601
THE CATALYTIC ACTIVITY OF BARIUM AND CALCIUM HYDRIDES. III. HYDROGEN EXCHANGE WITH SOME C_4 HYDROCARBONS. Leon W. Wright and Sol W. Weller. J. Am. Chem. Soc. 76, 5948-50 (1954). C.A. 49, 2842c.
The exchange of H between n-C_4H_{10}, iso-C_4H_{10}, and iso-C_4H_8 and BaH_2 and CaH_2 was studied. The exchange proceeds much more slowly with the paraffins than with the olefin.

1602
THE MOBILITY OF THE OXYGEN OF MANGANESE DIOXIDE AND THE CATALYTIC OXIDATION OF CARBON MONOXIDE. S. M. Karpacheva and A. M. Rozen. Zhur. Fiz. Khim. 27, 146-9 (1953). C.A. 49, 2842e.
The mobility of the O of MnO_2 samples that have undergone different treatments was studied for the exchange reaction with gaseous O_2 and for the catalytic oxidation of CO. The exptl. results show that the MnO_2 catalyst reacts in each case with the gaseous reaction mixture. The oxidation of CO is brought about by the reduction of the oxidized contact surface.

1603
NATURAL ABUNDANCE OF THE LITHIUM ISOTOPES. Dwight A. Hutchison. Phys. Rev. 96, 1018-21 (1954). C.A. 49, 2892h.
The natural abundance ratio of Li^7 to Li^6 was detd. from the density and x-ray data for certain crystals. Consideration of the max. limits of variation of this ratio in nature and the error assignments of the data used in this calcn. yield Li^7/Li^6 = 11.53 ± 0.29. This value disagrees with the mass spectrometric and optical detns.

1604
PROCEDURE OF CHEMICAL ISOTOPE EXCHANGE. Bernward Stuke. Z. Elektrochem. 57, 655-9 (1953). C.A. 49, 2892i.

Sepn. effect in exchange columns is investigated thermodynamically in order to complete the work instigated through Urey (U., et al., C.A. 32; 41[6]); Cohen (C.A. 34, 6522[9]); Hutchinson, et al., (C.A. 34, 5747[9]). As a concrete example, the exchange reaction $HC^{12}N_{(g)} + C^{13}N^- \rightleftharpoons HC^{13}N_{(g)} + C^{12}N^-_{(g)}$ is discussed.

1605
CONCENTRATION OF ISOTOPES. Charles A. H. Wright. U. S. 2,695,268. Nov. 23, 1954. C.A. 49, 2910b.
A method is described for recovering spray and vapor from the gases released from an electrolytic cell being used to sep. H and D.

1606
EFFECT OF ERUPTION OF HAWAIIAN VOLCANOES ON THE COMPOSITION AND CARBON ISOTOPE CONTENT OF ASSOCIATED VOLCANIC AND FUMAROLIC GASES. John J. Naughton and Kazuji Terada. Science 120, 580-1 (1954). C.A. 49, 2961h.
The CO_2, CO, H, SO_2, O, and N concns. were detd. in the gases issuing from the Sulfur Bank fumarole, Kilauea, Hawaii. The C^{12}/C^{13} ratio from the CO_2 of the fumarole is lower (89.0) than from the CO_2 of the volcanic lava flow (91.2) or of the olivine basalt from the lava flow (90.7).

1607
DETERMINATION OF THE ABSOLUTE CONCENTRATION OF DEUTERIUM IN THAMES RIVER WATER. G. R. Clarke, W. H. Denton and P. Reynolds. Nature 174, 469 (1954). C.A. 49, 3448f.
The value of 0.0152% D in the water lies at high end of the American freshwater range and near oceanic values.

1608
DETERMINATION OF THE TEMPERATURE DEPENDENCE OF THE VAPOR PRESSURE RELATIONS $C^{12}O/C^{13}O$ AND $C^{12}H_4/C^{13}H_4$. W. Groth, H. Ihle, and A. Murrenhoff. Z. Naturforsch. 9a, 805-6 (1954). C.A. 49, 3593e.
The difference in vapor pressure between ordinary CO and CO contg. 10% C^{13} was measured by a diaphragm manometer of sensitivity $\pm 10^{-3}$ mm. of Hg, and the vapor pressure was measured with a Hg manometer in the temp. range 68 to 70°K. The same measurements were made for CH_4 in the temp. range 90 to 96°K. The results, in terms of the parameters of the equation log p(light)/p(heavy) = A/T + B log T - C, are, for CO, A = 1.2190, B = 0.018692, C = 0.047251 and, for CH_4, A = 4.19855, B = 0.077507, and C = 0.19588. The value for p(light)/p(heavy) at the triple point is, for CO, 1.0113 ± 0.0002 and, for CH_4, 1.0049 ± 0.0002.

1609
THE POTENTIAL-DETERMINING PROCESS OF THE EXCHANGE OF CADMIUM BETWEEN AMALGAM AND CADMIUM CYANIDE SOLUTIONS. Sture Fronaeus and Carl O. Ostman. Acta Chem. Scand. 8, 961-70 (1954). C.A. 49, 3625c.
The exchange of Cd between liquid amalgams and Cd cyanide solns. at equil. potential was investigated by the use of a radioactive Cd isotope, Cd^{115}. From the rate law obtained it was shown that for the CN^- concns. used (between 0.025 and 0.065M) when practically all of the Cd in the soln. is bound in the complex $Cd(CN)_4^{2-}$, the rate of exchange is controlled by the discharge of $Cd(CN)_2$, present in very small concns.

1610
BURNING VELOCITIES IN DEUTERIUM-BROMINE AND HYDROGEN-BROMINE MIXTURES. Stone D. Cooley and Robbin C. Anderson. J. Am. Chem. Soc. 77, 235-7 (1955). C.A. 49, 3627h.
Burning velocities for D-Br and H-Br mixtures (37-50 mole percent Br) were detd. by the horizontal-tube method. The ratio of H to D velocities was 1.55 to 1.59.

1611
LOW-TEMPERATURE MOBILITY OF HYDROGEN IN URANIUM HYDRIDE. EXCHANGE EQUILIBRIUM OF DEUTERIUM BETWEEN HYDROGEN AND URANIUM HYDRIDE. Jacob Bigeleisen and Arthur Kant. J. Am. Chem. Soc. 76, 5957-60 (1954). C.A. 49, 3628f.
$UH_3(s)$ and D_2 undergo rapid isotopic exchange at and below room temp. The reaction is diffusion-controlled in the solid. The equi. const. for the reaction $UH_3(s) + HD(g) \rightleftharpoons UH_2D(s) + H_2(g)$ was measured between 195 and 433°K. The difference in enthalpies between UH_3 and UH_2D is 1186 cal. mole^{-1} at 200°K. The calcd. entropy change for the reaction at 200°K agrees well with expt. Why the ratio of dissocn. pressures of UH_2 and UD_2 is independent of temp. between 530 and 700°K is discussed.

1612
ENRICHMENT OF ISOTOPIC MOLECULES IN THE DIRECT-CURRENT GLOW DISCHARGE. III. THE PRIMARY EFFECT--MASS-SPECTROMETRIC DETERMINATION OF THE RELATIVE ION INTENSITIES IN THE DISCHARGE PLASMA. H. D. Beckey and H. Dreeskamp. Z. Naturforsch. 9a, 735-40 (1954). C.A. 49, 3648c.
A glow discharge tube was attached to the ion source of a mass spectrometer. The ratio of isotopic ions is given in a 50% H_2:50% D_2 mixture.

1613
PHOTOCHEMICAL REACTIONS IN THE SYSTEM METHYL IODIDE-IODINE-METHANE; THE REACTION $C^{14}H_3 + CH_4 \rightarrow C^{14}H_4 + CH_3$. G. M. Harris and J. E. Willard. J. Am. Chem. Soc. 76, 4678-87 (1954). C.A. 49, 3668i.
Expts. with I^{131} show that gaseous MeI and I_2 undergo a slow catalyzed exchange reaction in Pyrex in the dark at 25°. Exchange is also induced by light absorbed by MeI. The quantum yield for the gas-phase exchange at 2537 A is unity. Thermal $C^{14}H_3$ radicals from the photolysis of $C^{14}H_3$ undergo the reactions $C^{14}H_3 + CH_4 \rightarrow C^{14}H_4 + CH_3$ (B) and $C^{14}H_3 + I_2 \rightarrow C^{14}H_3I + I$ (C) with an estd. activation energy difference $E_B - E_C = 6.5 \pm 2$kcal/mole and the ratio of the frequency factor of B to that of C = 3×10^{-4}.

1614
SEPARATION OF CALCIUM ISOTOPES BY RADIOMETRIC ADSORPTION ANALYSIS. R. Linder. Z. Naturforsch. 9a, 798 (1954). C.A. 49, 3691g.
The separation of Ca^{40} and Ca^{45} by ion exchange was investigated on Dowex 50 ion-exchange resin with 5% NH_4 citrate soln. at pH 8 as eluent.

1615
CHLORINE ISOTOPE EFFECT IN REACTIONS OF TERT-BUTYL CHLORIDE. Rosalie M. Bartholomew, F. Brown, and M. Lounsbury. Can. J. Chem. 32, 979-83 (1954). C.A. 49, 3692a.
Experiments are detailed which show that the heavier isotope (Cl^{37}) is bound more firmly to the C atom than the lighter isotope (Cl^{35}) and undergoes bond-breaking reactions less rapidly. Studies have been made of the reaction of tert-BuCl with (1)

alcoholic $AgNO_3$ solution (0.1M) and (2) aqueous alcoholic NaOH (0.1M). A theoretical discussion and calcns. are given for the ratio of the rates of reaction which was found to be $k^{35}/k^{37} = 1.008$ (+0.002, -0.001).

1616
ISOTOPIC EXCHANGE REACTIONS OF NEPTUNIUM IONS IN SOLUTION. II. THE Np(IV)-Np(V) EXCHANGE. J. C. Sullivan, Donald Cohen, and J. C. Hindman. J. Am. Chem. Soc. 76, 4275-9 (1954). C.A. 49, 3692c.
The isotopic exchange reaction between Np(IV) and Np(V) was measured in $HClO_4$ as a function of H-ion concentration, metal-ion concentration, ionic strength, and temperature.

1617
REACTIONS WITH NITROGEN^{15}. XVI. FORMATION OF NITRATE IN THE OXIDATION OF AMMONIA WITH HYPOBROMITE. Klaus Clusius and Hans Heinrich Buhler. Helv. Chim. Acta 37, 2361-2 (1954). C.A. 49, 3713c.
The reaction $2NH_3 + 3KOBr = N_2 + 3H_2O + 3KBr$ is not quantitative. In the reaction of 0.625 mol. $N^{15}H_4NO_3$ with 2.251 mol. of 0.5M KOBr (that is 2.4 times the theoretical amt.) 0.40% of the NH_3 present is oxidized to the nitrate.

1618
A SEPARATION OF MIXTURES OF TRITIUM AND HYDROGEN USING HERTZ PUMPS. Frank J. Dunn, John R. Mosley, and Robert M. Potter. Anal. Chem. 27, 63-4 (1955). C.A. 49, 3729e.
Tritium of a purity in excess of 99.9% has been prepared from hydrogen-tritium mixtures by means of a twelve Hertz pump system and by means of a sixteen pump system employing continuous gas flow. Satisfactory separations were accomplished at pressures greatly in excess of those described by other workers.

1619
THERMAL-DIFFUSION SEPARATION APPARATUS. Walter Wahl. U. S. Patent 2,688,404, Sept. 7, 1954. C.A. 49, 3732e.
The apparatus is suitable for separation of hydrocarbon fractions as well as for O enrichment of the air supply for metallurgical furnaces. It is also said to be suitable for separation of isotopic mixtures, e.g., D_2O from H_2O.

1620
THE MERCURY-PHOTOSENSITIZED REACTIONS OF TRITIUM WITH ACETYLENE AND ETHYLENE. Louis Kaplan. J. Am. Chem. Soc. 76, 1448-9 (1954). C.A. 49, 3776b.
The exchange between H_2 and C_2H_2 is unexpectedly slow.

1621
HIGH-SPEED MACHINE COMPUTATION OF IDEAL GAS THERMODYNAMIC FUNCTIONS. I. ISOTOPIC WATER MOLECULES. A. S. Friedman and Lester Haar. J. Chem. Phys. 22, 2051-8 (1954). C.A. 49, 4346h.
A general code was designed to permit the calculation of the ideal gas thermodynamic functions for a large variety of molecular structures. Tables of C_p^o/R, $(H^o-E_o^o)/RT$, $(E_o^o-F^o)/RT$, and S^o/R were evaluated for H_2O, HDO, D_2O, HTO, DTO, and T_2O at close intervals from 50° to 5000°K.

1622
THE SOLUBILITY OF HYDROGEN AND TRITIUM IN PALLADIUM BLACK. R. L. Favreau, R. E. Patterson, D. Randall, and O. N. Salmon. (KAPL-1036, 21 pp. (1954). C.A. 49, 4357b.
The solubilities of H and T in Pd black were measured in the temperature range 200 to 400° and at pressures below an atmosphere. Variations of solubility constants with temperature are expressed for each gas by the following equations obtained by the method of least squares: $\log K_{H_2} = -1.51707 + 437.249/T$ and $\log K_{T_2} = -1.09855 + 103.901/T$. Ratio of solubility of tritium to that of H was calculated and compared with similar data for D_2 and H_2. Calculated heats of soln. are -4000 ± 110 cal./mol. for H_2 and -950 ± 300 cal./mol. for T_2.

1623
RADIOCHEMICAL STUDIES ON SOLID COMPOUNDS. I. ISOTOPE-EXCHANGE EXPERIMENTS IN THE SYSTEM SOLID-SOLUTION. W. Buser. Helv. Chim. Acta 37, 2334-44 (1954). C.A. 49, 4358i.
Isotope exchange in a solution-solid system is suggested as a method of determining the mobility of ions in a crystal. The principle of the method is explained and illustrated by the example of the Mn^{++}-$4MnO_2.Mn(OH)_2.xH_2O$ system. Graphic analysis of the results showed the occurrence of 3 reactions of different speeds.

1624
RADIOCHEMICAL STUDIES ON SOLID COMPOUNDS. II. ISOTOPE EXCHANGE REACTIONS OF SLIGHTLY SOLUBLE COBALT COMPOUNDS. W. Buser and U. Imobersteg. Helv. Chim. Acta 37, 2345-55. C.A. 49, 4359a.
The isotope exchange method was applied to the following 4 compounds: $Co(OH)_2$, $Co(OH)_{1.5}Cl_{0.5}$, $4Co(OH)_2.Co(OH)Cl$, and $4Co(OH)_2.Co_{1.25}$-$(OH)(NO_3)_{1.5}$. Exchange experiments in contact with Co^{++} solution were made by means of Co^{60}.

1625
THE RATES AND EQUILIBRIUM OF HYDROGEN-DEUTERIUM EXCHANGE IN HYDROXYLIC COMPOUNDS. Harold Kwart, Lester P. Kuhn, and Ernest L. Bannister. J. Am. Chem. Soc. 76, 5998-6001 (1954). C.A. 49, 4384d.
Studies are reported on the rate and equilibrium of exchange in systems comprised of varying proportions of D_2O, HOD, H_2O, CH_3OH, and CH_3OD both in liquid and gas-phase reactions. Calculation of data obtained by application of infrared spectroscopic techniques and the bearing of these results on the mechanism of exchange are discussed. Hydrogen-deuterium exchange reactions in hydroxylic compounds proceed largely through the agency of the unshared pairs of oxygen.

1626
THE KINETICS OF THE EXCHANGE OF WATER BETWEEN $Cr(H_2O)_6^{+++}$ AND SOLVENT. John P. Hunt and Robert A. Plane. J. Am. Chem. Soc. 76, 5960-2 (1954). C.A. 49, 4384e.
Measurements of the exchange of water between solvent and $Cr(H_2O)_6^{+3}$ were extended to dilute solution.

1627
ELECTROMAGNETIC CONCENTRATION OF THE STABLE ISOTOPES OF ZINC. L. O. Love, W. A. Bell,

and H. J. Buttram. March 17, 1950 (Y-693). C.A. 49, 4419f.

Zn metal has been processed in the calutron. Typical products include Zn^{70} enriched to 48% from a natural abundance of 0.62%.

1628

NEW RESULTS ON THE ISOTOPE SEPARATION OF HEAVY GASES IN THE GAS ULTRACENTRIFUGE. Gerh. Hertz and E. Nann. Z. Elektrochem. 58, 612-16 (1954). C.A. 49, 4419g.

Experiments with Xe confirmed earlier conclusions that the enrichment obtained is a multiple of the theoretical. Stability of the convection current made possible continuous operation, which achieved 4-5fold enrichment.

1629

THE PREPARATION AND USE OF CONCENTRATES OF Li^6 AND Li^7. A. Klemm. Elektrochem. 58, 609-10 (1954). C.A. 49, 4424b.

Samples of Li^7 of 99.9% purity were obtained by countercurrent electromigration of fused LiCl melt.

1630

ELECTROKINETICS OF HYDROGEN EVOLUTION. IV. ISOTOPIC SEPARATION AT MERCURY CATHODES. Martin Rome and C. F. Hiskey. J. Am. Chem. Soc. 76, 5207-11 (1954). C.A. 49, 4424g.

The electrolytic sepn. factor (S) of H and D at a Hg cathode is determined in a special cell containing aqueous H_2SO_4 solution. Samples are analyzed by the mass spectrometer. $S = (C^H/C^D)_g/(C^H/C^D)_s$. At a c.d. of 10^{-4} amp./sq. cm., S decreases from 3.83 (0°) to 3.71 (96.5°); with a c.d. = 3×10^{-2}, S increases from 2.96 (0°) to 3.31 (96.5°). These results are compared with previous theoretical and experimental estimates of S.

1631

THE EFFECTS OF DEUTERIUM SUBSTITUTION ON THE RATES OF ORGANIC REACTIONS. III. SOLVOLYSIS RATES AND ARRHENIUS PARAMETERS FOR 2,3-DIMETHYL-2-CHLOROBUTANE AND ITS 3-DEUTERO ANALOG. V. J. Shiner, Jr. J. Am. Chem. Soc. 76, 1603-6 (1954). C.A. 49, 4494g.

The observations of the effect of the β-D substitution on the solvolysis ratio of tertiary alkyl chlorides have been extended to include the case of a tertiary D atom.

1632

ADSORPTION AND EXCHANGE IN METAL-METAL ION SYSTEMS. Cecil V. King. Ann. N. Y. Acad. Sci. 58, 910-24 (1954). C.A. 49, 5067g.

A general review and discussion of experiments on adsorption and exchange in metal-metal ion systems. New data are presented for the $Ag-Ag_2SO_4$ system using S^{35}. In other experiments adsorption of radio Ag^+ on Ag was investigated as a function of immersion time.

1633

SEPARATION OF ISOTOPES BY MEANS OF SURFACE DIFFUSION IN POROUS MEDIA. R. A. W. Haul. Naturwissenschajten 41, 255-6 (1954). C.A. 49, 5071e.

Linde SiO_2 (surface area 300 sq. m. per. g.) was compressed in a steel tube to give a plug 1.04 cm. long, 0.73 cm. in diameter, porosity 0.60. Constant gas pressure was maintained on one side, resulting in adsorption of a monolayer; the other end was evacuated and diffused gas collected. Experiments with samples of O_2 enriched in O^{18} gave a greater separation effect than expected by Knudsen flow. This is thought to be due to the contribution of surface flow. See C.A. for details.

1634

EXCHANGE REACTIONS OF THE TRANSURANIUM ELEMENTS. I. Am(III)-Am(V)-Am(VI), Am(III)-Am(V), and Am(V)-Am(VI). Thomas K. Keenan. Univ. Microfilms (Ann Arbor, Mich.), Publ. No. 9727, 53 pp. Dissertation Abstr. 15, 34-5 (1955). C.A. 49, 5086a.

1635

THE EFFECT OF PRESSURE ON THE RATE OF IONIC ISOTOPE-EXCHANGE REACTIONS. M. B. Neiman, M. G. Gonikberg, V. B. Miller, Yu. M. Shapovalov, and V. S. Zvezdkin. Doklady Akad. Nauk S.S.S.R. 92, 365-8 (1953. C.A. 49, 5086a.

The kinetics of the isotope exchange between alkali halides and $n-C_3H_7I$ or $n-C_3H_7-Br$ in EtOH was studied at 19° and at pressures of 1, 1500, and 2400 atm. The exchange isotopes were I^{131} and Br^{32}. In both cases an increase in the pressure increases the exchange rate.

1636

ISOTOPIC EXCHANGES WITH THE SULFITE ION. II. THE SULFITETRITHIONATE EXCHANGE. Antonino Fava and Gastone Pajaro. Ann. chim. (Rome) 44, 545-50 (1954). C.A. 49, 5086c.

By working in concentrated solutions of salts of multivalent cations it was possible to observe an isotopic exchange between sulfite and trithionate. Analogous to the behavior of polythionates, the exchange probably consists of a nucleophilic displacement of the SO_3 group of the trithionate by the sulfite ion.

1637

HYDROGEN-ISOTOPE EFFECT IN THE BROMINE OXIDATION OF ETHANOL. Louis Kaplan. J. Am. Chem. Soc. 76, 4645-7 (1954). C.A. 49, 5087h.

The rate of oxidation of ethanol-1-t at 37.5° is 0.57 times the rate of oxidation of ethanol, which corresponds to a ratio of about 0.15 for the rates of removal of tritium and H atoms from methylene C. These results lend support to a postulated mechanism involving transfer of a hydride ion from the methylene C to Br.

1638

HEAVY WATER. D. R. Augood. Ind. Chemist 30, 585-93 (1954). C.A. 49, 5149b.

A comparison of the methods for the production of D_2O based upon an output of a ton per 28 days. Eight different methods, employing the principles of effusion, electrolysis, exchange, and distillation are discussed. A brief discussion of other methods possible, such as biological separation, is included.

1639

ISOTOPIC COMPOSITION OF BROMINE IN NATURE. A. E. Cameron and E. L. Lippert, Jr. Science 121, 136-7 (1955). C.A. 49, 5149c.

Samples of Br_2 from 4 natural sources and $(CH_2)_2Br_2$ from Gulf water were analyzed by precision mass spectrometry, the average of the determinations gave the value Br^{79}/Br^{81} = 1.0217 ± 0.0002, in agreement with the

value 1.0210 reported by Williams and Yuster.

1640
ENRICHMENT OF RUBIDIUM^{85} BY COUNTERCURRENT ELECTROMIGRATION. Ernest R. Ramirez. J. Am. Chem. Soc. 76, 6237-9 (1954). C.A. 49, 5170i.
The calculated difference in the mobilities (μ) of the 2 Rb isotopes ($\mu Rb^{85}/\mu Rb^{87}$ = 1.0056) was shown to allow isotopic enrichment in countercurrent electrophoresis of aqueous RbOH in a cell 1.6 cm in diameter and 100 cm long. The Rb^{85} concn. of the cathode compartment was raised from 72.2 to 73.8% after 200 hrs of operation at 80°. Enrichment was slightly less efficient at 40°.

1641
THE DETERMINATION OF THE ISOTOPIC COMPOSITION OF THE OXYGEN IN ALCOHOLS AND RELATED COMPOUNDS. M. Anbar, I. Dostrovsky, F. Klein, and David Samuel. J. Chem. Soc. 1955, 155-60. C.A. 49, 5206h.
Two general methods and a more limited one for the isotopic detn. of O in org. compounds are described. The last is based on the establishment of an isotopic equilibrium between the O atom of an alcohol and CO_2, by heating 1 mole sample, 0.001 ml H_2SO_4, and 0.05 mole CO_2 in a 1.2-ml sealed tube at 150-200°.

1642
THE EXCHANGE REACTION BETWEEN $S^{35}O_2$ AND SOME ORGANIC SULFUR COMPOUNDS. Hiroshi Mikawa. J. Chem. Soc. Japan, Pure Chem. Sect. 75, 791-3 (1954). C.A. 49, 5936a.
The exchange of S between a 2% aqueous solution of H_2SO_3 and p-toluenesulfonic acid, thiophenol, benzyl mercaptan, dibenzyl sulfide, and α-toluenesulfonic acid was studied at 100°. There was no observable exchange.

1643
EXCHANGE OF DEUTERIUM AND OXYGEN^{18} BETWEEN WATER AND OTHER SUBSTANCES. I. METHODS. Aase Hvidt, G. Johansen, K. Linderstrøm-Lang, and Fred Vaslow. Medd. Carlsberg Lab. 29, 129-57 (1954). C.A. 49, 5936b.
A micromethod for the estimation of the exchange of D or O^{18} between water and other substances is based on density measurements in the gradient tube and on a simple principle of equilibration between 2 small aqueous drops through a short air space.

1644
MOBILITY OF HYDROGEN IN ETHYLENIC HYDROCARBONS. A. I. Shatenshtein, L. N. Vasil'eva, and N. M. Dykhno. Zhur. Fiz. Khim. 28, 193-8 (1954). C.A. 49, 5936c.
The rate of isotopic exchange with ND_3 in the presence of KND_2 of the H atoms in 1-pentene, 2-pentene, 1-hexene, cyclohexene, 1-octene, 2,4,4-trimethyl-1-pentene, 2-octene, and 1-hexadecene was determined at temps. from 20 to 150°.

1645
CARBON^{13} ISOTOPE EFFECT IN THE THERMODECOMPOSITION OF ETHYL BROMIDE. Henry L. Friedman, Richard B. Bernstein, and Harry E. Gunning. J. Chem. Phys. 23, 109-12 (1955). C.A. 49, 5939a.
The C^{12}-C^{13} fractionation factor in the decompn. of gaseous EtBr was measured from 350° to 450°.

1646
THE KINETIC ISOTOPIC EFFECT IN ELECTROPHILIC AROMATIC SUBSTITUTIONS. Hch. Zollinger. Experientia 10, 481-2 (1954). C.A. 49, 5939i.
In a phosphate-buffered aqueous soln. (pH 6.64, ionic strength = 0.25) p-diazochlorobenzene reacts with 2-napthol-6, 8-disulfonic acid 4 times as rapidly as with the deuterated compound 2-naphthol-6,8-disulfonic acid-1-d. This indicates that proton loss is rate-limiting.

1647
PRODUCTION OF ENRICHED NONRADIOACTIVE ISOTOPES AT OAK RIDGE NATIONAL LABORATORY. C. P. Keim. Nature 175, 98-101 (1955). C.A. 49, 5975e.
The operation of the mass spectrographs is described and the difficulties reviewed. A list of the separated isotopes is given, and their use reviewed.

1648
PRODUCTION OF ELECTROMAGNETICALLY ENRICHED STABLE ISOTOPES AT HARWELL. W. D. Allen, R. H. Dawton, M. L. Smith, and P. C. Thonemann. Nature 175, 101-3 (1955). C.A. 49, 5975e.
The mass spectrograph is described, and a short resume of the application of the separated isotopes is given.

1649
NATURAL RADIOCARBON AND THE RATE OF EXCHANGE OF CARBON DIOXIDE BETWEEN THE ATMOSPHERE AND THE SEA. Hans E. Suess. Proc. Conf. Nuclear Process in Geol. Settings, Univ. Chicago, Natl. Research Council, Natl. Sci. Foundation 1953, 52-6. C.A. 49, 5976e.
The amount of C in the atmosphere resulting from the combustion of the fossil fuels is determined to be 3.4 ± 0.6% of the total by the variations in the specific activity of C^{14} in 19th and 20th century tree rings. The average lifetime of a CO_2 mol. in the atmosphere before it dissolves in the marine hydrosphere is between 20 and 50 years.

1650
VARIATIONS IN THE ISOTOPIC ABUNDANCE OF LITHIUM AND BROMINE IN NATURAL MATERIALS. A. E. Cameron. Proc. Conf. Nuclear Processes in Geol. Settings, Univ. Chicago, Natl. Research Council, Natl. Sci. Foundation 1953, 70. C.A. 49, 5976g.
Br^{79}/Br^{81} was determined in brines from West Virginia and Michigan sea water, and Searles Lake water. The West Virginia brines had a significantly lower value. The Li^6/Li^7 ratio found for 8 samples of spodumene differed from the value found in a lab. reagent.

1651
NATURAL VARIATIONS IN THE ISOTOPIC CONSTITUTION OF SILICON. John H. Reynolds. Proc. Conf. Nuclear Processes in Geol. Settings, Univ. Chicago, Natl. Research Council, Natl. Sci. Foundation 1953, 64-7. C.A. 49, 5976h.
The Si^{30}/Si^{28} ratio was determined in igneous rocks, sediments, and stony meteorites and an over-all range of 3 per mil was found.

1652
ORIGIN OF TEXAS AND LOUISIANA SULFUR DEPOSITS FROM ISOTOPE FRACTIONATION

STUDIES. H. G. Thode, R. K. Vanless, and R. Wallouch. Proc. Conf. Nuclear Processes in Geol. Settings, Univ. Chicago, Natl. Research Council, Natl. Sci. Foundation 1953, 57-63. C.A. 49, 5977c.

Mass analyses of the S^{32}/S^{34} ratio in S wells indicate that there is a wide variation in the ratio for SO_4^{--}, S, and S^{--} but that the isotopic enrichment factor between SO_4^{--} and S^{--} is remarkably const. This factor is similar in magnitude to values found in well water and lakes where SO_4^{--} reducing bacteria exist. T. et al. suggest these S deposits have also been formed by living organisms. The C^{12}/C^{13} ratios in the limestone cores of the S wells is indicative of organic origin.

1653

THE ELECTROMAGNETIC CONCENTRATION OF THE STABLE ISOTOPES OF INDIUM. W. A. Bell and L. O. Love. Mar. 18, 1951 (Y-779). C.A. 49, 5980a.

In isotopes have been separated in the calutron, with InI_3 as charge material. For In^{113} an enrichment factor of 33.4 was obtained, and the sample contained 59.6% In^{113}. For In^{115} the enrichment factor obtained was 73.6, the purity of In^{115} being 99.94%.

1654

EXCHANGE REACTIONS WHICH ACCOMPANY NEUTRON IRRADIATION OF ORGANIC NITROGEN COMPOUNDS. Maurizio Zifferero. Ann. chim. (Rome) 44, 555-7 (1954). C.A. 49, 5993a.

In the neutron irradiation of the oxalates of org. N bases (I) the appearance of radioactive $(CO_2H)_2$ and N base are attributed to exchange of C^{12} by C^{14}. For every salt it was possible to obtain a relation between the partition of C^{14} between acid and base and the size of the molecule or C content.

1655

ISOTOPIC EXCHANGE BETWEEN TETRAETHYLLEAD AND RADIOACTIVE METALLIC LEAD. Vinicio Genta and Antonietta Ansaloni. Gazz. chim. ital. 84, 921-6 (1954). C.A. 49, 5993e.

Optimum conditions are described for preparing small amounts of radioactive $PbEt_4$ of known specific radioactivity. This was accomplished by direct isotopic exchange between $PbEt_4$ and metallic Pb containing Pb^{210}. The maximum isotopic exchange occurred at 125° after 40 hrs. of heating. Similar experiments with radioactive PbS, PbO, and $PbSO_4$ were unsuccessful.

1656

ISOTOPIC MIGRATION AND SELF MIGRATION IN METALS. Alfred Klemm. Z. Naturforsch. 9a, 1031-5 (1954). C.A. 49, 6007e.

A theory is given to explain the electrolytic transport of light isotopes to the anode in liquid Hg and Ga.

1657

HYDROGEN AND DEUTERIUM IN IRON METEORITES. George Edwards. Proc. Conf. Nuclear Processes in Geol. Settings, Univ. Chicago, Natl. Research Council, Natl. Sci. Foundation 1953, 48-9. C.A. 49, 6052h.

The H concentration in p.p.m. in the Canyon Diablo and Henbury meteorites showed ranges of 4.4-5.5 and 28.3-29.3, respectively. The ratio, excess HD/H_2, in permillage varied between -7.4 and -10.6 as a difference from the standard of H from Lake Michigan water. The results indicate the D/H ratio in space cannot be strikingly different from that on earth.

1658

INORGANIC OXIDATION-REDUCTION REACTIONS IN SOLUTION. ELECTRON TRANSFERS. Bruno J. Zwolinski, Rudolph J. Marcus and Henry Eyring. Chem. Revs. 55, 157-80 (1955). C.A. 49, 6696e.

A review of oxidation-reduction systems that are characterized by a complete electron transfer between the reductant and the oxidant. Possible mechanisms of the transfer are discussed. 84 references.

1659

THE KINETICS OF EXCHANGE OF ISOTOPES WITH APPRECIABLE ISOTOPE EFFECT. Lars Melander. Arkiv Kemi 7, 287-9 (1954). C.A. 49, 6702e.

For an isotopic exchange reaction $A \rightleftharpoons B$ with appreciable isotope effect but with very small concentrations of the tracer atoms, the exchange law is $-\ln(1 - F) = (\beta a + \alpha b)Rt/ab$, where F is the fraction exchanged at time t, a, and b are the initial molar concentrations of A and B, and α and β are the isotope-effect coefficients for the forward and reverse reactions. This equation is derived without any assumptions concerning the mechanism of the exchange. A method is developed for determining the exchange equilibrium constants α/b from measurements on the initial exchange rates.

1660

THE EXCHANGE OF SULFUR BETWEEN DITHIONITE AND THIOSULFATE AND BETWEEN TETRATHIONATE AND SULFATE IONS. Heinz Elkeles. Acta Chem. Scand. 8, 1557-62 (1954). C.A. 49, 6702g.

The exchange of S atoms in the 2 above systems was determined at room temperature by use of S^{35} as a radioactive tracer. No exchange of S atoms was detected in either system in 44 hours.

1661

OXYGEN EXCHANGE BETWEEN NITROUS ACID AND WATER. C. A. Bunton, D. R. Llewellyn, and G. Stedman. Nature 175, 83-4 (1955). C.A. 49, 6702h.

The rate of isotope exchange between HNO_2 and H_2O^{18} was followed by isolation of HNO_2 as its Ag salt, decomposition of the salt to H_2O by heating with NH_4Cl, equilibration of the H_2O with CO_2, and determination of the isotope ratio in the CO_2 by mass spectrometry. The rate R is $R = k[HNO_2]^2$, where k = 32 moles $l.^{-1}$ $min.^{-1}$. Exchange is concluded to result from the mechanism $H_2NO_2^+ + NO_2^- \rightleftharpoons N_2O_3 + H_2O$. Chloride and bromide ions increase the rate.

1662

THE SELENIUM-COATED NICKEL CATALYST. II. THE MECHANISM OF EXCHANGE REACTION BETWEEN DEUTERIOAMMONIA AND HYDROGEN IN THE PRESENCE OF SELENIUM-COATED NICKEL CATALYST. Yoshihisa Kaneko. Shokubai No. 10, 20-5 (1954). C.A. 49, 6707h.

It was reported in the previous paper that the log of the rate of exchange reaction between deuterioammonia and H in the presence of Pt, or Se-coated Ni catalyst anomalously depends on the reciprocal of the absolute temperature with a discontinuous decrease at 40° (the curve became N-shaped). It is concluded that

the anomaly is due to the onset of rotation of ND_3 molecules adsorbed.

1663
PLATINUM CATALYST. IV. TEMPERATURE VARIATION OR EXCHANGE RATE BETWEEN D_2O AND H_2. Yoshihisa Kaneko. Shokubai No. 10, 26-9 (1954). C.A. 49, 6708a.
Graphs are given showing a linear relation between the log of the rate of exchange reaction and the reciprocal of absolute temperature between 21 and 338° in the presence of Pt catalyst whose surface areas are 90 and 200 sq. cm. The self-decomposition of D_2O to give D_2 was not observed. An N-shaped anomaly as in the case of ammonia was not found; this was attributed to the difference in orientations in the adsorbed state of the gases.

1664
EFFECT OF THE RATE OF FEED GASES ON THE ISOTOPIC EXCHANGE REACTION RATE IN THE CATALYTIC BED. Sadahiro Sakata and Noriyoshi Morita. Chem. Eng. (Japan) 19, 64-70 (1955). C.A. 49, 6709b.
The rate of exchange of O atoms between gaseous O and water vapor was determined under various conditions over the range of temp. from 487 to 598° and of feed rate from 30.1 to 136.1 cc./sec.

1665
RADIOCARBON AND TRITIUM DATING. POSSIBILITY OF USING THESE ISOTOPES IN INDUSTRY. W. F. Libby. Z. Elektrochem. 58, 574-85 (1954). C.A. 49, 6735f.
A review. Discussed are: the origin of C^{14} and H^3; the underlying principles of radiocarbon dating and measuring techniques; occurrence of T in nature; possible industrial uses of C^{14} and T.

1666
CHEMICAL SEPARATION OF ISOTOPES AS A PROBLEM OF RECTIFICATION. Cesare Marchetti. Z. Naturforsch. 9a, 1012-16 (1954). C.A. 49, 6744d.
The operation of a column for separating isotopes by chemical exchange reactions and cascading of a plant are described. Diagrams are given to facilitate construction of a plant.

1667
THE ANTICONTAMINATION CIRCUIT OF THE AMSTERDAM ISOTOPE SEPARATOR. I. J. Schutten, C. J. Zilverschoon, and J. Kistemaker. Appl. Sci. Research B4, 217-24 (1954). C.A. 49, 6744f.
The circuit used to prevent contamination of the collected isotopes in an electromagnetic isotope separator is described.

1668
DEUTERIUM OXIDE. Eger V. Murphree. U. S. 2,689,782, Sept. 21, 1954. C.A. 49, 6747i.
A process for the production of H_2O enriched in D_2O content is described. A fluidized bed is used for the production of H by reaction of finely divided Fe with superheated steam. A fixed-bed isotope-exchange catalyst in which H_2O flows countercurrent to the H_2 flow is used to increase the D concn. in the H_2O. The finely divided Fe used in the first fluidized bed is regenerated in a second fluidized bed by using H_2 as a reductant.

1669
PRODUCTION OF DEUTERIUM OXIDE AS A SOURCE OF DEUTERIUM. Harold C. Urey and Aristid V. Grosse. U. S. 2,690,379, Sept. 28, 1954. C.A. 49, 6748a.
D was sepd. from H by passing H_2O and H_2 either concurrently or countercurrently through a series of columns packed with a catalyst, such as Ni, Co, or Fe on kieselguhr or Re_2S_7 on charcoal, which promotes the exchange of D between the 2 molecular species. The equilibrium constants for the H_2-H_2O system range from 4.19 at 0° to 2.43 at 125° for the gaseous system and from 4.59 at 0° to 2.70 at 100° for the liquid H_2O system. The times at 50 atm. H pressure and 25° for attainment of 1/2 the equilibrium value are given as a function of the exposure time (age) of the catalyst to liquid H_2O. Another means of producing D is exchange of NH_3 and H_2. The space velocity (gas flow rate/hr./catalyst vol.) at which the exchange reached 1/2 the equil. value for the gaseous NH_3-H_2 system was 950 at 22° and 3700 at 48° for a 85% Ni on 15% Cr_2O_3 catalyst, 1500 at 22° and 10,000 at 48° for a 5% Pt on charcoal catalyst, and 1500 at 22° and 15,000 to 20,000 at 100° for a 1% Pt on charcoal catalyst. An increase in the metal concentration in the catalyst increased the catalyst activity provided the structure of the metal and the nature of the support stabilized the dispersed metal and prevented its crystallization or agglomeration to less active groups or clusters. The effect of poisons on the activity of the catalysts is discussed. Methods used to prep. the catalysts are given.

1670
DEUTERIUM OXIDE. Hugh S. Taylor. U.S. 2,690,380, Sept. 28, 1954. C.A. 49, 6748d.
Mixtures of H_2 and H_2O vapor each containing D were passed over catalysts to speed up the exchange and thus separate D from H. H_2 saturated with H_2O vapor at 80° was passed through catalyst to effect an exchange of D between the H_2O vapor and H_2. Pt supported by alumina, Pd by charcoal, Ni by chromia, and Ni by ceria were used as catalysts, and the conversion rates are given as a function of temperature. The rate of exchange between MeOH and H_2 and between cyclohexane and H_2, when a Pt catalyst on charcoal is used, was also determined.

1671
ISOTOPE-EXCHANGE PROCESS FOR CONCENTRATING DEUTERIUM. Hugh S. Taylor. U.S. 2,690,381, Sept. 28, 1954. C.A. 49, 6748h.
D is concd. by flowing a mixture of H_2 and cyclohexane over isotopic-exchange catalysts and removing H_2 enriched in D_2 by cracking the cyclohexane produced. The apparatus is described for the countercurrent contact of H_2 and cyclohexane at 100-200° and at sufficient pressure to maintain a liquid cyclohexane phase.

1672
DUAL-TEMPERATURE ISOTOPE EXCHANGE PROCESS. Geo. G. Joris. U.S. 2,690,382, Sept. 28, 1954. C.A. 49, 6748i.
A countercurrent flow system is described in which cyclohexane is enriched in D in

the colder of the 2 isotope-exchange units, and the D is removed in the hotter of the 2 exchange units. The cyclohexane exchanges with H_2 in a catalytic exchange tower. By controlling the flow between each dual temp. stage, a product containing a D concn. determined by the number of stages and by the enrichment factor per stage can be obtained.

1673
CHEMICAL IMPLICATIONS OF ISOTOPIC COMPOSITION OF CARBON IN ANCIENT ROCKS. Harmon Craig. Geochim. et Cosmochim. Acta 6, 186-96 (1955). C.A. 49, 6794b.
Rankama's (cf. C.A. 48, 8141b) assumption that carbonaceous deposits can be identified by means of carbon isotopic composition is discussed. This theory rests on the hypothesis that graphite can be formed from limestone. It is pointed out that thermodynamic data on the dissociation of CO_2 prohibit graphite formation at metamorphic temperatures in nature.

1674
THE ISOTOPIC COMPOSITIONS OF HYDROGEN AND CARBON IN THE CARBONACEOUS CHONDRITES. Giovanni Boato. Geochim. et Cosmochim. Acta 6, 209-20 (1954). C.A. 49, 6794c.
Meteoric and terrestrial isotopic composition of C were essentially the same.

1675
THE O^{18} ABUNDANCE IN FRESH WATER. Willi Dansgaard. Geochim. et Cosmochim. Acta 6, 241-60 (1954). C.A. 49, 7158c.
The O^{18} concentrations in ground, surface, and rain waters have been determined on a world-wide basis. The parameters which determine the various values are discussed.

1676
ISOTOPIC COMPOSITION OF ATMOSPHERIC OXYGEN AND NITROGEN. Malcolm Dole, G. A. Lane, D. P. Rudd, and D. A. Zaukelies. Geochim. Cosmochim. Acta 6, 65-78 (1954). C.A. 49, 7302g.
The O_2 and N_2 of air samples from altitudes up to 51.6 km. and of surface samples from various locations in the world showed normal isotopic ratios. N_2 in dissolved ocean air gave a normal ratio, but the O_2 displayed an increase in O^{18} with decreasing O_2 content.

1677
THE ISOTOPE ABUNDANCES OF CHLORINE FROM VARIOUS SOURCES. H. R. Owen and O. A. Schaeffer. J. Am. Chem. Soc. 77, 898-9 (1955). C.A. 49, 7303f.
Mass spectral patterns of CH_3Cl showed no differences in the Cl^{35}/Cl^{37} ratio of chloride ion from 10 marine, sedimentary, and igneous sources. The ratio is given as 3.13 ± 0.03.

1678
THE EXCHANGE OF OXYGEN BETWEEN ALCOHOLS AND WATER. I. RATES OF CARBONIUM-ION FORMATION AND DECOMPOSITION IN ACIDIC AQUEOUS SOLUTIONS OF TERT-BUTANOL. I. Dostrovsky and F. S. Klein. J. Chem. Soc. 1955, 791-6. C.A. 49, 7343a.
The rates of O exchange between tert-BuOH and H_2O and the rates of the dehydration in the presence of H_2SO_4 were determined at a number of temperatures and acid concentrations.

1679
THE EFFECTS OF CERTAIN NITRO AND RELATED COMPOUNDS UPON THE RATE OF EXCHANGE OF DEUTERIUM GAS WITH ACETIC ACID OVER ADAMS PLATINUM CATALYST. Hilton A. Smith and Edgar L. McDaniel. J. Am. Chem. Soc. 77, 533-5 (1955). C.A. 49, 7352a.
The effect of a NO_2-group containing compound on the rate of the catalytic exchange of D_2 and AcOH is determined by the remainder of the molecule. Where the NO_2 group is conjugated with an olefinic bond, the rate of exchange is accelerated by the addition of these compounds in low concentration. In more concentrated solutions of these compounds no exchange occurs initially, although exchange does occur after reduction of the NO_2 compound.

1680
HYDROGEN-DEUTERIUM EXCHANGE ON COPPER CATALYSTS. Mohammed Alei, Jr. Univ. Microfilms (Ann Arbor, Mich.), Publ. No. 10,822, 119 pp., Dissertation Abstr. 15, 339 (1955) C.A. 49, 7352b.

1681
A 2800° CALUTRON ION SOURCE UNIT AND ITS USE IN SEPARATING THE ISOTOPES OF PALLADIUM, PLATINUM, RUTHENIUM, AND IRIDIUM. W. A. Bell, L. O. Love, and C. E. Normand. 23 pp. (1954)(ORNL-1767). C.A. 49, 7413i.
A source capable of vaporizing 10 g. of charge material at 2800° for introduction into an electromagnetic isotope separator is described.

1682
THE EFFECT OF CYANIDE ON THE RATE OF THE THALLOUS-THALLIC EXCHANGE REACTION. Eduardo Penna-Franca and Richard W. Dodson. Engenharia e quimica (Rio de Janeiro) 6, No. 6, 1-10 (1954). J. Am. Chem. Soc. 77, 1651-3 (1955). C.A. 49, 7433b.
The rates of the Tl^+ - Tl^{3+} exchange in the presence of varying concentrations of CN^- have been determined. Small amounts of CN^- diminish the rate. After a minimum was observed the rate of the exchange reaction increased with increasing $[CN^-]$. An interpretation which is based on thallium-cyanide complex formation is given for the observed rates of exchange.

1683
ISOTOPE DISPLACEMENT BY ADSORPTION AND DESORPTION ON SILICA GELS AT LOW TEMPERATURES AND PRESSURES. G. A. Melkonian and B. Reps. Z. Elektrochem. 58, 616-19 (1954). C.A. 49, 7922a.
At low temps. (78-90°K.) and very low adsorption pressures a shift of the isotope ratio occurs in favor of the lighter isotope in the desorbed phase. The separation factors are higher than those obtained from statistical determination of equilibria and heat of adsorption. The separation factors were determined for the systems H_2-D_2, CH_4-CD_4, and Ne and its isotopes.

1684
ISOTOPE EFFECTS IN THE COMBUSTION OF CARBON MONOXIDE. R. W. Attree, F. Brown, G. E. Dunn, and M. Lounsbury. Can. J. Chem. 32, 921-30 (1954). C.A. 49, 7936d.
The relative rates of reaction of $C^{12}O$, $C^{13}O$, and $C^{14}O$ with O_2 were measured in the temp. range 550-700°. The relative rates k^{13}/k^{12} and k^{14}/k^{12} for the slow, heterogeneous reaction are, respectively,

0.985 and 0.959. Within experimental error the homogeneous gas-phase explosion reactions show no isotope effects.

1685
EXCHANGE OF DEUTERIUM AND OXYGEN-18 BETWEEN WATER AND OTHER SUBSTANCES. I. METHODS. Aase Hvidt, G. Johansen, K. Linderstrøm-Lang, and Fred Vaslow. Compt. rend. lab. Carlsberg, Ser. chim. 29, 129-57 (1955). C.A. 49, 7938g.

A method is described for the microdetermination of the exchange of D or O^{18} between water and other substances. It is based on density measurements in a gradient tube and equilibration between 2 small aqueous drops through a short air space.

1686
EXCHANGE REACTIONS OF LABELED POTASSIUM THIOCYANATE WITH ORGANIC THIOCYANATES AND ISOTHIOCYANATES. Antonino Fava and Antonio Iliceto. Ricerca sci. 25, 54-6 (1955). C.A. 49, 7939a.

The primary and tertiary (EtNCS and tert-BuNCS) isothiocyanates studied did not show any measurable extent of exchange under the exptl. conditions. With the exception of PhSCN, all thiocyanates did exchange with $KS^{35}CN$.

1687
EFFECT OF MOLECULAR STRUCTURE ON THE RATE OF IONIC AND ATOMIC REACTIONS OF ISOTOPE EXCHANGE. I. EFFECT OF LENGTHENING THE CARBON CHAIN OF THE ALKYL RADICAL ON THE RATE OF ISOTOPE EXCHANGE OF AN ALKYL HALIDE WITH HALIDE IONS. M. B. Neiman, Yu. M. Shapovalov, and V. B. Miller. Zhur. Fiz. Khim. 28, 1243-56 (1954). C.A. 49, 7939c.

The mechanism and rate were studied of the reactions $RX + X^{*-} \rightleftharpoons RX^{*} + X^{-}$, where RX is the alkyl halide MeBr, EtBr, PrBr, MeI, EtI, and PrI.

1688
HYDROGEN-ISOTOPE EFFECTS IN THE ALKALINE CLEAVAGE OF TRIORGANOSILANES. Louis Kaplan and K. E. Wilzbach. J. Am. Chem. Soc. 77, 1297-1302 (1955). C.A. 49, 7940i.

The effects of isotopic substitution on the rates of hydrolysis of triphenyl- and tripropylsilane in piperidine-water and EtOH-water solvents were studied in order to acquire information about reaction mechanisms. Substitution of D or T for protium in either the silane or the solvent in every case reduced the reaction rate.

1689
THE INTERACTION OF DEUTERIUM AND SATURATED HYDROCARBONS ON NICKEL CATALYSTS. H. C. Rowlinson, Robert L. Burwell, Jr., and Richard H. Tuxworth. J. Phys. Chem. 59, 225-31 (1955). C.A. 49, 7944f.

The interaction of D_2 and a variety of alkanes and cycloalkanes on evaporated Ni films and on a reduced NiO catalyst leads to very similar results. Isotopic exchange occurs conveniently at 150-200° to produce species with from 1 to all H atoms exchanged.

1690
A SIMPLE METHOD FOR THE CALCULATION OF THE APPROXIMATE VALUES OF THE VIBRATIONAL FREQUENCIES OF ISOTOPIC MOLECULES. Josef Plica and Bohdan Schneider. Chem. Listy 49, 149-57 (1955). Collection Czechoslov. Chem. Communs. 20, 452-60 (1955) (in English). English translation (AEC-tr-2297). C.A. 49, 7958c.

1691
PRODUCTION AND PHYSICAL PROPERTIES OF ISOTOPES. C. J. Bakker. Ned. Tijdschr. Geneesk. 99, I, 135-53 (1955). C.A. 49, 7991c.

A review.

1692
ELECTROMAGNETIC CONCENTRATION OF BERYLLIUM-10. W. A. Bell and L. O. Love. 1950. 30 p. (Y-577). C.A. 49, 7998g.

By starting with 50 g. Be irradiated until it contained approx. 100 γ Be^{10}, a final 4 mg. product containing 10 γ Be^{10} was produced. Procedures are described for dealing with Be health hazards and γ manipulations.

1693
ELECTROMAGNETIC CONCENTRATION OF CARBON-12. L. O. Love and W. A. Bell. Mar. 1951 (Y-813). C.A. 49, 7998h.

A 1 g. sample of C enriched to 99.96% C^{12} has been prepd. by using CO_2 as the charge material in the calutron. Operations, techniques used, sample wts., and assays are given.

1694
ELECTROMAGNETIC CONCENTRATION OF POTASSIUM-40. L. O. Love and W. A. Bell. 1950. 25 p. (Y-623). C.A. 49, 7998h.

The 700-fold enhancement of K^{40} in the calutron and the preparation of 30 mg. 7.13% K^{40} are described.

1695
ELECTROMAGNETIC CONCENTRATION OF BROMINE. H. J. Buttram, L. O. Love, and W. A. Bell. 1950. 15 p. (Y-671). C.A. 49, 7998i.

Enriched samples of both stable isotopes have been produced.

1696
ELECTROMAGNETIC CONCENTRATION OF GALLIUM-69 AND GALLIUM-71. W. A. Bell and L. O. Love. 1950. 22 p. (Y-628). C.A. 49, 7998i.

Both enriched isotopes have been produced. Ga^{71} was enriched from 39.8 to 98.08%.

1697
ELECTROMAGNETIC CONCENTRATION OF THE ISOTOPES OF STRONTIUM. W. A. Bell, H. J. Buttram, and L. O. Love. 1950. 18 p. (Y-692). C.A. 49, 7999a.

Samples have been prepd. enriched in each of the 4 isotopes of Sr.

1698
ELECTROMAGNETIC CONCENTRATION OF LEAD. H. J. Buttram, W. A. Bell, and L. O. Love. 1950. 23 p. (Y-669). C.A. 49, 7999a.

Enriched samples of all 4 stable isotopes have been prepared.

1699
THEORETICAL EFFECT OF DIFFUSION ON ISOTOPIC ABUNDANCE RATIOS IN ROCKS AND ASSOCIATED FLUIDS. F. E. Senftle and J. T. Bracken. Geochim. et Cosmochim. Acta 7, 61-76 (1955). C.A. 49, 8058a.

Diffusion is considered as a possible process of isotope fractionation taking place throughout geologic time.

1700
THE EXCHANGE OF HYDROGEN BETWEEN AMMONIUM SALTS AND ALCOHOLS. Louis Kaplan and K. E. Wilzbach. J. Am. Chem. Soc. 76, 2593 (1954). C.A. 49, 8673e.
By use of T as a tracer it was shown that the exchange rate between NH_4NO_3 and 54% HNO_3 has a half time of about 3 min. With both the salt and BuOH labeled with T at concns. of 0.1M, the half time of exchange at 0° was 10 hrs. for Et_2NH_2Cl and was 2 min. for Me_3NHCl. The large difference in the rates of exchange is not related to the acidity constants of the salts, since the half time for the exchange reaction of a 0.2M soln. of guanidium nitrate in EtOH was less than 1 min. at 0°.

1701
OXYGEN EXCHANGE DURING THE ACIDIC AND BASIC HYDROLYSES OF AMIDES AND THE ENZYMIC HYDROLYSIS OF ESTERS. Myron L. Bender, Roger D. Ginger, and Kenneth C. Kemp. J. Am. Chem. Soc. 76, 3350-1 (1954). C.A. 49, 8673g.
O exchange occurs between benzamide-O^{18} and water during the basic hydrolysis of benzamide, but no exchange occurs during acid hydrolysis. O exchange was not observed during the α-chymotrypsin-catalyzed hydrolysis of Me β-phenylpropionate-carbonyl-O^{18}.

1702
ISOTOPIC EXCHANGE OF ELEMENTAL SULFUR WITH SULFUR OF AMMONIUM THIOCYANATE, THIOUREA, AND SODIUM DIETHYLDITHIOCARBAMATE. I. I. Kukhtenko and G. P. Miklukhin. Doklady Akad. Nauk S.S.S.R. 100, 921-3 (1955). C.A. 49, 8673h.
Refluxing S^{35} in xylene with NH_4CNS in iso-AmOH no exchange was found in 5 hrs. at 115° reflux temp. Similar interchange was studied between S and $CS(NH_2)_2$; in this case exchange does occur and in 2.5 hrs. at 115° equilibrium is achieved. Exchange of S with Na diethyldithiocarbamate was also studied and rate constants determined.

1703
ISOTOPIC EXCHANGE BETWEEN SULFITE AND ALKYL THIOSULFATES. Gastone Pajaro and Antonino Fava. Ricerca sci. 24, 1905-6 (1954). C.A. 49, 8674a.
The exchange between $KO_2CCH_2SSO_3K$ and $S^{35}O_3^{--}$ at 25° in a soln. of pH 7 and ionic strength 0.335 (phosphate buffer, NaCl) has a half time of 148 min. The reaction is homogeneous. The rate increases with the pH and the ionic strength.

1704
HYDROLYSIS OF ALKYL HALIDES AND SULFONIUM SALTS BY LIGHT AND HEAVY WATER. C. Gardner Swain, Robert Cardinaud, and Arthur D. Ketley. J. Am. Chem. Soc. 77, 934-6 (1955). C.A. 49, 8678i.
Me_3CCl hydrolyzed 40% faster in H_2O than in 99.5% D_2O, whereas $[Me_3CSMe_2]^+$ and Me halides hydrolyzed at the same rate in the 2 mediums. The reaction of Me halides with pyridine also is unaffected by this solvent change.

1705
ISOTOPIC EXCHANGE REACTIONS IN LIQUID SULFUR DIOXIDE. KINETICS OF THE CATALYZED S^{35} EXCHANGE BETWEEN THIONYL CHLORIDE AND SULFUR DIOXIDE. B. J. Masters and T. H. Norris. J. Am. Chem. Soc. 77, 1346-52 (1955). C.A. 49, 8681g.
The kinetics of the Cl-catalyzed exchange reaction between SO_2 and $SOCl_2$ was studied in the temp. range -21 to +25°. Whereas RbCl and Me_4NCl are effective catalysts, $AlCl_3$ and HCl are found to be essentially inactive.

1706
THE BRIDGED-ACTIVATED COMPLEX FOR THE ELECTRON EXCHANGE OF CHROMIUM(II) AND MONOCHLOROCHROMIUM(III) ION. Henry Taube and Edward L. King. J. Am. Chem. Soc. 76, 4053-4 (1954). C.A. 49, 8723d.
The rate of electron exchange in the system Cr^{++}-$CrCl^{++}$ is rapid but measurable. The exchange must occur by a bridge-activated complex of the configuration $[Cr...Cl...Cr]^{4+}$, which permits transfer of Cl. Cr^{++} catalyzes the exchange of Cl^- and $CrCl^{++}$.

1707
EXAMINATION OF THE IODOFORM AND SCHMIDT REACTIONS OF ACETONE-1-C^{14} FOR ISOTOPE EFFECTS. Gus A. Ropp, William A. Bonner, Marion T. Clark and Vernon F. Raaen. J. Am. Chem. Soc. 76, 1710-11 (1954). C.A. 49, 8794d.
The iodoform reaction showed no measurable isotope effect. The Schmidt reaction of acetone-1-C^{14} showed small intra- and intermolecular isotope effects in the usual direction.

1708
THE EFFECT OF RING SUBSTITUENTS ON THE ISOTOPE EFFECTS IN REACTIONS OF CARBONYL-C^{14} ESTERS AND KETONES. Gus A. Ropp and Vernon F. Raaen. J. Chem. Phys. 22, 1223-7 (1954). C.A. 49, 8858d.
The variations of the isotope fractionation factor k^{14}/k^{12} with changes in ring substituents, reaction temperature, solvent concentration, and the alcohol group were studied for the saponification of ethyl benzoates (α-carbon-14). The variations of the k^{14}/k^{12} ratio with changes in temperature and ring substituents were studied for the formation of the 2,4-dinitrophenylhydrazones of acetophenones (α-carbon-14).

1709
OPERATION OF CONTINUOUS THERMAL DIFFUSION COLUMNS FOR LIQUIDS. Thomas S. Heines, Jr. Univ. Microfilms (Ann Arbor, Mich.), Publ. No. 11,388, 123 pp. (microfilm, $1.54; paper enlargement, $12.30); Dissertation Abstr. 15, 541 (1955). C.A. 49, 9332d.

1710
DETERMINATION OF THE COEFFICIENTS OF SELF DIFFUSION BY THE METHOD OF HETEROGENEOUS ISOTOPE EXCHANGE. Gaston Berthier. J. chim. phys. 52, 41-7 (1955). C.A. 49, 9346i.
Mathematical. The equations developed are more general than those previously used and also represent the experimental results more completely.

1711
KINETICS OF THE THIOSULFATE-TRITHIONATE ISOTOPIC EXCHANGE. Antonino Fava and Gastone Pajaro. J. chim. phys. 51, 594-9 (1954). C.A. 49, 9365a.
The exchange reaction is approximately 1st order with respect to the concentrations of both starting ions. No variation

of reaction rate with pH is found in the pH range 7-10, nor is any effect of the variation of surface area apparent. The concentrations of cations present are important variables affecting the reaction rate.

1712
THE MECHANISM OF EXCHANGE OF HYDROGEN BETWEEN NITROGEN AND OXYGEN ATOMS. C. Gardner Swain, James T. McKnight, Mortimer M. Labes, and V. Peter Kreiter. J. Am. Chem. Soc. 76, 4243 (1954). C.A. 49, 9365b.
The rate of D exchange between 0.3-o.5M NH_4Br and 0.1-1.2M MeOH in $HCONMe_2$ containing 0.0013-0.13M HBr at 0° was measured. The rate usually decreased with increasing polarity of the solvent. Tritium exchange was 0.8 as fast as D exchange.

1713
ISOTOPIC EXCHANGE OF BROMINE ATOMS BETWEEN CRYSTALLINE Hg_2Br_2 AND GASEOUS BROMINE. J. Deren, J. Haber, A. Halpern, and A. Polaczek. Roczniki Chem. 28, 673-5 (1954). C.A. 49, 9365d.
The extent of isotopic exchange of Br atoms between crystalline Hg_2Br_2 and gaseous Br was studied by use of radioactive tracers.

1714
RATE OF THE FERROCYANIDE-FERRICYANIDE EXCHANGE REACTION. Arthur C. Wahl and Charles F. Deck. J. Am. Chem. Soc. 76, 4054-5 (1954). C.A. 49, 9365d.
The isotopic exchange reaction between hexacyanoferrate(II) and hexacyanoferrate (III) is very rapid and the separation induced exchange is large, often complete.

1715
ISOTOPIC-EXCHANGE REACTIONS OF PHOSPHORUS PENTACHLORIDE. James J. Downs and Rowland E. Johnson. J. Am. Chem. Soc. 77, 2098-2102 (1955). C.A. 49, 9365e.
The rate of exchange between PCl_5 and labeled Cl_2 in CCl_4 shows a difference in reactivity for the various Cl atoms in PCl_5, 3 Cl atoms reacting rapidly and 2 slowly. Cl, on addn. to PCl_3, enters mainly into the equatorial positions; Hg attacking PCl_5 removes Cl mainly from the equatorial positions.

1716
ISOTOPIC EXCHANGE BETWEEN SELENIUM AND POLYSELENIDE IONS AND AUTODIFFUSION IN SELENIUM. D. G. Tuck and M. Haissinsky. J. chim. phys. 51, 577-80 (1954). C.A. 49, 9365f.
The exchange reaction between red, amorphous Se and dissolved polyselenide ions is slower at 18° than at 0°.

1717
ISOTOPIC EXCHANGE REACTIONS OF IODINE IN SYSTEMS WITH INORGANIC IODIDES. Ya. A. Fialkov and Yu. P. Nazarenko. Ukrain. Khim. Zhur. 19, 356-64 (1953); Referat. Zhur. Khim. 1954, No. 33869. C.A. 49, 9365g.
The isotopic exchange of I^{131} was studied in systems containing I_2 and various inorganic iodides. In the study of systems iodides-elemental iodine, I_2 was tagged and in systems $KI-MI_n$, KI was tagged. Results for numerous iodides are given in C.A.

1718
OXYGEN EXCHANGE AND THE WALDEN INVERSION IN sec-BUTYL ALCOHOL. C. A. Bunton, Alicja Konasiewicz, and D. R. Llewellyn. J. Chem. Soc. 1955, 604-7. C.A. 49, 9370f.
The rates of racemization and O-exchange of optically active sec-butyl alc. were measured in aq. $HClO_4$ (up to 1M concn.) at 100.8°. The kinetics of O-exchange was followed by (1) use of O^{18}-enriched sec-butyl alc. and measurement of the increase in O^{18} content of the water, and (2) measurement of the increase in O^{18} content of isotopically normal sec-butyl alc. using H_2O^{18}

1719
EXCHANGE REACTIONS OF COMPLEX PLATINUM COMPOUNDS. A. A. Grinberg, L. I. Kozlova, L. E. Nikol'skaya, and G. A. Shagisultanova. Zhur. Priklad. Khim. 28, 7-11 (1955); J. Appl. Chem. (U.S.S.R.) 28, 5-8 (1955)(Engl. translation). C.A. 49, 9425f.
The following exchange reactions were carried out with tagged atoms: (a) K_2PtCl_6 and K_2PtI_6 with chloro- and iodoplatinates of Cs, respectively. (b) $K_2PtCl + 4NH_4Cl^*$ and $K_2PtI_6 + 4NH_4I^*$. (c) The exchange of $K_2[Pt(NO_2)_2Cl_2] + 2NH_4Cl^*$ and $K_2PtCl_4 + 4NH_4Cl^*$. (d) $K_2PtBr_4 + 4NH_4Br^*$ and $K_2[Pt(NO_2)_2Br_2] + 2NH_4Br^*$.

1720
RADIOCHEMICAL STUDIES OF SOLIDS. III. ION- AND ISOTOPE EXCHANGE REACTIONS ON MANGANESE DIOXIDES AND MANGANITES. W. Buser and P. Graf. Helv. Chim. Acta 38, 810-29 (1955). C.A. 49, 9996f.
Exchange was studied between $Mn^*(NO_3)_2$ and $Zn^*(NO_3)_2$ solutions and various solid Mn and Zn compounds. Exchange was related to crystal disorder.

1721
HYDROGEN-DEUTERIUM EXCHANGE ON METALS AND ALLOYS. Richard J. Mikovsky. Univ. Microfilms (Ann Arbor, Mich.), Publ. No. 10,968, 140 pp. Dissertation Abstr. 15, 508-9 (1955). C.A. 49, 10002i.

1722
RADIATION INDUCED EQUILIBRIUM OF HYDROGEN-DEUTERIUM MIXTURES. S. O. Thompson and O. A. Schaeffer. J. Chem. Phys. 23, 759-60 (1955). C.A. 49, 10021d.
Radiation equilibrated (Po^{210} α and 2-Mev Van de Graaff electrons) mixture of H_2 and D_2 were compared directly to catalytically (Ni) equilibrated mixtures. The radiation induced equilibrium constant agreed with the catalytic constant within the experimental precision of 1%.

1723
ISOTOPIC EXCHANGE AND REARRANGEMENT PROCESSES ON SILVER SURFACES. Heinz Gerischer and Ragnar P. Tischer. Z. Elektrochem. 58, 819-27 (1954). C.A. 49, 10023e.
The take-up of radioactive Ag isotopes by exchange with a Ag sheet in a Ag-containing solution was studied.

1724
THE PRINCIPLES OF HYDROGEN ISOTOPE EXCHANGE REACTIONS IN SOLUTION. V. Gold and D. P. N. Satchell. Quart. Revs. (London) 9, 51-72 (1955). C.A. 49, 10023f.
A review with 95 references.

1725
EXCHANGE REACTIONS OF STANNIC CHLORIDE WITH HYDROGEN CHLORIDE AND ORGANIC CHLORIDES. Reed A. Howald and John E. Willard. J. Am. Chem. Soc. 77, 2046-9 (1955). C.A. 49, 10023g.
The exchange of Cl between HCl and solid, liquid, or gaseous $SnCl_4$ was studied in pyrex and quartz vessels. CH_3Cl, sec-BuCl, CCl_4, and CH_3CCl_3 did not exchange Cl with $SnCl_4$ after several hrs. at 200° in either vapor or when frozen out with $SnCl_4$ and melted. $(CH_3)_3CCl$ exchanged rapidly with liquid $SnCl_4$. The exchange also took place at a readily measurable rate in the vapor phase at 25 and 190°.

1726
CARBON-14 AND CARBON-13 INTRAMOLECULAR ISOTOPE EFFECTS IN THE DECARBOXYLATION OF LIQUID MALONIC ACID AT 140.5°. Peter E. Yankwich, Albert L. Promislow, and Robert F. Nystrom. J. Am. Chem. Soc. 76, 5893-4 (1954). C.A. 49, 10023h.
The results show 5.45 ± 0.46% for the C^{14} effect and 2.85 ± 0.09% for the C^{13} effect; the ratio is 1.91 ± 0.17. The malonic acid case cannot be considered deviant from the predictions of the absolute-rate theory.

1727
THE HOMOGENEOUS EXCHANGE REACTION BETWEEN UNIVALENT AND TRIVALENT THALLIUM. F. J. C. Rossotti. J. Inorg. Nuclear Chem. 1, 159-62 (1955). C.A. 49, 10024a.
In $NaClO_4$-$HClO_4$ media the kinetics are 1st order with respect to the total Tl concentration in each state.

1728
THE ADSORPTION OF HYDROGEN ON ALUMINA AND SILICA-ALUMINA CRACKING CATALYSTS; RELATION OF SURFACE AREA TO ACTIVITY OF SILICA-ALUMINA CRACKING CATALYSTS. Harry W. Guenther. Univ. Microfilms (Ann Arbor, Mich.), Publ. No. 10913, 117 pp. Dissertation Abstr. 15, 507-8 (1955). C.A. 49, 10028e.

1729
EXCHANGE REACTION BETWEEN NEOPENTANE AND DEUTERIUM ON EVAPORATED METALLIC FILMS. Charles Kemball. Trans. Faraday Soc. 50, 1344-51 (1954). C.A. 49, 10029i.
Ni and Pd films catalyzed the reaction by a simple exchange process involving the replacement by D of one H atom at a time. Although the major process on W and Rh films was similar to that on Ni and Pd films, there was evidence of a multiple exchange process.

1730
RADIATION-INDUCED CERIUM(III)-CERIUM(IV) EXCHANGE IN AQUEOUS NITRIC AND SULFURIC ACIDS. Geo. E. Challenger and Burton J. Masters. J. Am. Chem. Soc. 77, 1063-4 (1955). C.A. 49, 10070a.
Solutions containing unlabeled Ce(IV) and labeled Ce(III) were irradiated with unfiltered 50-kv. x-rays from a W target. In both HNO_3 and H_2SO_4 the exchange increased linearly with time.

1731
ELECTROMAGNETIC SEPARATION OF STABLE ISOTOPES. R. H. V. M. Dawton and Mervyn L. Smith. Quart. Revs. (London) 9, 1-22 (1955). C.A. 49, 10078g.
A review with 33 references.

1732
A MATHEMATICAL DERIVATION OF THE EXCHANGE OF A LABELED SUBSTANCE BETWEEN A LIQUID FLOWING IN A VESSEL AND AN EXTERNAL COMPARTMENT. W. C. Sangren and C. W. Sheppard. Bull. Math. Biophys. 15, 387-94 (1953). C.A. 49, 10673f.
An initially intravascular isotope exchanging with an initially unlabeled external compartment is considered. The solution for the spatial distribution at any time is given for an arbitrary initial distribution and for a single impulsive input.

1733
ISOTOPIC EFFECTS AND THERMODYNAMIC PROPERTIES IN CONDENSED PHASE. I. I. Prigogine, R. Bingen, and J. Jeener. Physica 20, 383-94 (1954). C.A. 49, 10688g.
The zero-point energy of isotopic mixts. is discussed and its value compared with that for pure isotopes. The one-dimensional harmonic lattice is treated. The stable state at 0°K. always requires a separation into pure isotopes. II. I. Prigogine and J. Jeener. Ibid. 516-20. The theoretical treatment is extended to real 3-dimensional lattices. The calculated difference in zero-point energy of H-D, He^3-He^4, and Ne^{20}-Ne^{22} mixtures from their pure isotopes is much smaller than the experimental values for their free energy of mixing. III. I. Prigogine, R. Bingen, and A. Bellemans. Ibid. 633-54. The hypothesis is made that the free energy of an isotopic mixture is, for given values of volume per particle and temperature, the sum of the free energy of the pure isotopes plus an entropy-of-mixing term. The calculated results agree with the limited available experimental thermodynamic properties for the H and the He isotopes. The theory predicts heat absorption and positive deviation from the Raoult law (and hence, phase separation at very low temps.) for isotopic mixtures.

1734
DEW POINTS OF MIXTURES OF HELIUM ISOTOPES. B. N. Esel'son and N. G. Bereznyak. Zhur. Eksptl'. i Teoret. Fiz. 27, 648-9 (1954). (English translation AEC-tr-2298; and AERE-Lib/Trans. 721). C.A. 49, 10694f.
In order to obtain data for the construction of the vapor-liquid phase diagram of the He^3-He^4 system, the dew points of mixtures of these isotopes were measured. The results are tabulated.

1735
A LABORATORY METHOD FOR SEPARATING NITROGEN ISOTOPES BY ION EXCHANGE. F. H. Spedding, J. E. Powell, and H. J. Svec. J. Am. Chem. Soc. 77, 1393 (1955). C.A. 49, 10702g.
A bank of columns 4 in. by 5 ft. filled with sulfonated cation-exchange resin (H form) was connected in series. Five liters 15N NH_4OH diluted 30-fold and adsorbed on the columns gave a band 10 ft. long; this was eluted with 0.5N NaOH. After traveling 50 band lengths most of the N^{15} was concentrated in the last 6 in. of the band and the original isotopic ratio, N^{15}/N^{14}, of 0.00365 had increased to more than 0.25 at the rear edge of the band. When the last 2% of the NH_3 from such a run was adsorbed on 1-in. columns and eluted an additional

100 ft., the mole % of N^{15} at the rear edge of the fraction exceeded 74%.

1736
REACTIONS OF ATOMIC OXYGEN WITH MOLECULAR OXYGEN. Richard A. Ogg, Jr., and Wm. T. Sutphen. Discussions Faraday Soc. No. 17, 47-54 (1954). C.A. 49, 10715d.

The reaction $O^{16}O^{16} + O^{18}O^{18} \rightleftharpoons 2O^{16}O^{18}$, catalyzed by normal O_3, was studied. The rate is much greater than that of the reactions of the type $O^{16}O^{18} + O^{16}O^{16}O^{16} \rightleftharpoons O^{16}O^{16} + O^{18}O^{16}O^{16}$. To permit more quantitative study of the rates the expts. were repeated in the presence of CO_2 (p = 0 to 2.8 atm.) and over the temp. range -22 to 97°. Exchange of O^{18} with CO_2 was slow in comparison with the other reactions.

1737
SOME PRACTICAL CONSEQUENCES OF ISOTOPIC EXCHANGE. C. B. Amphlett. Chem. Products 18, 173-6 (1955). C.A. 49, 10749c.

The uses of radioactive isotopes, e.g., in the labeling of compounds, in surface chemistry, and radioactive dating, are reviewed. 23 references.

1738
SOME ASPECTS OF ISOTOPE ENRICHMENT BY MEANS OF HIGH-SPEED CENTRIFUGES. H. Klepp.(1953) 13 pp (JENER-12). Science Abstr. 56A, 1008. C.A. 49, 10759e.

The yields under batch and under continuous operation are compared. Numerical data for the enrichment of U^{235}, as UF_6, are given.

1739
HEAVY WATER. Wm. J. Bushell and Christopher F. Kearton. Brit. 726,771, Mar. 23, 1955. C.A. 49, 10763a.

An improved process is described for the production of heavy water which involves the electrolysis of an aqueous electrolyte (KOH). The process avoids combusting large quantities of H_2, and reduces the amount of light H_2 which is subjected to repeated liberation from H_2O and recombination with O_2.

1740
HEAVY WATER. Herbert S. Coles. Brit. 726,532, Mar. 23, 1955. C.A. 49, 10763d.

A process is described for the prepn. of heavy water (D_2O) or water enriched in heavy water by multistage electrolysis of ordinary water with KOH as an electrolyte.

1741
IRON(II)-IRON(III) COMPLEX EXCHANGE REACTIONS. Ira B. Whitney, Geo. K. Schweitzer, and C. L. Comar. J. Am. Chem. Soc. 77, 1390 (1955). C.A. 49, 10788d.

Fe^{55} was used to prepare 0.02M solutions of tris(2,2'-bipyridyl)iron(II) and tris-(1,10-phenanthroline)iron(II). Rates of exchange between Fe^{55} in these compounds and Fe(II) in $FeCl_2$ increased with H^+ concentration.

1742
SOME NEW DATA ON THE REACTIONS OF HYDROGEN EXCHANGE OF ORGANIC FREE RADICALS AND IONS. D. N. Kursanov and V. V. Voevodskii. Uspekhi Khim. 23, 641-53 (1954). C.A. 49, 10829b.

Review with 38 references covering the period through 1953. Particularly stressed are the experimental techniques developed by Voevodskii, et al. (C.A. 46, 1852f).

1743
RELATIVE ISOTOPE EFFECTS OF CARBON-13 AND CARBON-14. Albert L. Promislow. Univ. Microfilms (Ann Arbor, Mich.), Publ. No. 11,527, 122 pp. Dissertation Abstr. 15, 723 (1955). C.A. 49, 11334a.

1744
FRACTIONATION OF CHLORINE ISOTOPES BETWEEN GASEOUS CHLORINE AND AQUEOUS CHLORIDE ION. A. C. Rutenberg. J. Am. Chem. Soc. 77, 3001-3 (1955). C.A. 49, 11344i.

The single-stage fractionation factor was in the range 1.0024-1.006, with Cl^{37} concg. in the gaseous phase.

1745
THE PROPERTIES OF THE LIGHT ISOTOPE OF HELIUM He^3 AT LOW TEMPERATURES. I and II. R. A. Chentsov. Uspekhi Fiz. Nauk 55, 49-80; 265-87 (1955). (English Translation Part I, AEC-tr-2966; Part II, AEC-tr-2989). C.A. 49, 11346a.

The properties of the ordinary isotope of He at low temperatures are reviewed. The availability of He^3, methods of enrichment of He with the light isotope and of obtaining pure He^3, and liquid solutions of He^3 and He^4 are discussed.

1746
TRITIUM ISOTOPE EFFECT IN THE ISOMERIZATION OF CYCLOPROPANE. Ralph E. Weston, Jr. J. Chem. Phys. 23, 988 (1955). C.A. 49, 11372b.

The isomerization of T-labeled cyclopropane to propylene was studied at approximately 500° as a function of pressure.

1747
OXYGEN TRACER EXPERIMENTS ON THE REACTION OF NO_2 WITH WATER. Michael Anbar and Henry Taube. J. Am. Chem. Soc. 77, 2993-4 (1955) C.A. 49, 11372b.

Experiments in which varying amounts of NO_2 were added by several methods to H_2O, buffered or containing NaOH, are interpreted on the basis of 2 active intermediates, the asym. "nitrosyl nitrate" structure (I) and the sym. N_2O_4. I is operative when NO_2 is dilute.

1748
EXCHANGE OF CHLORINE IN AQUEOUS SYSTEMS CONTAINING CHLORIDE AND TETRACHLOROPLATINATE(II). LeRoy F. Grantham, Thomas S. Elleman, and Don S. Martin, Jr. J. Am. Chem. Soc. 77, 2965-71 (1955). C.A. 49, 11372g.

The kinetics of exchange of Cl was measured in aqueous solutions containing Cl^-, $[PtCl_4]^{--}$, and $[PtCl_3(H_2O)]^-$, by the use of Cl^{36}.

1749
SELF-EXCHANGE OF BORON IN BORON HYDRIDES. I. Shapiro and B. Keilin. J. Am. Chem. Soc. 77, 2663 (1955). C.A. 49, 11372i.

The exchange of B between isotopically normal diborane and B^{10}-enriched diborane is rapid at 25°; the rate is similar to that for D exchange between B_2H_6 and B_2D_6. No B exchange occurs between isotopically normal pentaborane and B^{10}-enriched pentaborane at temps. up to 100° in the liquid phase and up to 250° in the gaseous phase. H exchange between pentaborane-d_2 and pentaborane takes place at 200° but not at room temp.

1750
ORDER AND MECHANISM OF ISOTOPIC EXCHANGE REACTIONS OF SECONDARY AND TERTIARY ALKYL BROMIDES IN ANHYDROUS ACETONE. L. J. Le Roux and E. R. Swart. J. Chem. Soc. 1955, 1475-9. C.A. 49, 11373a.

The isotopic exchange reactions between radioactive LiBr and Me_2CHBr and Me_3CBr in anhyd. Me_2CO were studied over a range of ionic concns.

1751
VARIATIONS IN NATURAL ABUNDANCE OF THE LITHIUM ISOTOPES. A. E. Cameron. J. Am. Chem. Soc. 77, 2731-3 (1955). C.A. 49, 11452h.

The Li^7/Li^6 ratio variation in commercial samples is between 12.44 and 12.93. Minerals show ratios between 12.47 and 12.72. Partial precipitation as phosphate or carbonate effects isotope separation.

1752
SEPARATION OF NITROGEN ISOTOPES BY CHEMICAL EXCHANGE BETWEEN NITRIC OXIDE AND NITRIC ACID. W. Spindel and T. I. Taylor. J. Chem. Phys. 23, 981-2 (1955). C.A. 49, 11453a.

The reaction, $N^{15}O(g) + HN^{14}O_3(aq.) = N^{14}O(g) + HN^{15}O_3(aq.)$, is favorable for the separation of N^{15}. The presence of NO_2, N_2O_3, and HNO_2 in the liquid phase apparently speeds up the exchange between NO and HNO_3. When the concentration of NO_2 in the gas phase is too high, the over-all separation for the system is lowered. Maximum over-all separation in column runs was obtained at a HNO_3 concentration of 10M.

1753
ISOTOPIC EXCHANGE REACTIONS OF AMERICIUM. Thomas K. Keenan, Robert A. Penneman, and John F. Suttle. J. Phys. Chem. 59, 381 (1955). C.A. 49, 11458b.

The exchange of Am^{+++} and AmO_2^+ is negligible at temps. up to 100° in acid concentrations up to 2.0 f and Am concentrations of approximately 0.03 f each. Exchange half-times of approximately 15 hrs were observed between 0.03 f tri- and quinquevalent Am under a wide range of conditions. The exchange of AmO_2^+ and AmO_2^{++} was complete within 1 min. at 0° in 1.0 f $HClO_4$.

1754
INFLUENCE OF TEMPERATURE ON THE ELECTROLYTIC SEPARATION OF HYDROGEN ISOTOPES. J. Brun and Th. Varberg. Kgl. Norske Videnskab. Selskabs, Forh. 26, Medd., 19-21 (1953)(Pub. 1954). C.A. 49, 11468e.

The separation efficiency of H and D was measured by using a commercial mild-steel cathode and a KOH electrolyte. The initial D_2O content of the electrolyte was about 10%. At the lowest temp. used, -19°, the electrolyte concentration was about 20% while 5% solutions were used at the higher temps. The separation efficiency varied from 17.5 at -19° to 5.8 at 97°.

1755
ISOTOPE GEOLOGY. Kalervo Rankama. New York, McGraw-Hill Book Co., Inc., London Pergamon Press, 1954. 535 p. C.A. 49, 11520g.

The influence of the isotopes on geology and their possible applications to problems of geology are the central theme of this book. The physics and chemistry of the isotopes are thoroughly reviewed as well as methods of isotope separation. An extensive bibliography, and subject and author indexes are included.

1756
THE C^{14} ISOTOPE EFFECT IN THE CONDENSATION OF BENZOYLBENZOIC ACID-CARBOXYL-C^{14} TO ANTHRAQUINONE-9-C^{14}. W. H. Stevens and D. A. Crowder. Can. J. Chem. 32, 792-801 (1954). C.A. 49, 11610g.

The C^{14} isotope effect in the condensation of the acid in concentrated sulfuric acid has been measured and the ratio of the rates, k(14)/k(12), found to be 1.074 ± 0.003.

1757
INTERRELATION OF GASEOUS VISCOSITY, SELF-DIFFUSION, AND ISOTOPIC THERMAL DIFFUSION. Eugene M. Holleran. J. Chem. Phys. 23, 847-53 (1955). C.A. 49, 12065c.

The general interrelation of the theoretical 1st approximations to viscosity, self-diffusion, and thermal diffusion previously derived is modified to conform with a simpler and more accurate approximation for the thermal diffusion ratio due to Kihara (Imperfect gases, Tokyo, 1949). The results were in good agreement with the experimental data for A.

1758
MOBILITY OF HYDROGEN IN SALTS AND DERIVATIVES OF ACETIC ACID. G. P. Miklukhin and A. F. Rekasheva. Doklady Akad. Nauk S.S.S.R. 101, 881-4 (1955). C.A. 49, 12090e.

AcOD was equilibrated with Ac_2O, AcOK, $(AcO)_2Pb$, AcOH, and EtOAc. Higher aliphatic acids show slower H-D exchange (probably in 2 position) as the chain length is increased; Pb salts in these cases show more rapid exchange than do Na salts. See C.A. for more detail.

1759
THE MECHANISM OF THE HYDROGEN-ISOTOPE REPLACEMENT IN SOLUTIONS. A. I. Brodskiĭ. Doklady Akad. Nauk S.S.S.R. 93, 847-50 (1953). C.A. 49, 12093b.

An explanation is offered for the extreme rapidity (A. I. Brodskii, C.A. 43, 5011c (1949)) or the great tardiness of the double exchange reaction $D^+ \rightleftharpoons H^-$. Three reaction-mechanism types involved in the possible slow $D^+ \rightleftharpoons H^+$ are discussed.

1760
HYDROGEN EXCHANGE AS AN ELECTROPHILIC AROMATIC SUBSTITUTION. Lars Melander. Svensk Kem. Tidskr. 67, 51-8 (1955). C.A. 49, 12093c.

A review with 15 references.

1761
RADIOCHEMICAL METHODS IN THE INVESTIGATION OF HETEROGENOUS ISOTOPIC EXCHANGE REACTIONS OF SULFUR COMPOUNDS. O. Gubeli and H. U. Wiesendanger. Helv. Chim. Acta 38, 716-27 (1955). C.A. 49, 12093d.

By use of S^{35} the solid-aqueous solution exchanges between CdS and Na_2S, $SrSO_3$ and Na_2SO_3, and $BaSO_4$ and Na_2SO_4 were investigated as a function of time and temperature. No exchange was found to take place between CdS and sulfide ion.

1762
KINETICS OF ISOTOPIC EXCHANGE REACTIONS. C. A. Bunton, D. P. Craig, and E. A. Halevi. Trans. Faraday Soc. 51, 196-204 (1955). C.A. 49, 12093e.

The exchange of a labelled atom X* between two molecular species AX_n and BX_m was studied. The rate of exchange was a function of the isotopic abundance and the equilibrium constant of the exchange. The dissociative exchange of X* between the species AX_n and X was treated in a similar way. Under most conditions likely to be realized in practice neither deviation from 1st-order kinetics as a result of isotopic fractionation nor difference in the kinetic form due to the mechanism of exchange should be observed.

1763
INVESTIGATION OF THE REACTIVITY OF AROMATIC COMPOUNDS BY THE METHOD OF ISOTOPIC EXCHANGE WITH DEUTERIUM BROMIDE. V. R. Kalinachenko, Ya. M. Varshavskiĭ, and A. I. Shatenshteĭn. Doklady Akad. Nauk S.S.S.R. 91, 577-80 (1953). C.A. 49, 12093f.

Data on H-D exchange between aromatic compounds and liquid HBr containing DBr are summarized. Such experiments show differences in reaction velocity of nonequiv. H atoms of the aromatic compd. much more sharply than do experiments with ND_3 + KND_2 (C.A. 48, 10413c). Selected data are given in C.A. Many other data, results of about 400 experiments are given. These results confirm Sh.'s earlier representation (C.A. 47, 3055b) of the mechanism of exchange of H isotopes in solution.

1764
THE STUDY OF RADICAL MOBILITY BY THE ISOTOPE METHOD. T. P. Gragerov. Doklady Akad Nauk S.S.S.R. 99, 101-4 (1954). C.A. 49, 12094b.

Double decomposition reactions of alkyl and aryl radicals and reactions between free radicals and carbonium ions were studied using D as a tracer to detect exchange.

1765
THE EXCHANGE REACTION BETWEEN DEUTERIUM AND METHYLAMINES ON IRON POWDER. Joel R. Gutmann. J. Phys. Chem. 59, 478-9 (1955). C.A. 49, 12094e.

The exchange of methylamine and dimethylamine with D_2 at 242° and 289° followed a 1st-order law. From this and from the distribution of the isotopes between the amines and the H_2 when isotopic equilibrium has been established, it seems that only the N-bound H's of the amines exchange rapidly.

1766
HIGH-SPEED MACHINE COMPUTATION OF IDEAL GAS THERMODYNAMIC FUNCTIONS. II. THE DIATOMIC FREE RADICALS OF THE ISOTOPIC HYDRIDES OF OXYGEN AND SULFUR. Lester Haar and A. S. Friedman. J. Chem. Phys. 23, 869-75 (1955). C.A. 49, 12107g.

Tables of thermodynamic functions were computed from 50 to 5000°K for OH, OD, OT, SH, SD and ST.

1767
RADIOCHEMICAL SEPARATIONS BY ISOTOPIC EXCHANGE--A RAPID, HIGH DECONTAMINATION METHOD FOR SILVER. Duane N. Sunderman and W. Wayne Meinke. Science 121, 777 (1955). C.A. 49, 12188i.

AgCl coated on Pt gauze immersed in a solution containing trace amounts of radioactive Ag results in a high percentage of the Ag in solution exchanging with the Ag in the precipitate.

1768
ISOTOPIC METHOD FOR THE DETERMINATION OF THE FORMATION TEMPERATURES OF CARBONATE MINERALS. R. V. Teĭs. Doklady Akad. Nauk S.S.S.R. 79, 291-4 (1951). C.A. 49, 12234b. cf. McCrea, C.A. 44, 10395d.

Experimental precipitations were made from CO_2-supersatuated solutions of $CaCO_3$ in the lab., at 86.5° and 10°. The isotopic composition of O in the precipitated carbonates is slightly different from that of O from water in which the solutions have been made. This difference in the contents in O^{18} corresponds to an accuracy of the corresponding formation temps. of 4° to 5°. Experimental results on natural deposits are given.

1769
EXAMINATION OF A MEERWEIN REACTION FOR AN INTRAMOLECULAR ISOTOPE EFFECT WITH CARBON-14. Gus A. Ropp and Vernon F. Raaen. J. Am. Chem. Soc. 76, 4484 (1954). C.A. 49, 12328a.

The results showed no isotopic effect within experimental error.

1770
THE KINETICS OF DOUBLE EXCHANGE REACTIONS OF SULFUR BETWEEN 2-MERCAPTOBENZOTHIAZOLE AND ELEMENTARY SULFUR. E. N. Gur'yanova. Doklady Akad. Nauk S.S.S.R. 98, 229-32 (1954). C.A. 49, 12933h.

The kinetics of the double exchange reaction of 2-mercaptobenzothiazole (Captax) and the elementary radioactive S was studied in napthalene solutions of various concentrations at 130-180°.

1771
EXCHANGE REACTION BETWEEN STRONTIUM SULFATE SOLID AND ITS IONS IN ACID AND SALT SOLUTIONS. Ellsworth D. Whitney. Univ. Microfilms (Ann Arbor, Mich.), Publ. No. 11,958, 288 pp. Dissertation Abstr. 15, 994 (1955). C.A. 49, 12933h.

1772
TREATMENT OF ISOTOPIC EXCHANGE REACTIONS HAVING COMPLEX MECHANISMS. R. A. Marcus. J. Chem. Phys. 23, 1107-12 (1955). C.A. 49, 12933i.

A simple method, useful in reactions having complex mechanisms, is developed for relating the 1st-order rate constant to the rate constants of elementary steps in the process. These results are used to reinterpret some data on the deuteriation of diborane obtained by Maybury and Koski (C.A. 47, 6745h).

1773
SIMPLIFIED CALCULATION OF ISOTOPIC EXCHANGE HALF-TIME. Leonard R. Darbee. J. Chem. Phys. 23, 1349 (1955). C.A. 49, 12985g.

An alignment chart was presented enabling a rapid calculation of exchange half-time in cases in which (1) the isotope effect is negligible, and (2) there is more than 1 exchangeable atom in a molecular species.

1774
ISOTOPIC EXCHANGE OF IODINE BETWEEN FREE IODINE AND SILICON TETRAIODIDE. Yu. P. Nazarenko and T. V. Vovk. Ukrain. Khim. Zhur. 21, 16-20 (1955). C.A. 49, 13003b.
The isotopic exchange between halogens and the halogen compounds with C, Sn, and Si is discussed in light of their ionic radii. The exchange reaction between SiI_4 and free I_2 was studied in CS_2 and xylene solutions over a temp. range 20-130° and at 130° in a melt without a solvent. There is no noticeable exchange at temps. below 130° but the change is significant in a xylene solution at 130°, the time for 50% exchange being 140 min. The exchange is complete in less than 1 hr. when carried out in a melt.

1775
INVESTIGATIONS OF THE ISOTOPIC EXCHANGE BETWEEN THIOCYANOGEN AND THIOCYANATES WITH RADIOACTIVE SULFUR. I. Maria Bruno and Vittoria Santoro. Ann. chim. (Rome) 45, 123-7 (1955). C.A. 49, 13003d.
$KCNS^{35}$ was allowed to exchange with $(SCN)_2$ in various solvents.

1776
KINETICS OF THE CARBONATE EXCHANGE AND RACEMIZATION REACTIONS OF CARBONATOBIS (ETHYLENEDIAMINE)COBALT(III) ION. John S. Holden and Gordon M. Harris. J. Am. Chem. Soc. 77, 1934-8 (1955). C.A. 49, 13008i.
The kinetics of carbonate exchange were followed by means of the radioactive tracer technique described previously (C.A. 46, 7854b). The over-all rate under comparable conditions showed that the ethylenediamine compound exchanged carbonate ion about 0.8 as rapidly as did the tetraamine analog.

1777
LAWS OF EQUILIBRIUM DEUTERIUM DISTRIBUTION IN HYDROGEN-ISOTOPE EXCHANGE REACTIONS. Ya. M. Varshavskii and S. E. Vaisberg. Doklady Akad. Nauk S.S.S.R. 100, 97-100 (1955). C.A. 49, 13709i.
A temperature dependent molecular partition function entering into the expression for the distribution coefficient is derived and evaluated for 26 hydrides ranging in weight from LiH to CsH.

1778
PERFORMANCE OF HOT-WIRE THERMAL-DIFFUSION COLUMNS. R. C. Srivastava. Proc. Phys. Soc. (London) 68A, 294-6 (1955). C.A. 49, 13714f.
Theory of the thermal diffusion column for the extreme cylindrical case has been extended to take into account the temp. variation of the thermal diffusion constant with temp. The expressions obtained agree closely with the experimental data on A.

1779
KINETICS OF ISOTOPIC EXCHANGE REACTIONS. IV. EXCHANGE BETWEEN FREE CARBONATE ION AND CARBONATOPENTAMMINE COBALTIC COMPLEX ION. D. R. Stranks. Trans. Faraday Soc. 51, 505-13 (1955). C.A. 49, 13749i.
The rate of exchange of free and complexed CO_3^{--} in aqueous mixtures of C^{14}-labelled Na_2CO_3 and $NaHCO_3$ with carbonatopentammine cobaltic nitrate was measured as a function of reactant concentrations, pH, and temp.

1780
KINETICS OF ISOTOPIC EXCHANGE REACTIONS. V. PHOTOCHEMICAL CARBON MONOXIDE PLUS PHOSGENE SYSTEM. D. R. Stranks. Trans. Faraday Soc. 51, 514-24 (1955). C.A. 49, 13750b.
The rate of exchange between C^{14}-labelled CO and $COCl_2$, illuminated at 2537 A., was measured as a function of incident light intensity, temp., and partial pressures of $COCl_2$ and CO. The results were consistent with an exchange mechanism based upon primary dissociation of $COCl_2$ by light followed by chain-terminating and chain-propagating reactions.

1781
KINETICS OF ISOTOPIC EXCHANGE REACTIONS. VI. THERMAL CARBON MONOXIDE PLUS PHOSGENE SYSTEM. D. R. Stranks. Trans. Faraday Soc. 51, 524-7 (1955). C.A. 49, 13750e.
The thermal exchange between C^{14}-labelled CO and $COCl_2$, in the presence of an equilibrium pressure of Cl_2 was determined from 375 to 450°. At 500° exchange was complete in 5 minutes.

1782
CARBON-14 ISOTOPE EFFECTS. I. BICARBONATE ION-CARBONATOCOBALTIC COMPLEX EXCHANGE SYSTEMS. D. R. Stranks. Trans. Faraday Soc. 51, 492-9 (1955). C.A. 49, 13755b.
The C^{14}/C^{12} equilibrium constants of the exchanges between HCO_3^- and both carbonatobis-ethylenediamine cobaltic and carbonatopentammine cobaltic ions were determined as 0.910 ± 0.0053 and 1.000 ± 0.0055 at 273°K. The value reported for the carbonatotetrammine cobaltic exchange systems (C.A. 47, 2079a) was 0.8746 ± 0.0057.

1782a
CARBON-14 ISOTOPE EFFECTS. II. CARBON MONOXIDE PHOSGENE EXCHANGE. D. R. Stranks. Trans. Faraday Soc. 51, 499-504 (1955). C.A. 49, 13755c.
The isotopic equilibrium constant of the C^{14} exchange between CO and $COCl_2$ was determined between 10 and 500°. Existing statistical-mech. theory was adequate in predicting the isotopic equilibrium constant over a considerable temp. range.

1783
CONCENTRATION OF HEAVY CARBON BY THERMAL DIFFUSION OF METHANE. II. Yoshio Horibe and Sumi Nishizawa. J. Chem. Soc. Japan Pure Chem. Sect. 76, 25-8 (1955). C.A. 49, 13768d.
The apparatus has been improved as compared with the one in the previous work (C.A. 46, 5387e).

1784
THE ENRICHMENT OF RADIOACTIVE ISOTOPES BY THERMAL DIFFUSION. A. E. de Vries. Physica 21, 124-6 (1955). C.A. 49, 13768e.
Clusius' method of increasing separation efficiency in thermal-diffusion columns by the addition of a 3rd component is discussed in relation to the separation of radioactive isotopes such as $C^{14}O$-$C^{12}O$.

1785
PHOTOCHEMICAL ISOTOPE SEPARATION. Bruce H. Billings. U.S. 2,713,025, July 12, 1955. C.A. 49, 13790c.
The 2537-A. resonance line of pure Hg^{198} (I) is used to irradiate natural Hg vapor

in the presence of H_2O vapor. This leads to preferential photochemical excitation of I in the natural isotopic mixt. and to subsequent formation of I-enriched HgO (II). After sepn. of II from unreacted Hg, it is decomposed by reaction with Cu. This is followed by distillation of I-enriched Hg. Enrichment of 50% is obtained.

1786
THE INTERACTION OF CHROMIUM(III) AND CHROMIUM(VI) IN ACIDIC SOLUTION. Edward L. King and John A. Neptune. J. Am. Chem. Soc. 77, 3186-9 (1955). C.A. 49, 13815g.
Experimental results indicate that there are rapidly formed in acidic solutions of Cr^{3+} and Cr^{6+}, and the species $CrCrO_4^+$ and $CrCrO_4H^{2+}$. It is postulated that these complexes are of the "inner-sphere" type, the Cr^{6+}-O bond being broken and formed in the reaction.

1787
BARRIER SYSTEMS IN THERMAL DIFFUSION COLUMNS. J. C. Treacy and R. E. Rich. Ind. Eng. Chem. 47, 1544-7 (1955). C.A. 49, 14390g.
A thermal diffusion column was designed utilizing barrier systems between the hot and cold surfaces (which eliminate the need for close tolerance) instead of small clearances. Columns with compounded barriers are 70 times more effective than open columns.

1788
KINETICS OF HOMOGENEOUS AND HETEROGENEOUS ISOTOPIC EXCHANGE REACTIONS. M. Haissinsky. Cahiers phys. No. 51, 52-68 (1954). C.A. 49, 14451a.
The isotopic effects on chemical reaction rates are shown to be not negligible.

1789
EFFECT OF ISOTOPIC SUBSTITUTION ON THE MASS SPECTRA OF MOLECULES. II. OXYGEN AND CARBON DIOXIDE, EXPERIMENTAL. Oliver A. Schaeffer and Henry R. Owen. J. Chem. Phys. 23, 1305-9 (1955). C.A. 49, 14471i.
The relative changes in the probability of bond breaking following electron impact were studied for $O^{16}O^{16}$ and $O^{16}O^{18}$; $O^{16}C^{13}O^{16}$, $O^{16}C^{12}O^{16}$, and $O^{16}C^{12}O^{18}$. In the case of O_2 the ratio of bond breaking in $O^{16}O^{18}$ to that in $O^{16}O^{16}$ is 0.98. The formation of C^+ from $O^{16}C^{13}O^{16}$ is 1.022 times the formation of C^+ from $O^{16}C^{12}O^{16}$ while the formation of C^+ from $O^{16}C^{12}O^{18}$ is 0.997 times the formation of C^+ from $O^{16}C^{12}O^{16}$. The formation of CO^+ from $O^{16}C^{13}O^{16}$ is 0.974 times that from $O^{16}C^{12}O^{16}$ while the relative formation of $C^{12}O^{18+}$ from $O^{16}C^{12}O^{18}$ is 1.03 times and that of $C^{12}O^{16+}$ is 0.97 times the formation of CO^+ from $O^{16}C^{12}O^{16}$. The relative formation of O^{16+} is 1.05 times and that of O^{18+} is 0.98 times the formation of O^+ from $O^{16}C^{12}O^{16}$.

1790
EFFECT OF ISOTOPIC SUBSTITUTION ON THE MASS SPECTRA OF MOLECULES. III. CARBON DIOXIDE, THEORETICAL INTERPRETATION. Oliver A. Schaeffer. J. Chem. Phys. 23, 1309-13 (1955). C.A. 49, 14472c.
The relative changes in pattern for O^{18} and C^{13} substituted carbon dioxide are calculated. It is concluded that a Franck-Condon type calculation adequately describes the electron impact process in carbon dioxide.

1791
EXCHANGE OF ISOTOPIC CHLORINE BETWEEN HCl AND THE SERIES CH_3Cl, CH_2FCl, CHF_2Cl, AND CF_3Cl. James E. Boggs and L. O. Brockway. J. Am. Chem. Soc. 77, 3444-8 (1955). C.A. 49, 14472e.
In the gas state in Pyrex vessels, the reaction rates of the first two exchanges are directly proportional to the surface/volume ratio and depend strongly on condition of the surface. The CHF_2Cl-HCl exchange is independent of the surface area or condition. The CF_3Cl-HCl exchange rate is much slower.

1792
ATOMIC WEIGHT VARIATIONS IN NATURE. James E. Boggs. J. Chem. Educ. 32, 400-2 (1955). C.A. 49, 15302d.

1793
RELATIONS BETWEEN THE ANHARMONICITY CONSTANTS AND THE FREQUENCIES OF ISOTOPIC MOLECULES. L. M. Sverdlov. Doklady Akad. Nauk S.S.S.R. 94, 451-4 (1954). C.A. 49, 15303b. English translation, AEC-tr-2405.
A sum rule is given for the anharmonicty constants of a system of diatomic isotopic molecules and applied to H_2, HD, D_2, HT, DT, T_2, Li^6H, Li^7H, Li^6D, and Li^7D. A previously derived relation between the frequencies of vibration of isotopic molecules is applied to the deuteriobenzenes C_6H_6, C_6H_5D, etc., and to the deuterioacetylenes C_2H_2, C_2HD, and C_2D_2. An approximately valid sum rule is given for the sums of the frequencies.

1794
THE DEUTERIUM ISOTOPE EFFECT. Kenneth B. Wiberg. Chem. Revs. 55, 713-43 (1955). C.A. 49, 15303d.
The D isotope effect arises largely from the difference in zero-point energy between a bond to H and the corresponding bond to D. The maximum isotope effect is obtained when the bond to H or D is essentially completely cleaved in the activated complex, and the isotope effect decreases with increasing bonding in the activated complex. There is no apparent difference in magnitude for the isotope effect in the removal of H or D as a proton, a hydride ion, or an atom. 241 references.

1795
BARRIER HEIGHT AND THERMODYNAMIC FUNCTIONS OF GASEOUS HNO_3 AND DNO_3. Ann Palm and Martin Kilpatrick. J. Chem. Phys. 23, 1562-3 (1955). C.A. 49, 15320e.
Values of $-(F^o-H_o^o)/T$, $(H^o-H_o^o)/T$, S^o, and C_p^o in cal./mole degree calculated from spectroscopic data are given.

1796
CONCENTRATION OF NITROGEN-15 BY CHEMICAL EXCHANGE IN A THERMAL DIFFUSION COLUMN. W. Spindel and T. I. Taylor. J. Chem. Phys. 23, 1318-22 (1955). C.A. 49, 15321b.
A concentration of N^{15} was effected in a thermal diffusion column under conditions where the gaseous exchange reaction $N^{14}O_2 + N^{15}O = N^{15}O_2 + N^{14}O$ can contribute to the separation process. The top of the column was fed with NO_2 of normal isotopic abundance. The exchange was studied in a 2-m. column over a pressure range of 0.25 to 1.0 atm., a temp. range of 400-700°, and a withdrawal rate of 5 to 66 cc. atms./

day. A maximum over-all separation of 2.6 was obtained at a filament temp. of 685° and a pressure of 0.5 atm. At a withdrawal rate of 27 cc. atms. the over-all separation is about 70% of this maximum value.

1797

THE ISOTOPIC COMPOSITION OF WATERS OF CRYSTALLIZATION. R. V. Teis. Doklady Akad. Nauk S.S.S.R. 99, 585-8 (1954). C.A. 49, 15342h. Correction, C.A. 50, 2238i.

The double-exchange tendency of O^{18} isotope in recrystn. of $Na_2CO_3 \cdot 10H_2O$, $BaCl_2 \cdot 2H_2O$, $Na_2SO_4 \cdot 10H_2O$, and $CaSO_4 \cdot 2H_2O$ was studied. Most hydrates were obtained by recrystallizing the anhyd. salts from waters contg. varying amts of the O^{18} isotope, except the $CaSO_4 \cdot H_2O$ which was formed by combining dil. solns. of $CaCl_2$ and Na_2SO_4. The O-isotope content of the crystals was determined and was found to be lower than in the water from which the salts were crystallized and the D content was higher. As a confirmation, the O^{18} in the mother liquor was found to be higher than in the original water used, and the D concn. was lower.

1798

THE RELATIVE SOLUBILITY OF HYDROGEN AND DEUTERIUM IN LIQUIDS AT LOW TEMPERATURES. S. K. Lachowicz. Research Correspondence, suppl. to Research (London) 8, No. 6, S27-8 (1955). C.A. 49, 15381h.

Theoretical. The physical properties of H_2 and D_2 are examined in order to predict their solubilities in liquids by means of Hildebrand's solubility equation. The solubility parameter, δ_2, of H_2 and D_2 calculated from their heats of vaporization at the normal b.p. are, resp., 2.5 and 3.3 (cal./cc.)$^{\frac{1}{2}}$; a difference of 30%. The solubilities of H_2 and D_2 at higher temps. are discussed in relation to the probable values of the parameters of the equation.

1799

EXCHANGE OF OXYGEN BETWEEN NITRIC ACID AND WATER, AND ITS RELATION TO THE PHENOMENA OF NITRATION AND NITROSATION. C. A. Bunton. Mem. services chim. etat (Paris) 38, 417-25 (1953). C.A. 49, 15384f.

The rate of exchange of O atoms between HNO_3 and H_2O was investigated at 0° with O^{18} as tracer. At 8-28 mol. % HNO_3, exchange takes place only if HNO_2 is present in concentrations of 0.002 to 0.01 mol. %. The rate is a function of both HNO_3 and HNO_2 concentrations. At HNO_3 concentrations higher than 40 mol. %, O exchange proceeds without catalyst; the rate is related to HNO_3 concentration in the same way as are the rates of nitration of a number of aromatic compounds.

1800

SOME ISOTOPIC EXCHANGE REACTIONS OF MANGANESE. James A. Happe and Don S. Martin, Jr. 1955, 37 pp. (ISC-566). C.A. 49, 15394a.

The exchange between various chemical forms of Mn occurring in the reaction $3Mn^{++} + 2MnO_4^- + 2H_2O \rightarrow 5MnO_2 + 4H^+$ has been studied by using Mn^{54} in the form of its perchlorate. A rapid partial exchange between Mn^{++} and the freshly formed precipitate occurred, with 30-40% of the exchange taking place in the first 1 or 2 min., additional reaction being negligible after 20 min. No exchange took place between Mn^{2+} and MnO_4^- while exchange was rapid between Mn^{2+} and Mn^{4+}.

1801

HYDROGEN ISOTOPE INTERCHANGE IN HYDROCARBONS IN A LIQUID DEUTERIUM FLUORIDE MEDIUM. Ya. M. Varshavskii and A. I. Shatenshtein. Doklady Akad. Nauk S.S.S.R. 95, 297-9 (1954) (English trans. AEC-tr-2113). C.A. 49, 15403i.

The effect was studied of the dielectric constant of the medium on the mechanism of double exchange reactions. D-exchange rate constant in benzene in a DF soln. is on the order of 10^4 greater than in HBr. The H atoms in the toluene side-chain were not exchanged for D in 1000 hrs., whereas all the ring atoms were exchanged in 15 min. at 25°. BF_3 addition to DF accelerates the exchange, as found with cyclohexane, which exchanged its H atoms only slowly in the absence of BF_3. The H atoms connected to tertiary C atoms are readily exchanged for D.

1802

RATES OF ISOTOPIC REACTIONS BETWEEN METHYL AND HYDROGEN. J. C. Polanyi. J. Chem. Phys. 23, 1505-13 (1955). C.A. 49, 15404c. Erratum, J. Chem. Phys. 24, 493-4 (1956).

By using a calibrated surface, designed to give the lowest barrier height compatible with a surface free of energy basins, a "symmetrical" surface was obtained for the isotopic reactions between CH_3 and H_2. Zero-point energies derived from this surface lead to relative rate consts. in fair agreement with the 8 observed values.

1803

INTERMOLECULAR CARBON ISOTOPE EFFECT IN THE DECARBOXYLATION OF THE MONO-ANION OF MALONIC ACID IN QUINOLINE SOLUTION. Peter E. Yankwich and Harold S. Weber. J. Am. Chem. Soc. 77, 4513-16 (1955). C.A. 49, 15405i.

Decarboxylation of malonic acid (normal C-isotope distribution) in quinoline solution with 1-butylpiperidine added as a weak base, was studied in the temp. range 67.5-119°. Inter- and intramolecular isotope effects are described in terms of the mole fraction of C^{13} in the CO_2 collected.

1804

THE ROLE OF DIFFUSION IN OXIDE LATTICES IN REACTIONS WITH OXIDATION-REDUCTION MECHANISM AND OXYGEN EXCHANGE. A. Rozen and S. Karpacheva. Doklady Akad. Nauk S.S.S.R. 88, 507-10 (1953). C.A. 49, 15413e.

The transfer of O^{18} by an oxidation-reduction mechanism from catalysts was limited by diffusion in oxide lattices. The effect was illustrated by periodically detg. the rate of exchange of H_2O vapor with Fe oxides at 400° in presence of H_2 and allowing the catalyst to rest between each of the detns. in the presence of N_2 or H_2. A sharp rise in rate of exchange was noted after every rest period. Similar results were obtained with H_2O vapor and Al_2O_3 catalyst.

1805

EFFICIENCY OF CERTAIN CATALYSTS IN THE EXCHANGE BETWEEN H_2O AND HD. Pavle Savic, Slobodan V. Ribnikar, and Natalija N. Dogramadzi. Bull Inst. Nuclear Sci. "Boris Kidrich" 4, 25-30 (1954). C.A. 49, 15414f.

The reaction was studied in a circulating closed system at 20° and in a flow system at 110°. Pt on C is the most active catalyst, followed in order by reduced $NiWO_4$, $ZnO-Cr_2O_3$, $MnO-Cr_2O_3$, and Cr_2O_3; Fe_3O_4 is inactive.

1806

EXCHANGE REACTIONS OF SOLID OXIDES. VI. THE REACTIONS OF CARBON MONOXIDE, CARBON DIOXIDE, AND OXYGEN ON CUPROUS OXIDE, NICKEL OXIDE, AND CHROMIUM OXIDE. E. R. S. Winter. J. Chem. Soc. 1955, 2726-40. C.A. 49, 15438h.

The reaction $2CO + O_2 \rightarrow 2CO_2$ was studied on NiO, Cr_2O_3, and Cu_2O at pressures of 1-9 cm. and temps. from 10 to 155°, C^{13} and O^{18} being used where needed to determine the reaction course. The O exchange of the gases with the surface ions is negligible at the temps. of interest for oxidation studies. On Cu_2O reacy exchange of O between CO and CO_2 occurs with the surface O ions.

1807

SEMIEMPIRICAL STUDY OF THE H_2Cl TRANSITION COMPLEX THROUGH THE USE OF HYDROGEN ISOTOPE EFFECTS. Jacob Bigeleisen and Max Wolfsberg. J. Chem. Phys. 23, 1535-9 (1955). C.A. 49, 15466a.

Linear and triangular structures for the H_2Cl transition complex were analyzed in terms of normal vibration theory and by an evaluation of the exptl. data on the effect of H-isotope substitution on the rate of reaction of H molecules and Cl atoms. The relative rates of reaction of the isotopic H_2 molecules with Cl atoms as a function of temp. Good agreement was found between the calcd. rates for both linear and triangular structures and the available data on HD, D_2, and HT.

1808

REACTION $CH_3 + CD_4 \rightarrow CH_3D + CD_3$. F. S. Dainton and D. E. McElcheran. Trans. Faraday Soc. 51, 657-64 (1955). C.A. 49, 15501i.

CH_3 radicals were generated photochemically at a constant rate in the presence of CD_4. D was only slowly exchanged between CD_4 and CH_3COCH_3 at 354°. The rate constant for the reaction $CH_3 + CD_4 \rightarrow CH_3D + CD_3$ was determined.

1809

γ-RAY INDUCED DEUTERIUM GAS-WATER EXCHANGE. Sheffield Gordon and Edwin J. Hart. J. Am. Chem. Soc. 77, 3981-4 (1955). C.A. 49, 15502d.

D_2 dissolved in H_2O has been found to undergo exchange only when these solutions are exposed to the γ-radiations of Co^{60}. In neutral and acid solutions, the major product of the exchange is HD. H_2 is formed in smaller yields. In alkaline solutions the HD formation is suppressed, whereas the H_2 formation is unchanged over a wide range of pH. The effects of pH, D_2 concentration, and dose rate have been determined and a mechanism is postulated.

1810

ULTRASONIC UNMIXING OF ISOTOPIC SOLUTIONS. S. G. Bankoff and R. N. Lyon. Ind. Eng. Chem. 47, 1183 (1955). C.A. 49, 15553e.

A theoretical argument to show that unmixing of isotopes by ultrasonic means is a practical impossibility.

1811

ISOTOPE SEPARATION BY IONIC EXPANSION IN A MAGNETIC FIELD. Joseph Slepian. Proc. Natl. Acad. Sci. U.S. 41, 451-7 (1955). C.A. 49, 15553e.

The theory that underlies the method is mathematically developed. Experimental apparatus and procedures used in the separation of U isotopes are discussed.

1812

ELECTROMAGNETIC SEPARATION OF STABLE ISOTOPES. THE AMSTERDAM ISOTOPE SEPARATOR. J. Kistemaker, C. J. Zilverschoon, and J. Schutten. Ned. Tijdschr. Natuurk. 20, 5-11 (1954). C.A. 49, 15554a.

A brief description of the Amsterdam calutron, large-scale mass spectrograph.

1813

FRACTIONATION OF ISOTOPES BY DISTILLATION OF SOME ORGANIC SUBSTANCES. P. Baertschi, W. Kuhn, and H. Kuhn. Nature 171, 1018-20 (1953). C.A. 49, 15554b.

The distillation of chloroform, carbon tetrachloride, methyl alcohol, and benzene were found to lead to an enrichment of C^{13} in the distillate, whereas the other heavy isotopes such as Cl^{37} and O^{18} were enriched in the still pot. A possible general rule is suggested that in isotopic molecules having a central atom, the molecular variety containing the heavier isotope of the central atom will exhibit a somewhat higher vapor pressure than the variety containing the lighter isotope as the central atom.

1814

ISOTOPIC EXCHANGE OF COPPER BETWEEN CUPRIC NITRATE AND THE METAL. J. F. Duncan and B. W. Oakley. J. Chem. Soc. 1955, 1401-3. C.A. 49, 15554h.

The isotopic exchange reaction of Cu between aqueous solutions of $Cu(NO_3)_2$ and the powdered metal was studied with radioactive Cu^{64} as the nitrate. Rapid apparent exchange reactions were observed, but they were dependent on the nature of the Cu surface and on the surrounding atmosphere.

1815

ISOTOPE SEPARATION BY EXCHANGE DISTILLATION. Aktiebolaget Atomenergi (K. E. O. Holmberg, inventor). Swed. 149,918, May 10, 1955. C.A. 49, 15556f.

To a compound, (A) of an element which is to be separated into its isotopes, a compound (b) is added. These compounds react to form a composite compound (AB). If necessary, a solvent is added. By a cascade procedure, e.g. column distillation, a stream containing A and B in gaseous form is brought into contact with AB in liquid form, so that isotope exchange between A and AB takes place. Thus, light and heavy isotopes are enriched and extended to the ends of the column. For example, $Et_2O \cdot BF_3$ is distilled in a column with about 30 plates at a pressure of 60 mm. Hg. B^{10} is enriched at the bottom of the column. The total separation is 2.33.

1816

THE ABSENCE OF ISOTOPE EFFECT IN THE EXCHANGE REACTION BETWEEN CARBONATE AND CARBONATOTETRAMMINECOBALT IONS. E. Saito and B. Lazard. J. Inorg. Nuclear Chem. 1, 218-27 (1955). C.A. 49, 15587i.

Carbonate exchange with the carbon-

atotetrammine cation was studied by using C^{14} and C^{13} tagging both separately and together; the former isotope was estimated by counting and the latter by mass spectroscopy. Normal carbonate exchange was also studied. The lack of an isotope effect in carbonate exchange with carbonatobisethylenediamine cation was confirmed by using C^{14} tracer. With C^{14}, an isotope effect constant of 0.89 was found, while with natural carbonate there was no enrichment of C^{13}, a constant of 1.00 rather than the 0.95 predicted from the C^{14} work resulting. In doubly tagged samples, variations of the enrichment constant from 0.85 to 0.97 for C^{14} and from 0.94 to 1.00 for C^{13} were found. These contradictions are consonant with the interpretation that the complex-ion preparation contains a nonexchanging impurity and that the measured isotope effect is spurious.

1817

AN APPLICATION OF THE ISOTOPE EXCHANGE METHOD TO THE STRUCTURE STUDY OF AQUAPOLY AND HETEROPOLY COMPOUNDS. Vikt. I. Spitsyn and E. A. Torchenkova. Doklady Akad. Nauk S.S.S.R. 95, 289-92 (1954). C.A. 49, 15591i.

The W^{185} isotope was used in the study of the relative stability of tungstate anions in solution. The double-exchange reaction between the para- and metatungstates did not proceed instantaneously. The ordinary tungstate anion did not enter into double-exchange reactions with the heteropoly anions, while the hexatungstate anion of the paratungstate did, which might indicate it to be the structural unit of heteropoly anions. Na phosphotungstate and the acidified $Na_2W^*O_4$ solution interact very rapidly while the crystals of $Na_2W^*O_4$ react much more slowly than does the freshly formed paratungstate. Two heteropoly compounds, the radioactive silicophosphotungstic acid and the phosphotungstic acid, interact to an extent of only 20% at pH 1.8 in any length of time between 5 min. and 240 hrs. At higher pH, the reaction is more rapid.

1818

HYDROLYSIS AND EXCHANGE STUDIES OF SOME COBALT AND CHROMIUM COMPLEXES. A. W. Adamson and R. G. Wilkins. Chem. Soc. (London), Spec. Publ. No. 1, 75-8 (1954). C.A. 49, 15593e.

1819

A NOTE ON THE ISOTOPE RATIO CARBON-12/CARBON-13 IN METAMORPHOSED ALUM SHALE. Sture Landergren. Geochim. et Cosmochim. Acta 7, 240-1 (1955). C.A. 49, 15676b.

The C^{12}/C^{13} ratios in various Scandinavian alum shales are the same in samples that either have or have not undergone thermal metamorphism.

1820

THE CARBON-13 ABUNDANCE OF LIMESTONES AND COALS. P. M. Jeffery, W. Compston, D. Greenhalgh, and J. De Laeter. Geochim. et Cosmochim. Acta 7, 255-86 (1955). C.A. 49, 15676g.

The C^{12}/C^{13} ratio of coals and limestones show large variations. The authors suggest these results can most simply be explained by assuming large changes in the isotopic composition of the atmosphere and hydrosphere throughout geologic time.

1821

THE EXCHANGE OF OXYGEN ISOTOPES BETWEEN CARBON MONOXIDE AND CARBON DIOXIDE ON AN IRON OXIDE CATALYST. N. V. Kul'kova, Z. D. Kuznets, and M. I. Temkin. Doklady Akad. Nauk. S.S.S.R. 90, 1067-70 (1953). C.A. 49, 18684.

The reactions $CO^{18} + COO \rightarrow CO + COO^{18}$ and $CO + COO^{18} \rightarrow CO^{18} + COO$ were studied by use of a Fe_3O_4 catalyst. The kinetics and the mechanism of these reactions are discussed. The reaction $CO + H_2O \rightarrow H_2 + CO_2$ was studied on the same catalyst and the results show that there is an isotopic exchange between the O of the catalyst and that in the reaction mixture.

1822

THE STATISTICAL THERMODYNAMICS OF ISOTOPE EFFECTS. III. THE EQUATION OF STATE OF THE HYDROGEN ISOTOPES. Abraham S. Friedman and Irwin Oppenheim. Mar. 15, 1955. 7 p. (NBS-3992). NSA 9, 3892.

The isotope effect on the compressibility factors of the hydrogen isotopes has been computed from an expansion of the quantum mechanical partition function in powers of $\hbar^2$. The compressibility factor differences between H_2 and HD, D_2, HT, DT, and T_2 are evaluated for temperatures between 40 and 150°K over a wide density range.

1823

THE STATISTICAL MECHANICAL CALCULATION OF THE DATA OF STATE OF THE HELIUM ISOTOPES AT INTERMEDIATE TEMPERATURES AND DENSITIES. Abraham S. Friedman and Irwin Oppenheim. Apr. 1, 1955. 6 p. (NBS-4005). NSA 9, 3893.

The isotope effect on the compressibility factors of the helium isotopes has been computed from an expansion of the quantum mechanical partition function in powers of $\hbar^2$. The compressibility factor differences between He^4, He^3, and He^6 are evaluated over a wide temperature and density range.

1824

THE EXCHANGE REACTION BETWEEN SUBSTITUTED BENZYL IODIDES AND POTASSIUM IODIDE. IV. p-IODOBENZYL IODIDE. Milton Kahn and J. L. Riebsomer. Dec. 1954. 11 p. (LA-1873UNM). NSA 9, 4414.

A measurable exchange has been observed in methanol and ethanol between the iodine atom in p-iodobenzyl iodide and the iodide ion in potassium iodide. The exchange reaction was investigated over a temperature range from 0 to 30.9°. The rate laws for the exchange are given.

1825

A REVIEW OF THE REACTION KINETICS OF DEUTERIUM COMPOUNDS. III. REARRANGEMENT—ISOMERIZATION REACTIONS. Lawrence M. Brown and Abraham S. Friedman. Feb. 1, 1955. 41 p. (NBS-3872). NSA 9, 4738.

The published literature on the kinetics of rearrangement-isomerization reactions of deuterium compounds has been reviewed for the period 1932 to 1953, inclusive. The review covers the ortho-para-deuterium conversion, the mutarotation of glucose, and the racemization of several organic deuterium compounds. Tabular summaries of the experimental data are included.

1826
A REVIEW OF THE REACTION KINETICS OF DEUTERIUM COMPOUNDS. II. DECOMPOSITION REACTIONS OF ORGANIC COMPOUNDS. Lawrence M. Brown and Abraham S. Friedman. Oct. 15, 1954. 119 p. (NBS-3676). NSA 9, 5279.

The kinetics of decomposition reactions of organic deuterium compounds are reviewed for the period 1932 to 1953. The review treats both thermal and photochemical decompositions in the liquid and gas phases, and contains tabular summaries of the experimental data for most of the reactions discussed.

1827
BIBLIOGRAPHY ON THE ANALYSIS OF NITROGEN 15. M. W. Chapman and H. P. Broida. Progress Report to Atomic Energy Commission. [1954]. 40 p. (NBS-4059). NSA 9, 5711.

A bibliography of the literature on N^{15} which has appeared through 1952 with a few later references. It covers the abundance of N^{15}, its physical properties, methods of concentrating it, methods of N^{15}/N^{14} measurement, and uses and synthesis of N^{15} compounds.

1828
THE EXCHANGE REACTION BETWEEN SUBSTITUTED BENZYL IODIDES AND POTASSIUM IODIDE. III. p-CYANOBENZYL IODIDE. Milton Kahn and J. L. Riebsomer. June 1955. 8 p. (LA-1926UNM). NSA 9, 6179.

A measurable exchange has been observed in methanol and ethanol between the iodide atom in p-cyanobenzyl iodide and the iodide ion in potassium iodide. The exchange reaction was investigated over a temperature range from 0 to 30.9° C. The rate laws for the exchange are given.

1829
ISOTOPIC COMPOSITION OF METEORITIC HYDROGEN. George Edwards. Nature 176, 109-11 (1955) July 16. NSA 9, 6338.

Methods of isolation and determination of protium and deuterium in meteorites, and of preparation of meteorites for analysis are described. The ratios of deuterium to hydrogen in various chondrite and iron meteorites are reviewed.

1830
A REVIEW OF THE PROPERTIES OF DEUTERIUM COMPOUNDS. Annual Bibliography—1953. Lawrence M. Brown and Abraham S. Friedman. Sept. 1, 1955. 78 p. (NBS-3985). NSA 9, 7706.

1831
CALUTRONS. E. O. Lawrence. U. S. Patent 2,714,664, Aug. 2, 1955. NSA 9, 8011.

The patent relates to a calutron comprising a plurality of ion sources arranged to transmit a corresponding plurality of ion beams in an evacuated tank space so disposed in a substantially regular pattern in the tank and arranged to transmit a corresponding pluraility of substantially regularly disposed ion beams within the evacuated tank space.

1832
ISOTOPE SEPARATING APPARATUS. H. L. Hull and S. M. MacNeille. U. S. Patent 2,715,186, Aug. 9, 1955. NSA 9, 8019.

An improvement has been made in a calutron wherein the material is initially vaporized by a controlled internal radiant heater closely adjacent the charge material and a control circuit for energizing the heater in response to variations in the drain current.

1833
STUDY OF STRUCTURE AND TRANSFORMATIONS OF COMPLEX COMPOUNDS BY THE METHOD OF LABELED ATOMS. A. A. Grinberg. Sessiya Akad. Nauk S.S.S.R. po Mirnomu Ispol'zovaniyu Atomnoĭ Energii 1955, Zasedaniya Otdel. Khim. Nauk, 238-49 (English Summary, 249-50); Conf. Acad. Sci. U.S.S.R. on Peaceful Uses of Atomic Energy, Session Div. Chem. Sci. 1955, 145-51. Also see AEC-tr-2435 (pt. 2)(p. 145-152). C.A. 50, 10i.

Review up to 1955 with 30 references.

1834
INVESTIGATION OF STRUCTURE AND REACTIVITY OF CHEMICAL COMPOUNDS WITH THE AID OF ISOTOPES. A. I. Brodskii. Sessiya Akad. Nauk S.S.S.R. po Mirnomu Ispol'zovaniyu Atomnoĭ Energii 1955, Zasedaniya Otdel. Khim. Nauk, 210-35 (English Summary, 235-7); Conf. Acad. Sci. U.S.S.R. on Peaceful Uses of Atomic Energy, Session Div. Chem. Sci. 1955, 129-43. (AEC-tr-2435, pt. 2, p. 129-44). C.A. 50, 11a.

A detailed review with 70 references.

1835
FRACTIONATION OF LITHIUM ISOTOPES BY THERMAL DIFFUSION IN AQUEOUS SOLUTION. Gilbert S. Panson. Univ. Microfilms, Publ. No. 12,490, 39 pp. Dissertation Abstr. 15, 1325 (1955). C.A. 50, 11b.

1836
THE ISOTOPIC EXCHANGE BETWEEN UNIVALENT AND TRIVALENT GOLD IN HYDROCHLORIC ACID SOLUTIONS. Aldo Turco and Giovanni Sordillo. Gazz. chim. ital. 85, 977-80 (1955). C.A. 50, 33a.

The disproportionation reaction $3Au^{+} \rightleftharpoons 2Au + Au^{3+}$ was studied by labeling the trivalent form with Au^{198}. Results indicated that the isotopic exchange reaction has a high velocity, reaching 50% of the original value in about 2 minutes. In a 0.6N HCl medium, the exchange reaction ran to completion before the separation could be completed.

1837
ISOTOPIC EXCHANGE OF SULFUR BETWEEN HYDROGEN SULFIDE AND 2-MERCAPTOBENZOTHIAZOLE. A. F. Rekasheva, G. A. Blokh, and G. P. Miklukhin. Zhur. Obscheĭ Khim. 25, 1631-6 (1955). C.A. 50, 35e.

The exchange was studied kinetically by means of H_2S labeled with S^{35}.

1838
THE THEORY OF ISOTOPE SEPARATION BY COUNTERCURRENT CHEMICAL EXCHANGE. W. C. DeMarcus and E. Von Halle. Jan. 19, 1955. 63 p. (K-1190). C.A. 50, 75i.

The theory of isotope separation by countercurrent chemical exchange is worked out in detail using the continuous transfer concept. A comparison is made with discrete stagewise processes such as gaseous diffusion and with various general concepts of solvent extraction. The effects of a cell structure in the flow is also worked out. An elementary design procedure is included both for the no-loss case and the case where the losses are small. In addition, a method of estimating stage lengths or transfer rate constants from small scale batch experiments is presented.

1839
SEPARATION OF ISOTOPES BY FRACTIONAL DISTILLATION. I. Dostrovsky, J. Gillis, and D. R. Llewellyn. Research Council Israel, Publ. No. 1 (L. Farkas Mem. Vol.), 62-94 (1952). C.A. 50, 76b.

The separation of isotopes by fractional distillation is treated mathematically. Formulas are derived for the equilibrium enrichment of some isotopes and the rate of approach to equilibrium of the system by using a nonzero boiler and finite supply reservoir. Tables and graphs are given which permit direct evaluation of the unit process separation factor and of the efficiency of the column from the enrichments corresponding to 2 or more production rates. Comparison is made with experimental results.

1840
CONCENTRATION OF THE STABLE ISOTOPES OF CHROMIUM BY THE ELECTROMAGNETIC PROCESS. C. V. Ketron, W. A. Bell, and L. O. Love. U. S. Atomic Energy Comm. AECD-3642, 22 pp. (1951). C.A. 50, 76c.

Cr isotopes have been separated by using $CrCl_3$ as charge material. Calutron components used in processing the material, operating characteristics of the charge, and production rates are presented.

1841
ELECTROMAGNETIC CONCENTRATION OF THE ISOTOPES OF HAFNIUM. L. O. Love and W. A. Bell. U. S. Atomic Energy Comm. AECD-3641, 3-24 (1951). C.A. 50, 76d.

The 6 known stable isotopes of Hf have been concentrated by the electromagnetic process. Samples were also collected in the 170, 172, and 182 mass positions in order that the presence of unknown isotopes might be investigated.

1842
MOBILITY OF SULPHUR IN SULPHUR-CARBON BONDS AND MECHANISM OF ACTION OF RUBBER VULCANIZATION ACCELERATORS. G. P. Miklukhin. Sessiya Akad. Nauk S.S.S.R. po Mirnomu Ispol'zovaniyu Atomnoĭ Energii 1955, Zasedaniya Otdel. Khim. Nauk 251-68 (English summary 268-9). Conf. Acad. Sci. U.S.S.R. on Peaceful Uses of Atomic Energy, Session Div. Chem. Sci. 1955, 153-62 (English translation); see also AEC-tr-2435 (pt. 2)(p. 153-62). C.A. 50, 599a.

Results are presented of investigations of the mobility of bivalent sulphur in organic compounds having C--SH, C--SC, CS--SC, C--S and $--C\begin{smallmatrix}=S\\-SR\end{smallmatrix}$ bonds, obtained by studying the exchange reactions of corresponding compounds with radioactive sulphur. Particular attention is devoted to isotope exchange of sulphur and hydrogen sulphide with sulphur-containing organic compounds used as accelerators of rubber vulcanization.

1843
EXCHANGE OF SULFUR IN POLYSULFIDES AND VULCANIZATION ACCELERATORS. E. N. Gur'yanova, V. N. Vasil'eva, and L. S. Kuzina. Sessiya Akad. Nauk S.S.S.R. po Mirnomu Ispol'zovaniyu Atomnoĭ Energii 1955, Zasedaniya Otdel. Khim. Nauk, 270-98 (English summary, 298-300); Conf. Acad. Sci. U.S.S.R. on Peaceful Uses of Atomic Energy, Session Div. Chem. Sci. 1955, 153-62 (English translation); see also AEC-tr-2435 (pt. 2)(p. 163-76). C.A. 50, 599e.

The radioactive sulfur isotope S^{35} was used in the work to find out the influence the structure of molecules exerts on the mobility of sulfur atoms in the bonds S-C, C-S, C=S of organic polysulfides and a number of other compounds, including vulcanization accelerators.

1844
THE STEADY-STATE FRACTIONATION OF MULTICOMPONENT AND COMPLEX MIXTURES IN AN IDEAL CASCADE. V. THE EXTENSION TO PACKED COLUMNS. Andreas Acrivos and Neal R. Amundson. Chem. Eng. Sci. 4, 206-8 (1955). C.A. 50, 615c.

Previously reported calcns. involved in rectification of multicomponent and complex mixtures are extended to performance in packed columns.

1845
ISOTOPES. Harmon Craig and Giovanni Boato. Ann. Rev. Phys. Chem. 6, 403-32 (1955). C.A. 50, 629b.

A critical review and evaluation of current research in geochemistry and chemical kinetics are presented. Research on the isotope effects in chemical and phase equilibria was also reviewed.

1846
DIFFUSION OF $C^{14}O_2$ IN MIXTURES OF $C^{12}O_2$-H_2 AND $C^{12}O_2$-C_3H_8. Chan H. Chou. Univ. Microfilms. Publ. No. 12552, 229 pp. Dissertation Abstr. 15, 1361-2 (1955). C.A. 50, 635i.

1847
BINARY DIFFUSION OF SIMILAR OR ISOTOPIC MOLECULES IN THREE-COMPONENT SYSTEMS. Wm. P. Senett, Fred Gollob, and T. I. Taylor. J. Chem. Phys. 23, 1679-83 (1955). C.A. 50, 636.

The 2-bulb mixing problem for isotopic gradients in each of 2 molecular species but with no molecular gradient as a whole was solved as 2 independent 3-component systems; this led to relatively simple equations. The validity of the treatment was confirmed by a series of experiments in which agreement between the calculated relaxation time and observed time were well within the estimated error of about 5%.

1848
SOME PROPERTIES OF SOLUTIONS OF He^3 IN He^4. PART 3. VAPOR PRESSURE. B. N. Esel'son. Zhur. Eksptl. i Theoret. Fiz. 26, 744-50 (English translation AERE Lib/Trans-713). C.A. 50, 637f.

Vapor pressure at vapor-liquid equilibrium condition was measured for concentrations of He^3 in He^4 from 0.49-8.08%. The behavior of the solutions was found to be non-ideal.

1849
COMMENTS ON THE CARBON-13 ISOTOPE EFFECT IN THE THERMODECOMPOSITION OF ETHYL BROMIDE. Henry L. Friedman, Richard B. Bernstein, and Harry E. Gunning. J. Chem. Phys. 23, 1722-3 (1955). C.A. 50, 656i.

Experiments on the photolysis of EtBr in the presence of excess cyclopentane inhibitor gave enrichments in C^{12} similar to those found in the thermodecomposition of

EtBr and thus the unimolecular model is apparently incorrect. Several errors in the original publication are corrected.

1850
KINETICS OF THE MANGANATE-PERMANGANATE EXCHANGE REACTION. John C. Sheppard. Univ. Microfilms, Publ. No. 12,814, 67 pp. Dissertation Abstr. 15, 1327 (1955). C.A. 50, 657g.

1851
HOMOGENEOUS CATALYTIC HYDROGENATION. III. ACTIVATION OF HYDROGEN BY CUPROUS AND SILVER ACETATES IN PYRIDINE AND DODECYLAMINE. Leon W. Wright, Sol W. Weller, and G. A. Mills. J. Phys. Chem. 59, 1060-4 (1955). C.A. 50, 658h.

Kinetic measurements were made at 78° and 100° for the hydrogenation of Ag and cupric acetates in pyridine and dodecylamine. D exchanges with a H donor in the CuOAc-pyridine system. No exchange was observed during the reduction of AgOAc in pyridine by D. The reduction of AgOAc by D is 30% slower than that by H.

1852
KINETICS OF THE ISOTOPE EXCHANGE REACTION OF FLUORINE WITH HYDROGEN FLUORIDE. Richard M. Adams, Richard B. Bernstein, and Joseph J. Katz. J. Chem. Phys. 23, 1622-4 (1955). C.A. 50, 659e.

The exchange of F^{18} between HF and F was studied over a wide range of concns. at 467, 497, and 530°K. The exchange can be accounted for entirely by a heterogeneous catalysis mechanism involving competitive adsorption of the Langmuir-Hinshelwood type. NiF_2 was an active catalyst.

1853
AN EXPERIMENTAL CONTRIBUTION TO THE PROBLEM OF ISOTOPIC SEPARATION BY CHEMICAL MEANS. II. G. Wagner and A. Pelz. Monatsh. 86, 414-18 (1955). C.A. 50, 692h.

The initial results given in the previous paper are confirmed. The experimental procedure outlined results, by concg. Li^7 in a Li_2CO_3 ppt., in raising the isotopic content of Li^7 from the originally occurring 92.58 to 93.35% or in changing the at. wt. (phys.) from 6.9438 ± 0.0018 to 6.9514 ± 0.0055. The separation factor is 1.0069.

1854
RADIATION-INDUCED EXCHANGE OF HYDROGEN ISOTOPES: CHAIN INHIBITION. Leon M. Dorfman and F. J. Shipko. J. Phys. Chem. 59, 1110-11 (1955). C.A. 50, 696a. cf. C.A. 48, 11206h.

The earlier measurements of H_2 and D_2 exchange were extended and yields as high as 2 x 10^4 mols./100 e.v. at a total pressure of 276 mm. were obtained for the H-D exchange. The source of radiation, T gas, was present at pressures below 0.09 mm.

1855
CONCENTRATION OF ISOTOPES. Karl E. Holmberg. Brit. 736,459, Sept. 7, 1955. C.A. 50, 696i.

A stable complex compound AB is prepared from A, a compound which contains the isotope to be concentrated, and another compound, e.g., Et_2O. AB is converted to a liquid, heated to form a vapor phase, and countercurrent flow created between the vapor and the liquid phase in cascade to effect isotope exchange in which the lighter isotopes are concentrated at one end of the cascade and the heavy isotopes at the other end. Thus, when A is NH_3, B is NaH_2PO_4 + Na_2HPO_4, and the solvent C is H_2O, B and C form a buffer solution from which A is driven out by heating. Thus, $Et_2O \cdot BF_3$ was distilled at 75° in a column containing about 30 theoretical plates at a pressure of 60 mm. to near equilibrium. B^{10} was thus concentrated at the bottom of the column with a total separation of 2.33. Trimethylamine (20%) plus about 80% AcOH was distilled at 80° in a 30-plate column at 40 mm. N^{15} was concentrated at the bottom with a total separation of 1.48. Enrichment of S isotopes was obtained by distilling Et_3NSO_2 at 40 mm. and by countercurrent exchange between gaseous SO_2 and HSO_3 in a buffer solution at atmospheric pressure and about 60°.

1856
ISOTOPE EXCHANGE METHOD FOR MEASURING THE VELOCITY OF EVAPORATION AND THE COEFFICIENT OF DIFFUSION OF SOLID METALS. An. N. Nesmeyanov, N. F. Lebedev, V. I. Lozgachev, and E. G. Chudinov. Sessiya Akad. Nauk S.S.S.R. po Mirnomu Ispol'zovaniyu Atomnoi Energii 1955, Zasedaniya Otdel. Tekh. Nauk 79-99 (English summary, 99-100). C.A. 50, 748a.

General methods of measuring the evaporation rate and the autodiffusion coefficient of metals are described, and the formulas derived are verified by using radioactive Ag.

1857
EXCHANGE OF RADIOCYANIDE ION WITH TUNGSTEN OCTACYANIDE COMPLEXES. E. L. Goodenow and C. S. Garner. J. Am. Chem. Soc. 77, 5268-71 (1955). C.A. 50, 1426i.

Essentially no exchange of radiocyanide with $W(CN)_8^{3-}$ and $W(CN)_8^{4-}$ complex ions in aqueous solution of natural pH occurs in the dark at 25° even after 100 days. The exchange of CN^- with $W(CN)_8^{3-}$ and with $W(CN)_8^{4-}$ is strongly light-accelerated.

1858
THE EXCHANGE REACTION BETWEEN OCTACYANOTUNGSTATE(IV) AND OCTACYANOTUNGSTATE(V) IONS. E. L. Goodenow and C. S. Garner. J. Am. Chem. Soc. 77, 5272-4 (1955). C.A. 50, 1427b.

Exchange of radiotungsten between $W(CN)_8^{4-}$ and $W(CN)_8^{3-}$ ions in aqueous solution at complex ion concentrations of 0.001 and 0.0001 *f* and at pH 2.4-3.0, 5.8-6.6, and 11.3-11.8 is apparently complete in an exchange time of 0.2 sec. at 1-2° in the dark.

1859
OXYGEN EXCHANGE IN HALOGEN ACIDS, AND ITS MECHANISM. A. I. Brodskii and N. A. Vysotskaya. Doklady Akad. Nauk S.S.S.R 101, 869-71 (1955). C.A. 50, 1427d.

In double exchange reactions with a number of inorganic acids or their anions the O was found to enter by way of a reversible addition of H_2O to the double bond in X=O, with an intermediate formation of ortho-compounds. Such reactions are possible only if the element X is capable of combining with OH^- with an increase

in its coordination number. No O exchange was observed with $HClO_4$ at 160° in 1 hr., whereas with HIO_4 the exchange was quantitative at room temp. in less than 20 min.

1860
CHLORINE EXCHANGE REACTION BETWEEN CHLOROFORM AND AQUEOUS CHLORIDE SOLUTION. Juro Horiuchi, Kozo Tanabe, and Kazunori Tanaka. J. Research Inst. Catalysis Hokkaida Univ. 3, 119-46 (1955). C.A. 50, 1428c.

$CHCl_3$ and radioactive aqueous chloride solutions of different pH, with or without the addition of NaCl, were sealed air-free in a 28-cc. quartz vessel and shaken briskly at 100°. The exchange rate was proportional to the concentration $[Cl^-]$.

1861
TRACER STUDY OF THE OXYGEN IN PRECIPITATED HgO AND Ag_2O; OXYGEN-18 ISOTOPE EFFECT IN THE REACTION OF OH^- WITH Hg(II) AND Ag(I). Richard B. Bernstein and Harry G. Pars. J. Am. Chem. Soc. 77, 4433-4 (1955). C.A. 50, 1429f.

O^{18} was used to study the source of the O in HgO and Ag_2O precipitated by OH^-. An O^{16}/O^{18} effect was found in the reactions of Hg^{++} and Ag^+ with OH^-; O^{16} concentrates preferentially in the precipitated oxide. The results suggest a kinetic isotope effect.

1862
OXYGEN-18 ISOTOPE EFFECT IN THE REACTION OF OXYGEN WITH COPPER. Richard B. Bernstein. J. Chem. Phys. 23, 1797-1802 (1955). C.A. 50, 1429g.

The fractionation of O^{18} in the reaction of Cu with O_2 of natural isotopic composition was measured over the temp. range 68-256°. $O^{16}O^{16}$ reacted preferentially compared with $O^{16}O^{18}$. The isotope effect was independent of the O_2 pressure over a range of 2 to 25 cm. The magnitude of the fractionation factor was 2.0% at 150°, with a small negative temp. coefficient. The apparent activation energy for the fractionation factor was 17 cal./mole compared with the calcd. isotopic zero-point energy difference of 64 cal./mole.

1863
INVESTIGATION OF THE ACTIVE SURFACE OF SOME SEMICONDUCTORS BY ISOTOPE METHODS. N. P. Keier. Problemy Kinetiki i Kataliza, Akad. Nauk S.S.S.R. 8, 224-32 (1955). C.A. 50, 1451b.

The following adsorptions were investigated: H_2 and D_2 on active sugar coal; H_2 and D_2 on metallic Ni; C_2H_2 and $C_2^{14}H_2$ on Ni; I_2 and I_2^{131} on Pt on asbestos; H_2 and D_2 on ZnO prepared from $ZnCO_3$; C_2H_2 and $C_2^{14}H_2$ on NiO from $NiCO_3$; CO and $C^{14}O$ on an Fe catalyst as used for the NH_3 synthesis. With the exception of the first one of these reactions, it was found that the adsorption function always appears in the shape of $f(E) = He^{\alpha E}$; where E is activation energy, and H and α are constants.

1864
CORRELATION BETWEEN THE VIBRATIONAL FREQUENCIES OF ISOTOPIC MOLECULES (THE SUM AND PRODUCT RULES). L. M. Sverdlov. Doklady Akad. Nauk S.S.S.R. 86, 513-16 (1952). C.A. 50, 1468c.

S. derives expressions for the sum and product rules governing the vibration frequencies of isotopically substituted molecules, and applies them with good success to the deuterioethylenes.

1865
STABLE AND RADIOACTIVE ISOTOPES IN SCIENTIFIC INVESTIGATIONS. Hellmuth Freimuth. Inst. nacl. invest. cienc. nat. y museo Argentino cienc. nat. "Bernardino Ravadavia," Pubs. extension cultural y didact. No. 9, 1-87 (1954). C.A. 50, 1473i.

A review with 61 references, including lists of stable isotopes, their separation, lists of radioactive isotopes, their half-lives and types of activity, availability of isotopes for research in chemistry and medicine, and methods of shielding.

1866
AN UNUSUAL ISOTOPE FRACTIONATION EFFECT. Francis E. Jenkins and Gordon M. Harris. J. Am. Chem. Soc. 77, 4439 (1955). C.A. 50, 1488g.

The exchange reaction $CNI + C^{14}N^- \rightleftharpoons C^{14}NI + CN^-$ was investigated in water and various dioxane-water mixtures. The reaction was followed by precipitation and radioassay of the inorganic cyanide as AgCN. The equilibrium constant is the ratio of the specific activities of CNI to cyanide after equilibration; a value of 1.05 is predicted for this constant by statistical thermodynamics. The experimentally determined constant increases with increase in dioxane content of the solvent. In experiments in which a solution of $NaC^{14}N$ was poured directly into a solution containing $AgNO_3$ and CNI, the precipitated cyanide had undergone complete exchange with the CNI. The rate of the equilibration reaction is much greater than the rates of the precipitation reactions. Isotopic equilibrium is thus maintained continuously in the solution during the precipitation procedure.

1867
EXCHANGE REACTIONS AND MAGNETIC SUSCEPTIBILITIES OF COMPLEX SALTS. III. EXCHANGE REACTIONS OF SOME NICKEL COMPLEX SALTS. H. C. Clark and A. L. Odell. J. Chem. Soc. 1955, 3435-8. C.A. 50, 1512b.

The synthesis and use in exchange studies of (carbonyl-C^{14}) salicylaldehyde is described. In pyridine solns., rapid and complete exchange of the active ligands of bis-salicylaldoximenickel, and bis-salicylaldiminenickel, and bis-N-methylsalicylaldiminenickel was observed, while zero exchange occurred with bis-salicyaldehydeethylenedi-iminenickel and bis-salicylaldehyde-o-phenylenedi-iminenickel.

1868
OXYGEN INTERCHANGE BETWEEN CALCIUM CARBONATE AND WATER IN CONNECTION WITH THE GEOLOGIC THERMOMETER. A. I. Brodskiĭ and V. A. Lunenok-Burmakina. Doklady Akad. Nauk S.S.S.R. 101, 715-17 (1955). C.A. 50, 1546e.

The accuracy of the geologic thermometer (Urey, C.A. 43, 2507a) as an indication of O exchange was fully confirmed, although some possible pitfalls in its application must be investigated for its dependable application.

1869
THE FRACTIONATION OF OXYGEN ISOTOPES. George A. Lane. Univ. Microfilms. Publ.

No. 13,106, 140 pp. Dissertation Abstr. 15, 1736-7 (1955). C.A. 50, 2227a.

1870
ADSORPTION AND SILVER-SILVER ION EXCHANGE. Cecil V. King and Boris Levy. J. Phys. Chem. 59, 910-14 (1955). C.A. 50, 2240d.
The adsorption of Ag_2SO_4 on Ag was measured with S^{35} as tracer. Exchange was studied with Ag^{110} as tracer. Exchange was rapid on initial immersion and was greatly retarded as adsorption interfered. If reversibly adsorbed salt was washed off frequently, much higher levels of exchange were obtained in a given total time of immersion. Exchange between metal and adsorbed salt was faster than exchange between adsorbed salt and solution.

1871
OXYGEN EXCHANGE IN THE HYDROTHERMAL GROWTH OF QUARTZ. Richard G. Yalman, James F. Corwin, Gwilym E. Owen, and Neil Fetter. J. Am. Chem. Soc. 77, 4779-80 (1955). C.A. 50, 2254e.
The exchange of O in a SiO_2-H_2O system with water-soluble oxy-ions (in the absence of F^- ions) was studied. All of the SiO_2 reacting was in the H_2O phase, and complete isotopic exchange was observed. In other experiments in which SiO_2 glass was completely converted into α-quartz under isothermal conditions at 400° and 340 atmospheres in NaOH and NaCl solutions, only partial isotopic exchange was observed.

1872
ISOTOPE EFFECTS IN THE CHROMIC ACID OXIDATION OF 2-PROPANOL-2-t. Louis Kaplan. J. Am. Chem. Soc. 77, 5469-71 (1955). C.A. 50, 2257a.
The relative oxidation rates of 2-propanol and 2-propanol-2-t in aqueous chromic acid containing $HClO_4$ were measured by a competitive method. When Mn^{++} ions are added to isolate the first stage of the oxidation by $HCrO_4^-$, the experimental isotopic rate ratio k_T/k_H is 0.04 ± 0.02, as compared to the calculated value of 0.06. In the absence of Mn^{++}, this ratio varies from 0.13 in 0.3M to 0.26 in 2M $HClO_4$.

1873
ISOTOPIC EXCHANGE REACTIONS OF NEPTUNIUM IONS IN SOLUTION. III. THE EFFECT OF CHLORIDE AND NITRATE IONS ON THE RATE OF THE Np(V)-Np(VI) EXCHANGE. Donald Cohen, J. C. Sullivan, and J. C. Hindman. J. Am. Chem. Soc. 77, 4964-8 (1955). C.A. 50, 2257e.
Within exptl. error, no effect on exchange rate R was found in going from an inert surfact (Teflon) to Pyrex. R was increased by the addition of Au or Pt. R increased with increasing ionic strength, in the direction expected for a reaction involving 2 ions of like sign. Nitrate ion had little effect on R, but a marked catalysis was found in chloride solution.

1874
MECHANISM OF THE EXCHANGE REACTION BETWEEN HYDROGEN AND DEUTERIUM ON ZINC OXIDE CATALYSTS. Ettore Molinari. Gazz. chim. ital. 85, 930-43 (1955). C.A. 50, 2262h.
The heterogeneous exchange reaction between H and D on ZnO was studied to establish a correlation between the catalytic activity and the defective lattice structure of this semiconductor. Additions of Al_2O_3, Ga_2O_3, and Li_2O were used to modify the structure.

1875
CATALYTIC REACTION BETWEEN ALIPHATIC ALCOHOLS AND DEUTERIUM. J. R. Anderson and C. Kemball. Trans. Faraday Soc. 51, 966-73 (1955). C.A. 50, 2263b.
Evaporated films of Ni, W, Rh, Pd, Fe, Ag, ZnO powder, and an Fe Fischer-Tropsch catalyst were used. Exchange reactions between MeOH, EtOH, PrOH and tert-BuOH and D_2 were studied. In all cases the OH hydrogen exchanged much more rapidly and with a lower activation energy than did the aliphatic hydrogens for which the activation energy was of the same magnitude as for saturated hydrocarbons.

1876
ISOTOPIC EXCHANGE REACTIONS BETWEEN COMPOUNDS OF LEAD(II) AND LEAD(IV). Antonino Fava. J. chim. phys. 50, 403-6 (1953). C.A. 48, 2494a.
In very alkaline solutions, an isotopic exchange occurs between plumbite and plumbate at temperatures below 100°. The energy of activation is of the order of 33 kcal/mole.

1877
OXYGEN EXCHANGE IN CHEMISORBED CARBON MONOXIDE. A. N. Webb and R. P. Eischens. J. Am. Chem. Soc. 77, 4710-13 (1955). C.A. 50, 3034b.
$C^{13}O$ and CO^{18} were adsorbed on Fe at -78° and -196° and then pumped off and collected in batches at various temps. up to 160°. The amount of $C^{13}O^{18}$ in excess of that naturally present was a measure of the degree of exchange. The fraction of complete exchange increases with pump-off temperature and is almost unity at 120-60° when CO_2 and O_2 impurities are present but is less when pure CO is used. The extent of exchange is increased by the presence of a gaseous phase of CO. at 25° over Fe, there was no exchange in mixtures of $C^{13}O$ + CO_2 and $C^{13}O^{18}$ + CO_2. Therefore, no oxidation-reduction reaction or O exchange occurs between CO and CO_2 at temperatures where the carbiding reaction does not occur. Instead, exchange takes place between neighboring CO molecules on the surface.

1878
THE KINETICS OF HYDROGEN ISOTOPE EXCHANGE REACTIONS. II. THE REACTION BETWEEN PARA-SUBSTITUTED [o-H^2]PHENOLS AND AQUEOUS SULFURIC ACID. V. Gold and D. P. N. Satchell. J. Chem. Soc. 1955, 3609-18. C.A. 50, 3043f.
The loss of D from p-nitro[o-H^2]phenol, p-chloro[o-H^2]phenol, and [o-H^2]-p-cresol was examd. kinetically in various H_2SO_4-H_2O mixtures. III. THE REACTION BETWEEN [H^2]BENZENE AND AQUEOUS SULFURIC ACID. Ibid. 3619-22. The rate of loss of D from [H^2]benzene in aqueous H_2SO_4 solutions depends on the acidity of the solvent in a similar way to that for the analogous reactions of the o-deuteriated phenols. IV. A COMPARISON OF THE EXCHANGE REACTIVITY OF DIFFERENT AQUEOUS ACID. Ibid. 3622-4. The rates of loss of D from p-chloro[o-H^2]phenol in aqueous H_3PO_4 and from [o-H^2]-p-cresol in aqueous HCl were

studied as a function of the acid concentration.

1879
EXCHANGE REACTIONS OF SOLID OXIDES. VII. CHROMIC OXIDE, NICKEL OXIDE, AND FERRIC OXIDE. E. R. S. Winter. J. Chem. Soc. 1955, 3824-34. C.A. 50, 3046g.

With all three oxides the rate of isotopic exchange between gaseous O_2 and the oxide surface was independent of the partial pressure of O_2. On all three oxides the exchange and the equilibration of molecular O_2 catalyzed by the oxide occur at the same speed.

1880
OXYGEN-18 AS TRACER IN THE CATALYTIC DECOMPOSITION OF POTASSIUM CHLORATE. F. E. Brown and J. D. Woods. Proc. Iowa Acad. Sci. 62, 258-63 (1955). C.A. 50, 3050g.

The results prove that some of the Mn loses O and then regains O from the chlorate during catalytic decomposition of $KClO_3$.

1881
STATISTICAL MECHANICS OF ISOTOPIC SYSTEMS WITH SMALL QUANTUM CORRECTIONS. I. GENERAL CONSIDERATIONS AND THE RULE OF THE GEOMETRIC MEAN. Jacob Bigeleisen. J. Chem. Phys. 23, 2264-7 (1955). C.A. 50, 3063a.

The differences in the thermodynamic properties of isotopic mols. subject to small quantum effects ($u^2/24$ law) depend on the difference in the reciprocal masses of the atoms in the molecule and are, therefore, independent of all masses except of those atoms isotopically substituted. This theorem provides a rigorous proof of the rule of the geometric mean for gaseous mols. The partition function ratio for a pair of double-labeled molecules, e.g., $N^{15}D_3/N^{15}H_3$ is equal to the ratio for the single-labeled pair $N^{14}D_3/N^{14}H_3$. The application of the $u^2/24$ law to isotopic isomer equilibrium was pointed out.

1882
MISCELLANEOUS PROCESSES FOR THE ISOLATION OF HEAVY WATER. James O. Maloney, George F. Quinn, and Harold S. Ray. Natl. Nuclear Energy Ser., Div. III 4F, 99-111 (1955). C.A. 50, 3104e.

A number of methods for the separation of D from H were studied and the separation factors predicted. The separation factor, $\alpha = (D_2/H_2)_g/(D_2/H_2)g$ (I), and the equilibrium constant (II) for the gaseous reaction $NH_3 + HD = NH_2D + H_2$ at 0° are 6.85 and 4.37, at 25°, 5.83 and 3.89, and at 100°, 4.10 and 2.73, respectively. The value for I and II for the reaction $(NH_3) + (HD)g = (NH_2D) + (H_2)g$ at 0, 25, and 100° are 7.01 and 4.67, 5.90 and 3.93, and 4.05 and 2.70, respectively. The constants for the exchange of D between mercaptans and water and between cyclohexane-benzene-H were determined.

1883
HYDROGEN-DISTILLATION PROCESS FOR THE ISOLATION OF HEAVY WATER. James O. Maloney, George F. Quinn, and Harold S. Ray. Natl. Nuclear Energy Ser., Div. III 4F, 83-98 (1955). C.A. 50, 3104f.

The design and economic evaluation of a process for producing D by distillation of a H-D mixture are described.

1884
CATALYTIC EXCHANGE. ELECTROLYTIC PROCESS FOR THE ISOLATION OF HEAVY WATER AT TRAIL, B. C. James O. Maloney, Geo. F. Quinn, and Harold S. Ray. Natl. Nuclear Energy Ser., Div. III, 4F, 9-52 (1955). C.A. 50, 3104g.

A process for separating H_2O from D_2O by catalytic exchange between HD and HDO is described. In the primary plant the D_2O concentration was increased from 0.0138 to 2.37 mole % by catalytic exchange and electrolysis. In the secondary plant the D_2O concentration was increased to 99.8 mole % by electrolysis alone. The equilibrium constant for the gaseous reaction $H_2O + HD = HDO + H_2$ was 4.19 at 0°, 3.62 at 25°, 3.20 at 50°, 2.88 at 75°, 2.62 at 100°, and 2.42 at 125°. The costs for development, design, construction and operation are given.

1885
ELECTROMAGNETIC SEPARATION OF PLATINUM ISOTOPES. W. C. Davis and C. W. Sheridan. U. S. Atomic Energy Comm., ORNL-1900, 8 pp. (1955). C.A. 50, 3115h.

Chemical reactions of Pt are described appropriate to the preparation of sponge for charge material, the chemical refinement of separated isotopes, and the recovery of charge material.

1886
THE KINETICS OF ISOTOPE EXCHANGE. ISOTOPE EXCHANGE UNDER DYNAMIC CONDITIONS. S. Z. Roginskiĭ. Doklady Akad. Nauk S.S.S.R. 100, 939-42 (1955). C.A. 50, 3116b.

The kinetic formulas for isotope exchange are derived by using the theoretical considerations developed in earlier work. Equations are derived on the basis of the reaction $AX + BX^* \rightleftharpoons AX^* + BX$, giving the change in p_A and p_B (the specific concentration of molecules AX^* and BX^* containing the unusual isotope X^*) with time.

1887
ISOTOPE EXCHANGE OF THE SULFUR IN SODIUM DIETHYLDITHIOCARBAMATE WITH ELEMENTAL SULFUR. I. I. Kukhtenko, G. A. Blokh, and G. P. Miklukhin. Ukrain. Khim. Zhur. 21, 227-32 (1955)(in Russian). C.A. 50, 3758a.

The isotope exchange of S in NaS_2CNEt_2 with radioactive S was studied in an EtOH-toluene solution at 50°, 60°, and 70°. The activation energy of the 1st-order reaction was approx. 22 kcal./mole. Threefold dilution of the reagents did not change the rate constant. Rates increased with increasing temperature.

1888
STATISTICAL MECHANICS OF MIXTURES OF ISOTOPES. G. V. Chester. Phys. Rev. 100, 446-54 (1955); cf. ibid. 93, 606 (1954). C.A. 50, 3813b.

The excess free energy of a mixture of isotopes is expanded in a Taylor series in powers of the relative mass differences $(m_0-m_j)/m_j$, where m_j and m_0 are the masses of the particles of the jth component and of a reference isotope, respectively. This expansion is useful only if it is assumed that all the particles in the mixture obey classical or Boltzmann statistics. The result indicates a phase separation of the isotopes in a mixture at a sufficiently low temperature and an ap-

proximate law of corresponding states between different mixtures of isotopes. The theory applies directly to all solid mixtures and to fluid mixtures of the H isotopes.

1889
VAPOR PRESSURE OF HT. Jacob Bigeleisen and Eugene C. Kerr. J. Chem. Phys. 23, 2442-3 (1955). C.A. 50, 3824b.

The vapor pressure of HT is greater than that of D_2 at 20°K. Additional confirmation is thus provided for the theory of the vapor pressures of isotopic molecules. (Phys. Rev. 99, 638 (1955)). The rule of the geometric mean is valid for the sequence H_2-HT-T_2.

1890
SOME PHYSICOCHEMICAL CONSTANTS OF HEAVY-OXYGEN WATER. N. M. Zhavoronkov, O. V. Uvarov, and N. N. Sevryugova. Primenenie Mechenykh Atomov v Anal. Khim., Akad. Nauk S.S.S.R., Inst. Geokhim. i Anal. Khim. 1955, 223-33. (English trans. AERE-Lib/Trans-693). C.A. 50, 3827f.

H_2O^{18} (1.1 to 1.4 mole %) was obtained by rectification of river water in packed columns followed by a removal of D_2. On this was determined the coefficient of relative volatility α of the system H_2O^{16}-H_2O^{18}. Two methods of determination were used, (1) quiescent vaporization and (2) evaporation of a large volume to a small residue. α was determined at 20-92°. Both methods gave similar results: $\alpha = 0.9822e^{7.942/RT}$. The difference in the heats of vaporization of H_2O^{18} and H_2O^{16} was determined as 15.8 cal./mol., the vapor pressure of H_2O^{18} at 100° was determined as 757.5 mm. Hg, and the b_{760} of H_2O^{18} as 100.09_2. The results agree well with those of Riesenfeld and Chang (C.A. 30, 6255^2) and Wahl and Urey (C.A. 29, 5711^9) at average temperature but differ from the former at higher temperatures, and from the latter at lower temperatures.

1891
ISOTOPE EXCHANGE OF COPPER BETWEEN ITS UNI- AND BIVALENT FORMS. Yu. P. Nazarenko and E. E. Kriss. Ukrain. Khim. Zhur. 21, 300-4 (1955). C.A. 50, 3853f.

The exchange of Cu between Cu_2O or its halides and a CuO solution was studied in homogeneous and heterogeneous media. In the homogeneous medium the exchange between the uni- and bivalent Cu goes to completion rapidly, whether O is present or absent. The exchange between the precipitate of univalent Cu halides and a solution of a salt of bivalent Cu is accelerated by the presence of halides. The exchange between Cu_2Br and Cu in the alkaline Na K tartrate solution is not completed during the formation of Cu_2O precipitate.

1892
DEUTERIUM EXCHANGE BETWEEN TRICHLOROETHYLENE AND WATER. INFRARED SPECTRAL DATA FOR TRICHLOROETHYLENE-d. Thomas J. Houser, Richard B. Bernstein, Richard G. Miekka, and John C. Angus. J. Am. Chem. Soc. 77, 6201-3 (1955). C.A. 50, 3855g.

Exchange of C_2Cl_3H with NaOD in D_2O appears to be first order. The half-time found is 50 hrs. Seventeen new overtones and combination bands of C_2Cl_3D are assigned for the region above 1250 cm.$^{-1}$.

1893
ACID CATALYSIS OF THE HYDROGEN-ISOTOPE EXCHANGE IN LIQUID DEUTERIUM BROMIDE MEDIUM. A. I. Shatenshteĭn, K. I. Zhdanova, L. N. Vinogradov, and V. R. Kalinachenko. Doklady Akad. Nauk S.S.S.R. 102, 779-82 (1955). ibid. 94, 923; 95, 115 (1954). C.A. 50, 3860i.

Acid catalysis in the protogenic DBr was studied with $AlBr_3$ as catalyst. The catalytic activity of $AlBr_3$ is very high, and 0.1% of the H in C_6H_6 is exchanged for D at 20° at unmeasurably high velocity, whereas the exchange velocity in the absence of catalyst is very low. H replacement by D was measured in BzOH, methylcyclohexane, and cyclohexane.

1894
ACID-BASE CATALYSIS IN CONCENTRATED ACID SOLUTION. DEUTERIUM ISOTOPE EFFECTS IN THE DECARBONYLATION OF AROMATIC ALDEHYDES. W. M. Schubert and Howard Burkett. J. Am. Chem. Soc. 78, 64-8 (1956). C.A. 50, 3861a.

Isotope effects were determined for the decarbonylation of 2,4,6-$Me_3C_6H_2CHO$ (I) and 2,4,6-$Me_3C_6H_2CDO$ (II) in 60-100% H_2SO_4, and the decarbonylation of I in 60-100% H_2SO_4 vs. D_2SO_4. Rate constants are given.

1895
EXCHANGE REACTION BETWEEN AMINES AND DEUTERIUM ON EVAPORATED METAL FILMS. C. Kemball and F. J. Wolf. Trans. Faraday Soc. 51, 1111-19 (1955). C.A. 50, 3862g.

The exchange reactions between D_2 and $MeNH_2$, Me_2NH, and Me_3N were studied on Pt, Pd, W, Ni, and Fe catalysts. Although Fe films had no activity for the exchange of hydrocarbons with D_2, they catalyzed the exchange of H atoms bonded to C in all 3 amines and H atoms bonded to N in $MeNH_2$.

1896
MANUFACTURE OF HEAVY WATER. E. W. Becker. Angew. Chem. 68, 6-13 (1956)(English translation: AEC-tr-2808 and AERE-Lib./Trans-734). C.A. 50, 3907a.

The following are reviewed: electrolysis of H_2O, electrolysis with chemical exchange, distillation of H_2O, distillation of liquid H, chemical exchange in the hot and cold systems, and economics of the processes.

1897
WATER-DISTILLATION PROCESS FOR THE ISOLATION OF HEAVY WATER AS EMPLOYED BY E. I. du PONT de NEMOURS & CO., INC., AT MORGANTOWN, W. VA. James O. Maloney, Geo. F. Quinn, and Harold S. Ray. Natl. Nuclear Energy Ser., Div. III, 4F, 53-81 (1955). C.A. 50, 3907b.

The large scale separation of D_2O from H_2O by distillation to produce 88-92 mole % D_2O is described. The research and development, construction, and operating costs are given.

1898
SEPARATION OF SOME ISOTOPES BY CONVECTION DIFFUSION. D. Heymann and J. Kistemaker. J. Chem. Phys. 24, 165-6 (1956). C.A. 50, 3921a.

Separation factors were reported for Ne^{20}/Ne^{22}, A^{36}/A^{40}, H/D, O_2^{32}/O_2^{34}, and N_2^{28}/N_2^{29}. The separation column consisted of a porcelain tube with very fine pores inserted in the center of a Pyrex cooling jacket with a gap between the inner tube and the cooled surface of 0.7 cm. A liquid was introduced in the porcelain tube and a liquid head of several meters was maintained. The liquid was evaporated from the surface of the porous porcelain tube by means of a heating coil. Gas analyses were made at the top and the bottom of the column.

1899

ISOTOPE ENRICHMENT BY MOLECULAR DISTILLATION OF URANIUM POLYALKOXIDES. Aubrey K. Brewer, Samuel L. Madorsky, and T. Ivan Taylor. U. S. 2,727,000, Dec. 13, 1955. C.A. 50, 3926d.

The alkoxides are distilled at 10^{-5} to 10^{-3} mm. Hg in a 20-250-cell reflux column. U pentaethoxide molecularly distilled at 110-15° for 116 hrs. in a column having 25 cells showed a 1.4% enrichment of U^{235} in the distillate. U pentapropoxide, after 256 hrs. at 137-40°, showed a similar enrichment. When 150 cells were used, U pentaethoxide molecularly distilled for 720 hrs. at 130-2° was enriched 6.75% in U^{235} in the distillate and impoverished 0.51% in the residue.

1900

HYDROGEN ISOTOPE EFFECT IN THE OXIDATION IN VIVO OF METHIONINE LABELED IN THE METHYL GROUP. Julian R. Rachele, Edward J. Kuchinskas, F. Howard Kratzer, and Vincent du Vigneaud. J. Biol. Chem. 215, 593-601 (1955) Aug. C.A. 50, 4014c.

A hydrogen isotope effect has been demonstrated by a comparison in vivo of the oxidation of labeled methionine preparations in which C^{14} atoms in the methyl group are bonded either to protium atoms or to deuterium atoms. The methyl groups in which the C^{14} is bonded to deuterium were oxidized at a rate from 60 to 80% of the rate of oxidation of methyl groups containing the C^{14} bonded to protium.

1901

DEPENDENCE OF ISOTOPIC EXCHANGE OF HYDROGEN AND OXYGEN IN SOLUTIONS ON THE STRUCTURE OF MOLECULES. A. I. Brodskiĭ. Voprosy Khim. Kinetiki, Kataliza i Reaktsionnoĭ Sposobnosti, Akad. Nauk S.S.S.R., Otdel. Khim. Nauk 1955, 18-23. C.A. 50, 4567d.

The structural requirements for isotope exchange of H and O atoms in molecules of various substances are reviewed. The suggestion is made that the existence of an unshared electron pair in the atom bound to the H atom in question leads to the possible addition of a proton or deuteron to this electron pair, with simultaneous expulsion of another proton or deuteron; such a process is estimated to have an activation energy of about 2-3 kcal./mole and can be rapid even at low temps.; organic compounds in which unshared electron pairs are lacking at the C atom in question must undergo the relatively slow D-H exchange with bond ruptures and have a high activation energy. No instance is known of rapid D-H exchange in substances without an unshared electron pair. The H_2O-addition mechanism of O exchange is applicable only to atoms capable of octet expansion. Data are presented on H-D exchange for NH_3, NH_4^+, H_3PO_3, H_3PO_2, and trisilanes, and for O exchange with a series of O acids of P.

1902

SOLUBILITY OF HYDROGEN AND DEUTERIUM IN HEPTANE AND OCTANE AT HIGH PRESSURES. S. K. Lachowicz, D. M. Newitt, and K. E. Weale. Trans. Faraday Soc. 51, 1198-1205 (1955). C.A. 50, 4591g.

The solubilities were determined at 25°, 37.5°, and 50° at pressures between 50 and 300 atmospheres. The data indicated no significant differences between the solubilities of the two gases in these solvents.

1903

EFFECT OF STRUCTURE OF HALOGEN DERIVATIVES OF HYDROCARBONS ON THE RATE OF IONIC AND ATOMIC REACTIONS OF ISOTOPE EXCHANGE. M. B. Neĭman, V. B. Miller, and Yu. M. Shapovalov. Voprosy Khim. Kinetiki, Kataliza i Reaktsionnoĭ Sposobnosti, Akad. Nauk S.S.S.R., Otdel. Khim. Nauk 1955, 722-38. C.A. 50, 4598e.

Exchange of halogens in aliphatic halides was examined by Br^{82} and I^{131} labeling. Isotope exchange of simple alkyl halides with Na halides in aqueous alcoholic solutions was studied. RI always exchange more rapidly than do RBr of the same structure.

1904

ISOTOPE EXCHANGE OF HYDROGEN IN FREE RADICALS. G. K. Lavrovskaya, R. E. Mardaleĭshvili, and V. V. Voevodskiĭ. Voprosy Khim. Kinetiki, Kataliza i Reaktsionnoi Sposobnosti, Akad. Nauk S.S.S.R., Otdel. Khim. Nauk 1955, 40-53. C.A. 50, 4598i.

The reaction of H atoms with olefins was examined in a dynamic flow system with C_2H_4, C_3H_6, $Me_2C{:}CH_2$, $(Me_2C{:})_2$, and cyclohexene in the presence of D_2. The results indicate a definite exchange of H-D type with D_2, produced by addition of H to the double bonds with formation of radicals. The rate of exchange of radicals with D_2 is rapid and requires low activation energy.

1905

THE EFFECT OF INHIBITORS ON THE HYDROGEN-DEUTERIUM EXCHANGE REACTION. M. J. Stephen and C. J. Danby. Proc. Roy. Soc. A232, 271-7 (1955). C.A. 50, 4599b.

The exchange reaction between H and D in SiO_2 vessels at temps. in the region of 560° was studied, the rate of formation of HD being determined by mass-spectrometer analysis. NO and propylene are effective inhibitors of the reaction.

1906

KINETICS OF THE ISOTOPIC EXCHANGE BETWEEN ANTIMONY(III) AND ANTIMONY(V) IN THE PRESENCE OF BROMIDE. Aldo Turco and Giovanni Faraone. Ricerca sci. 25, 2887-93 (1955) (English summary). C.A. 50, 4599e.

The isotopic exchange between Sb(III) and Sb(V) was measured in 3.2 molal HCl and 1.5 molal Br^- with Sb^{124}.

1907

EXCHANGE REACTIONS OF FREE AND BOUND RADICALS IN SOLUTION. I. P. Gragerov. Voprosy Khim. Kinetiki, Kataliza i Reaktsionnoi Sposobnosti, Akad. Nauk S.S.S.R., Otdel. Khim. Nauk 1955, 36-9. C.A. 50, 4599f.

EtBr labeled with D does not exchange Et radicals even at 195° with EtOPh or EtOAc;

similarly, labeled PhI does not exchange radicals with MeOPh. Appreciable exchange (25%) occurs between labeled and unlabeled EtI, but not between EtI and EtOPh or between MeI and MeOPh. Exchange between EtBr and Et_2SO_4 occurs readily at 155°. D-labeled Me_2SO_4 exchanges Me readily with MeI or MeOAc at 125-55°, but not with p-Me-$C_6H_4SO_3Me$, but the latter exchanges readily with MeI at 155°. In the presence of AcOH, EtBr exchanges Et with EtOAc at 195°, but $AlBr_3$ does not cause (at 60°) an exchange between EtOPh and EtBr. With Ph radicals no exchange was detected in solutions of Ph_2O, EtOPh, PhBr, or PhI. D-labeled Me or Et radicals exchange moderately readily with MeOPh, EtOPh, MeOBu, and Et_2O. However, Me or Et radicals formed from reaction with EtMgBr do not exhibit such exchange.

1908
KINETICS OF THE THERMAL AND PHOTOCHEMICAL EXCHANGE BETWEEN BENZYL IODIDE AND IODINE. Moshe Gazith and Richard M. Noyes. J. Am. Chem. Soc. 77, 6091-8 (1955). C.A. 50, 4599i.

The thermal exchange was studied in solutions activated with I^{131} in the temperature range 60-90°. The photochemical exchange initiated by 5461-A. light was studied at 25° and 36°.

1909
KINETICS OF ISOTOPIC OXYGEN EXCHANGE BETWEEN SUBSTITUTED BENZOIC ACIDS AND WATER. Myron L. Bender, Ricardo R. Stone, and Ray S. Dewey. J. Am. Chem. Soc. 78, 319-21 (1956). C.A. 50, 4609f.

The kinetics of O exchange between some substituted benzoic acids and H_2O enriched in H_2O^{18} was determined. The measurements were made at 80.0 ± 0.1° by use of a catalyst of about 0.07N HCl in 33% dioxane-67% H_2O mixture containing approximately 0.6% H_2O^{18}.

1910
THE EXCHANGE OF OXYGEN BETWEEN ALCOHOLS AND WATER. II. THE ACID-CATALYZED REACTIONS OF BUTYL ALCOHOL AND NEOPENTYL ALCOHOL. I. Dostrovsky and F. S. Klein. J. Chem. Soc. 1955, 4401-6. C.A. 50, 4610b.

The rates of the acid-catalyzed O exchange and decompn. of BuOH and Me_3CCH_2OH in aqueous media were measured at 125°.

1911
HYDROGEN PEROXIDE FORMATION BY THE ACTION OF GAMMA RADIATION ON THE AQUEOUS SOLUTIONS $O^{16}O^{18}$-H_2O^{16}. Edwin J. Hart, Sheffield Gordon, and Dwight A. Hutchison. J. chim. phys. 52, 570-7 (1955). C.A. 50, 4647b.

The kinetics of the formation of hydrogen peroxide by the action of γ radiation on aqueous solutions containing O^{18} enriched oxygen were studied. The primary products of radiation are hydrogen peroxide and normal O^{16}, and hydrogen peroxide containing O^{18}-enriched oxygen. The yield of normal hydrogen peroxide is independent of pH between pH = 0.4 and 9.65. The radiochemical yield of enriched hydrogen peroxide decreases when pH increases, and the yield of normal oxygen rises very rapidly for pH greater than 8.0.

1912
INDUSTRIAL PRODUCTION METHOD FOR THE HEAVY NITROGEN ISOTOPE. S. I. Babkov and N. M. Zhavoronkov. Khim. Prom. 1955, 388-92. C.A. 50, 4668i.

The chemical exchange between $N^{15}H_3$(gas) and $NH_4{}^{14}NO_3$(soln.) is used as a basis for N^{15} production. A vertical absorption column of 20 m. height and of 185 theoretical plates was calculated to be needed at 100-mm. Hg pressure. A horizontal separator designed with a rotating gas distributing mechanism, in combination with a vertical absorber, was found to be more economical in vertical space requirements, to reduce the number of circulating pumps, and to reduce the power required for restarting operations after a shutdown. The horizontal separator is illustrated and the design and operation calculations fully described.

1913
PREPARATION OF THE RARE ISOTOPE NEON-21. P. A. K. Clusius, M. Huber, H. Hürzeler, and E. Schumacher. J. Chem. Phys. 24, 167-8 (1956). C.A. 50, 4669c.

Starting with 60 l. of commercial Ne, 48 l. of Ne^{20} with a purity of 99.95% was isolated, while 12 l. with 45% Ne^{22} and 1.1% Ne^{21} remained. The latter gas was split up in the column in fractions with 95-8% Ne^{20}. Several l. of 99.7% Ne^{22} and 99.8% Ne^{20} were recovered with the residual Ne^{21} concentrated in the middle of the column. In the middle of the tube the concentration of Ne^{21} reached as high as 13%. A further concentration of Ne^{21} was obtained by using deuteriated methanes. Ne^{22} was "washed off" the Ne^{21} by CD_4 and the Ne^{20} was removed by CHD_3. In an experiment lasting 175 days, 99.6% Ne^{21} was obtained.

1914
CONCENTRATION OF ISOTOPES BY VERY RAPID ELECTROMIGRATION ON PAPER. Andre Bonnin, Marius Chemla, and Pierre Sue. Compt. rend. 241, 40-2 (1955). (English translation, AEC-tr-2315). C.A. 50, 4669d.

The electromigration of ions on paper by the influence of a high electric field was applied to the isotopic separation and concentration of Na^{22} and Na^{24} in the ratio varying from 0.28 to 1.83. The relative mobilities of the 2 ions were deduced from the results and are discussed.

1915
NONEXCHANGE OF FLUORINE-18 BETWEEN HYDROGEN FLUORIDE AND FLUORINATED METHANES. James E. Boggs, E. R. Van Artsdalen, and A. R. Brosi. J. Am. Chem. Soc. 77, 6505-6 (1955) C.A. 50, 4674b.

No exchange of F occurred between HF and the compounds CH_2F_2, CHF_3, CF_4, or CF_2Cl_2 in 1 hr. at temperatures up to 500°, or between CH_3F and HF up to 400° in 1 hr. No radioactivity was ever observed on the Ni reactor walls, confirming the absence of exchange between HF and NiF_2 reported by Rogers and Katz. (C.A. 46, 6536c).

1916
THEORETICAL ASPECTS OF THE ELECTROLYTIC METHOD OF PREPARING HEAVY WATER. G. S. Subramanian. Bull. Central Electrochem. Research Inst., Karaikudi 2, No. 2, 65-8 (1955). C.A. 50, 4679i.

A review with 19 references.

1917
PLEISTOCENE TEMPERATURE VARIATIONS IN THE MEDITERRANEAN. Cesare Emiliani. Quaternaria 2, 87-98 (1955). C.A. 50, 4737b.
Isotopic analyses of O were made on samples of Globigerina dubia, G. inflata, and Globigerinoides rubra from 66 samples from a core 8.43 meters long taken at a depth of 2664 meters. Ten temperature stages were identified, the temperature minima of even stages ranging from 8 to 13°, the maxima of odd stages from 27 to 33°.

1918
CALCULATION METHODS FOR TRANSFER COLUMNS. S. Villani. Energia nucleare (Milan) 2, 504-18 (1955) Oct. 15. C.A. 50, 5335b.
The performance of various types of countercurrent separation columns for deuterium separation has been studied with respect to the flow conditions in order to establish the common characteristics of the columns. A transfer fraction is defined, which is advantageously applicable in many calculations. As an example, the calculation of the separation factor for a dual-temperature separating element is shown. The definition of the yield of a column is more convenient in other cases. By the use of this quantity, the optimal distribution of deuterium recovery units has been stated in a four stage electrolytic plant.

1919
A LABORATORY METHOD FOR SEPARATING NITROGEN ISOTOPES BY ION EXCHANGE. F. H. Spedding, J. E. Powell, and H. J. Svec. J. Am. Chem. Soc. 77, 6125-32 (1955). C.A. 50, 5363f.
NH_4 as the hydroxide and NaOH as the eluant are used to obtain sharply defined front and rear edges to the adsorbed band of NH_4^+ on the resin Dowex 50-X12. The isotopic equilibrium constant between dilute NH_4OH solution and the NH_4 form of the resin, $K = R_R/R_S = 1.0257$, where R_R and R_S are the N^{14}/N^{15} ratios in the resin and aqueous phases, respectively. An adsorbed NH_4^+ band 7-10 ft. long, eluted about 39 times its length is necessary to achieve over 99% isotope separation. N^{15} is deposited at the rear edge, and N^{14} enriched at the leading edge as the band is eluted along the column.

1920
EXCHANGE OF SILVER IONS BETWEEN SILVER BROMIDE AND A SOLUTION OF AN ALKALI BROMIDE SATURATED WITH SILVER. A. M. Venet and J. Pouradier. J. chim. phys. 52, 779-83 (1955). C.A. 50, 5381.
The exchange of Ag^+ between solid AgBr and KBr solutions saturated with AgBr complexes was studied by use of Ag^{110} to follow the exchange. The rate of exchange increases with increasing KBr concentration and with increasing temperature. It appears that the exchange rather than the diffusion of Ag^+ is the rate-determining step.

1921
TRITIUM IN NATURE. W. F. Libby. J. Wash. Acad. Sci. 45, 301-14 (1955). C.A. 50, 5418i.
The abundance of naturally occurring T in water from many different sources was measured and tabulated.

1922
REALIZATION OF AN ELECTROMAGNETIC ISOTOPE SEPARATOR USE IN THE 93 MASS ISOTOPE STUDY IN MOLYBDENUM AND TECHNETIUM. Rene Bernas. Comm. energie atomique (France) Rapp. No. 308, 113 pp. (1954). C.A. 50, 5422c.
Design and construction of a 60° electromagnetic isotope separator is described. Ion source and target construction as well as detailed operating conditions are given for separating milligram quantities of the stable isotopes of Mg, Ca, Cd, Br, Mo, Hg, Zr, Sb, Zn, Th, As, U, and Tc.

1923
VARIATIONS OF NITROGEN-15 ABUNDANCE IN NATURALLY OCCURRING SUBSTANCES. Thomas Hoering. Science 122, 1233-4 (1955). C.A. 50, 5422d.
The difference in N^{15}/N^{14} ratio from that of standard atmospheric N of 37 naturally occurring substances was not constant.

1924
AMMONIA-AMMONIUM CARBONATE SYSTEM FOR THE CONCENTRATION OF NITROGEN-15. G. M. Begun, A. A. Palko, and L. L. Brown. J. Phys. Chem. 60, 48-51 (1956). C.A. 50, 5422e.
The isotopic exchange reaction between gaseous NH_3 and $(NH_4)_2CO_3$ colution saturated with NH_3 was studied. Rapid exchange was found between carbamate ion and the other N species present. The effective separation factor at atmospheric pressure determined from single stage equilibrations was 1.015 at 15.6, 1.019 at 25.8, 1.021 at 35.9, and 1.022 at 44.3°. Calcns. from the data gave the following values for the separation factor between gaseous NH_3 and the carbamate ion: 1.023 at 15.6, 1.021 at 25.8, 1.021 at 35.9, and 1.019 at 44.3°. In both cases, N^{15} concentrates in the aqueous phase. Column studies were in agreement with these data and showed the system to be a feasible one for the production of enriched N^{15}.

1925
FEASIBILITY OF LARGE-SCALE NITROGEN-15 PRODUCTION FOR NUCLEAR REACTORS. D. A. Hayford, W. N. Johnson, S. A. Levin, J. Shacter, and E. Von Halle. U. S. Atomic Energy Comm. K-1232, 54 pp. (1955). C.A. 50, 5422g.
This is a report of a preliminary process and economic survey completed early in 1954. The designs and cost estimates are supported to a very limited extent by experimental data. Seven separation systems were evaluated, 4 chemical exchange, 1 gaseous diffusion, 1 ion exchange, and 1 gaseous centrifuge process. It is concluded that 1 or several of the chemical exchange processes could be developed for making a 99% product at the rate of 50 metric tons/yr. for $1-5/g. including initial costs amortized at 20% per yr. The chemical exchange (I) processes evaluated were (1) closed-reflux I between NH_4NO_3 and NH_3, (2) I between $(NH_4)_2SO_4$ and NH_3, (3) I between NH_4OH and NH_3, and (4) closed-reflux I between NO and N_2O_5.

1926
LEAD AND SULFUR ISOTOPIC ABUNDANCES IN MISSISSIPPI VALLEY GALENAS. J. L. Kulp, G. L. Bate, W. U. Ault, and H. W. Feely. Bull. Geol. Soc. Am. 67, 123-4 (1956). C.A. 50, 5486d.

Unusually large variations (up to 15%) in the Pb^{207}/Pb^{206} ratio are found for the galenas. Measurement of the S^{32}/S^{34} ratio in the galenas shows the ratio to be constant for 2 districts and to vary by 2.7% in a 3rd. Isotopic fractionation is thus not considered important in causing the variation in the Pb isotopes, and the cause is thought to lie in changes in the source of the Pb.

1927
REACTIONS OF HYDROGEN EXCHANGE OF SATURATED ALDEHYDES WITH DEUTERIOPHOSPHORIC ACID. V. N. Setkina and D. N. Kursanov. Doklady Akad. Nauk S.S.S.R. 103, 631-4 (1955). C.A. 50, 5518f.

H exchange between RCHO and D_3PO_4 was examined in Et_2O at room temperature. All aldehydes which do not have a free H atom in 2-position (Me_3CCHO, CH_2O, BzH) show no D-H exchange. Keeping CH_2O in D_2SO_4 1 hour at -12° showed no D-H exchange.

1928
A CARBON-14 ISOTOPE EFFECT STUDY OF THE DIECKMANN CONDENSATION OF DIETHYL PHENYLENEDIACETATE. Wayne L. Carrick and Arthur Fry. J. Am. Chem. Soc. 77, 4381-7 (1955). C.A. 50, 5574a.

An intramolecular isotope effect of 5.6% is observed with diethyl phenylenediacetate-1-C^{14} and an intermolecular isotope effect of about 8.5% is observed with both diethyl phenylenediacetate-1-C^{14} and diethyl phenylenediacetate-2-C^{14} when the reaction is carried out in alcohol solution using sodium ethoxide as the condensing agent. When the reaction with diethyl phenylenediacetate-1-C^{14} is carried out in toluene solution using metallic sodium as the condensing agent an intramolecular isotope effect of 1.6% is observed.

1929
THE OXYGEN-INDUCED HYDROGEN-DEUTERIUM EXCHANGE. Ralph Klein, Milton D. Scheer, and Louis J. Schoen. J. Am. Chem. Soc. 78, 47-9 (1956). C.A. 50, 6155g.

Traces of O_2 were found to accelerate the rate of H_2-D_2 exchange in fused SiO_2 vessels at 500°. Concentrations as low as 2 parts per 1000 increased the initial rate of HD formation by a factor of 100 or more, depending on the pretreatment of the vessel walls.

1930
THE EXCHANGE OF ISOTOPES OF OXYGEN BETWEEN NATURAL FORMS OF SILICA AND CARBON DIOXIDE. E. I. Dontsova. Doklady Akad. Nauk S.S.S.R. 95, 1223-6 (1954). C.A. 50, 6161d.

Diatoms, after 3 days in vacuo at 600°, were held in contact with CO_2^{18}. In different experiments the ratio of O in the CO_2 to O in SiO_2 was 1:10, 1:5, or 1:2; the temperatures were 700, 600, 500, 400, and 300°; times varied from 7 to 180 min. Similar experiments were made with cryst. quartz (particle size averaging 12 μ or 4 μ), for which exchange rates are considerably lower.

1931
RECOMMENDED VALUES FOR THE THERMODYNAMIC PROPERTIES OF HYDROGEN AND DEUTERIUM PEROXIDES. Paul A. Giguere and I. D. Liu. J. Am. Chem. Soc. 77, 6477-9 (1955). C.A. 50, 6169g.

Recent spectroscopic and calorimetric data on H_2O_2 have been used to recalculate the thermodynamic functions of that compound. Similar calculations were carried out for the isotopic molecules D_2O_2 and HDO_2. Various derived thermodynamic quantities of the peroxide molecules are tabulated.

1932
METHOD FOR GRAPHICAL CALCULATION OF THEORETICAL PLATES IN AN ELECTROLYTIC PLANT WITH EXCHANGE TOWERS FOR THE PRODUCTION OF HEAVY WATER. Dino Dinelli. Energia nucleare (Milan) 2, 426-33 (1955). (English translation AERE-Lib/Trans-606) C.A. 50, 6208a.

The fundamental equations for a water-electrolysis plant with exchange towers are obtained for any D concentration. The graphical method of solution is described by illustrations.

1933
ANALYSIS AND PREPARATION OF STABLE ISOTOPES. M. Roth. Chim. anal. 38, 3-14 (1956). C.A. 50, 6245f.

A theoretical discussion and review.

1934
INVESTIGATION OF THE MOBILITY OF OXYGEN IN SILICATES AND ALUMINOSILICATES BY THE ISOTOPE TRACER METHOD. E. I. Dontsova. Doklady Akad. Nauk S.S.S.R. 103, 1065-7 (1955). C.A. 50, 6261b.

The present investigations concern sphene, albite, and phlogopite powders of a grain size of 12 μ and 4 μ. The experimentally observed exchange of O^{16} with O^{18} in the temperature interval 500 to 1100° during 20 min. to 6 hrs. is based on the use of CO_2 with an O^{18} content of 1.4%. The $O^{16} \rightleftharpoons O^{18}$ exchange reactions under geol. conditions are best illustrated for albite, with an exchange of 10% in a time period of 10^{11} years, for sphene with 10^{10} years, for mica with 10^6 years.

1935
MUTUAL EFFECT OF ATOMS IN MOLECULES OF SOME AROMATIC HYDROCARBONS OBSERVED BY MEANS OF REACTIONS INVOLVING THE ISOTOPIC EXCHANGE OF HYDROGEN. A. I. Shatenshteĭn and E. A. Izrailevich. Doklady Akad. Nauk S.S.S.R. 94, 923-6 (1954). C.A. 50, 6851b.

The following exchange (after an equil.) of H for D was found to occur in compounds in 0.8N solution of KND_2 in ammonia-d_3 after a period of 150-3000 hrs.: 18 atoms in C_6Me_6 and 16 atoms in C_6HMe_5 at 100°; 8 in C_6H_5Me, 7 atoms each in C_6H_5Et, C_6H_5Pr, and C_6H_5Bu, 6 atoms each in $C_6H_5CHMe_2$ and in $C_6H_5CHEt_2$, and 5 atoms in $C_6H_5CMe_3$ at room temperature.

1936
THE APPLICATION OF THE ISOTOPE METHOD OF EXCHANGE IN INVESTIGATING THE MECHANISM OF ANION ADSORPTION. S. N. Ivanov. Pochvovedenie 1955, No. 7, 44-58. C.A. 50, 6871g.

Using radiophosphorus exchange between freshly precipitated $FePO_4$, $AlPO_4$ and $Ca_3(PO_4)_2$ with KH_2PO_4 solution was studied.

1937
CRYSTAL GROWTH AND ISOTOPIC EXCHANGE OF LEAD SULFATE IN AQUEOUS MEDIUM. Lawrence B. Nelson. Univ. Microfilms (Ann Arbor, Mich.), Publ. No. 14993, 120 pp. Dissertation Abstr. 16, 36-7 (1956). C.A. 50, 6877f.

1938
HYDROGEN-ISOTOPE FRACTIONATION BETWEEN ICE AND WATER. Ralph E. Weston, Jr. Geochim. et Cosmochim. Acta 8, 281-4 (1955). C.A. 50, 6884i.

The equilibrium constant for the exchange of D between ice and water is calculated from available thermodynamic data. At 0°, ice is enriched in D by 1.92% compared with the water with which it is in equilibrium. The effect of dissolved salts is estimated to be only a lowering of the freezing point.

1939
DEUTERIUM ISOTOPE EFFECT ON THE AQUATION AND HYDROLYSIS RATES OF AQUEOUS $[Co(NH_3)_5Cl]^{++}$ AND $[Co(NH_3)_5Br]^{++}$. Arthur W. Adamson and Fred Basolo. Acta Chem. Scand. 9, 1261-74 (1955). C.A. 50, 6887g.

The hydrolysis of $[Co(NH_3)_5Cl]^{++}$ and the aquation of this and of $[Co(NH_3)_5Br]^{++}$ were studied in both ordinary and in D-containing systems.

1940
ISOTOPE EFFECT IN THE HYDROLYSIS OF GRIGNARD COMPOUNDS. Lars Olof Assarsson. Acta Chem. Scand. 9, 1399-1400 (1955). C.A. 50, 6888d.

Grignard compounds were hydrolyzed by a large excess of tritiated water in order to calculate the ratio k_T/k_H between the reaction rates of T and H, respectively. In hydrolyzing CH_3MgI and C_6H_5MgI, the Grignard compound dissolved in anisole was added slowly to a solution of H_2O in pyridine. At 20° k_T/k_H for the CH_4 formation was 0.67 ± 0.01 and that for the C_6H_6 = 0.61 ± 0.03. A difference of 1 kcal./mole was found in apparent energy of activation between T and H reactions.

1941
PERFORMANCE OF A HOT-WIRE THERMAL DIFFUSION COLUMN. J. W. Corbett and W. W. Watson. Phys. Rev. 101, 519-22 (1956). C.A. 50, 6897b.

The performance of a carefully constructed metal hot-wire thermal diffusion column is examined in the regions of laminar and turbulent gas flow in the column for several hot-wire temps. with the normal A isotopic mixture as a column gas. The effect on column performance of spacers on the center wire was also examined.

1942
CARBON-13 ISOTOPE EFFECTS IN THE DECARBOXYLATION OF SOME OXALOACETATES. E. Gelles and R. I. Reed. Nature 176, 1262 (1955). C.A. 50, 6934c.

The C^{13} isotope effect in the decarboxylation of 'natural' oxalacetic acid in aqueous solution at 25°, alone, and in the presence of diamagnetic yttrium (Y^{+++}) and paramagnetic dysprosium (Dy^{+++}) ions was measured. A comparison of the isotope effect shows that paramagnetic Dy^{+++} catalyzes the fission of C^{12}-C^{12} bonds about 4% more strongly than the fission of C^{12}-C^{13} bonds.

1943
BIBLIOGRAPHY OF RESEARCH ON DEUTERIUM AND TRITIUM COMPOUNDS, 1945 TO 1952. Lawrence M. Brown, Abraham S. Friedman, and Charles W. Beckett. Natl. Bur. Standards (U. S.), Circ. 562, 85 pp. (1956). C.A. 50, 6935i.

1944
NITROSYL COMPLEXES. II. EXCHANGE OF CHLORINE-36 BETWEEN NITROSYL CHLORIDE AND SOME INSOLUBLE METAL CHLORIDES. J. Lewis and D. B. Sowerby. J. Chem. Soc. 1956, 150-3. C.A. 50, 6995c.

The exchange of Cl^{36} between $ZnCl_2$, $HgCl_2$, or $CdCl_2$ and adsorbed NOCl is rapid, followed by a slow heterogeneous exchange with excess solvent. There is no exchange between $(NO)_2SnCl_6$, a stable nitrosonium salt, or NaCl or KCl, chlorides that do not form a complex with NOCl, and NOCl. AgCl does not form a complex with NOCl because there is no exchange in the dark, but a slow heterogeneous exchange occurs in the light.

1945
THE PARTIAL SEPARATION OF Na^{22} FROM Na^{24} BY ION EXCHANGE CHROMATOGRAPHY. R. H. Betts, W. E. Harris, and Margaret D. Stevenson. Can. J. Chem. 34, 65-74 (1956). C.A. 50, 7006f.

The separation of Na^{22} from Na^{24} by ion exchange chromatography was investigated. Using Dowex 50 resins, partial isotopic separations of 8 to 10% were obtained.

1946
LEAD AND SULFUR ISOTOPE RATIOS IN GALENAS. P. Eberhardt, J. Geiss, and F. G. Houtermans. Helv. Phys. Acta 28, 339-41 (1955). C.A. 50, 7032g.

A single-focus, high-resolution mass spectrometer was used to measure the Pb isotope ratio in 80 samples of Pb sulfides. The ages of the minerals varied up to 3.3 x 10^6 years. Differences in the S^{32}/S^{34} ratio of about 3% were also observed.

1947
POSSIBLE NATURAL FRACTIONATION OF THE MAGNESIUM ISOTOPES. Kalervo Rankama. Bull. comm. geol. Finlande No. 166, 1-3 (1954). C.A. 50, 7032h.

The natural fractionation of the stable isotopes, Mg^{24}, Mg^{25}, and Mg^{26}, is probable and the fractionation possibilities are discussed on the basis of the geochemistry of Mg and its position in the system of nuclides.

1948
VAPOR PRESSURE AND CRITICAL CONSTANTS OF D_2O. Geo. D. Oliver and J. W. Grisard. J. Am. Chem. Soc. 78, 561-3 (1956). C.A. 50, 7530i.

The vapor pressure of D_2O from 208° to 371° was measured by means of a high-pressure ebulliometer. Over 2 temperature ranges, the value of $\log(P_{D_2O}/P_{H_2O})$ can be represented by the following equations: from 208 to 300°, it is $-3.4273 \times 10^{-2} + 2.1988 \times 10^{-4}t - 2.9329 \times 10^{-7}t^2$; and from 300 to 370.6°, it is $0.21516 \times 10^{-2} - 0.22949 \times 10^{-4}t + 1.1143 \times 10^{-7}t^2$. At 220.7° and 340.9 lb./sq. in. absolute, the boiling points of the 2 compounds are equal but differ by 2° at the critical pressure of D_2O. The critical temperature and pressure of D_2O are 370.9 ± 0.10° and 317.0 ± 5 lb./sq. in. absolute, respectively.

1949
INTRAMOLECULAR CARBON ISOTOPE EFFECT IN THE DECARBOXYLATION OF THE MONO-ANION OF MALONIC ACID IN QUINOLINE SOLUTION. Peter

E. Yankwich and H. S. Weber. J. Am. Chem. Soc. 78, 564-7 (1956). C.A. 50, 7550b.

The intramolecular C isotope effect was studied from 79 to 138°; the results are compared with the intermolecular isotope effect (cf. C.A. 49, 15405i). This comparison yields reasonable values for the equilibrium constant for isotope discrimination in anion formation and the ratio of the isotopic constants for complex formation involving the solvent.

1950
MASS-SPECTROMETRIC STUDY OF THE B_2D_6-B_5H_9 EXCHANGE REACTION. W. S. Koski, Joyce J. Kaufman, Lewis Friedman, and A. P. Irsa. J. Chem. Phys. 24, 221-5 (1956). C.A. 50, 7577h.

The distribution of partially deuteriated pentaborane species resulting from the reaction between B_2D_6-B_5H_9 was studied mass spectroscopically. Tracer studies with B^{10} indicated that B atoms were not involved in the exchange.

1951
INVESTIGATION OF "BITTERNS" AS A SOURCE FOR HEAVY WATER. E. Weingaertner and R. L. Datta. J. Indian Inst. Sci. 38, 73-86 (1956). C.A. 50, 7613i.

The D_2O content of "Bitterns", the water remaining in the mother liquid of the solar evaporation process, is determined, mass spectrometrically, to be ~ 0.0208 mole % and is compared with natural H_2O sources having a D_2O content of 0.0140 to 0.0150 mole %.

1952
SEPARATION OF HELIUM-3 FROM ATMOSPHERIC AIR. K. W. Taconis. Compt. rend. 27e congr. intern. chim. ind, Brussels 1954, 1; Industrie chim. belge 20, Spec. No., 395-8 (1955). C.A. 50, 7614a.

Starting with a gaseous residue from a liquid N plant, H was removed by high-temperature combustion with excess O. The O and N were frozen out at 65°K., and Ne at 14°K. He^3 was separated from superfluid He^4 by cooling below 2.19°K.

1953
VISCOSITY OF HD AND HELIUM-3 BETWEEN 14 AND 20°K. E. W. Becker and R. Misenta. Z. Physik 140, 535-9 (1955). C.A. 50, 8275e.

The viscosities of HD and He^3 were measured, and the known viscosities of H_2, D_2, and He^4 redetermined; the results are tabulated.

1954
ISOTOPIC EXCHANGE OF SULFUR BETWEEN HYDROGEN SULFIDE AND 2-MERCAPTOBENZOTHIAZOLE. A. F. Rekasheva, G. A. Blokh, and G. P. Miklukhin. J. Gen. Chem. U.S.S.R. 25, 1591-5 (1955)(Engl. translation). C.A. 50, 8305c.

See reference No. 1837.

1955
THE DEUTERIATION AND EXCHANGE OF ETHYLENE ON EVAPORATED METAL CATALYSTS AT LOW TEMPERATURES. Charles Kemball. J. Chem. Soc. 1956, 735-43. C.A. 50, 8308h.

The amounts of the various deuterio-compounds formed during the reaction between C_2H_4 and D on evaporated films of W, Ni, Rh, and Fe at -100° were measured by a mass spectrometric technique. The results provided new evidence for the close connection between exchange and deuteriation of C_2H_4.

1956
THERMAL DIFFUSION OF GASEOUS ISOTOPES. Stanislaw Szpikowski. Wiadomości Chem. 9, 305-40 (1955). C.A. 50, 8337i.

A comprehensive review covering thermal diffusion (I) and intermolecular forces, application of I in the separation of isotopes, and multistep columns. 210 references.

1957
PREPARATION OF 99.8% NITROGEN-15 BY CHEMICAL EXCHANGE. W. Spindel and T. I. Taylor. J. Chem. Phys. 24, 626-7 (1956). C.A. 50, 8342i.

N^{15} 99.8% pure was obtained in a 2-stage cascade system by utilizing the following reaction: $N^{15}O(g) + HN^{14}O_3(aq) = N^{14}O(g) + HN^{15}O_3(aq)$. Details of the apparatus and the procedure are given.

1958
THE SEPARATION OF ISOTOPES BY ELECTROMIGRATION. Julio V. Iribarne. Chemia 16, 41-8 (1955). C.A. 50, 8364h.

A review.

1959
SEPARATION OF D_2O/H_2O BY HIGH-TEMPERATURE DISTILLATION. G. F. Mills. 1951 (declassified Oct. 1955) 8 pp. (KLI-1098). C.A. 50, 8389c.

It is questionable if worthwhile D_2O recoveries can be made by utilizing only high-pressure (1800 lb. per sq. in. at 330°) fractionation. The most economical method appears to be a combination of approximately 200 plates of high-pressure fractionation with further fractionation in low-pressure columns. An analysis of the methods available for direct determination of HDO/H_2O separation is included.

1960
MEANING OF DEUTERIUM ABUNDANCE IN METEORITES. Giovanni Boato. Nature 177, 424-5 (1956). C.A. 50, 8414b.

Methods for determining D/H ratios in meteorites and what they signify with respect to solar origin are discussed.

1961
THE DEUTERIUM ISOTOPE EFFECT OF THE METHANOLYSIS OF SOME ORGANOMETALLIC COMPOUNDS. Kenneth B. Wiberg. J. Am. Chem. Soc. 77, 5987-90 (1955). C.A. 50, 8446c.

The 1-butyl, phenyl and benzyl Grignard and lithium reagents have been found to react with methanol-d_1 faster or as fast as with ordinary methanol. A similar isotope effect was noted in the reaction of methyl sodiopropionate with methanol. The isotope effect of the neutralization of the C-anion of mandelonitrile also was determined, and the rate law for the benzoin condensation has been reconsidered based on this evidence.

1962
EXAMINATION OF THE ISOTOPE EFFECT IN THE CONDENSATION OF o-BENZOYLBENZOIC ACID-CARBOXYL-C^{14} TO ANTHRAQUINONE-9-C^{14}. Gus A. Ropp. J. Chem. Phys. 23, 2196-7 (1955). C.A. 50, 8578d.

It is suggested that the "reverse isotope effect" observed in the condensation of o-benzoylbenzoic acid-carboxyl-C^{14} to anthra-

quinone-9-C^{14} (Can. J. Chem. 32, 792-801 (1954)) was due to an isotopic dilution after synthesis of the acid. The theory of carbon isotope fractionation in addition processes is discussed.

1963
MATHEMATICAL THEORY OF CHROMATOGRAPHY AND MODIFICATION OF THE DIFFUSION METHOD OF ISOTOPE SEPARATION. Prem Behari Mathur. J. Sci. Ind. Research 14B, 667-9 (1955). C.A. 50, 9099.

A brief mathematical treatment is presented that predicts the exact positions of different adsorbates and indicates the conditions under which the separation factor of adsorbates could be increased or decreased.

1964
HYDROGEN-ISOTOPE EXCHANGE BETWEEN AROMATIC MOLECULES AND AQUEOUS ACID. V. Gold and D. P. N. Satchell. Nature 176, 602-3 (1955) C.A. 50, 9119a.

o-Deuterio derivatives of p-cresol, p-chlorophenol, p-nitrophenol, and monodeuteriobenzene were investigated for the quanitative nature of this reaction on acidity in homogeneous solutions at 25°. The exchange rates were measured in aqueous H_2SO_4, HCl, and H_3PO_4.

1965
ABSENCE OF RAPID EXCHANGE IN SOLUTIONS OF THIOCYANATE AND ELEMENTARY SULFUR. A. H. W. Aten, Jr., E. Kriek, S. G. Hovenkamp, A. M. de Roos, and W. A. Spoon. J. Inorg. Nuclear Chem. 2, 203-4 (1956). C.A. 50, 9119c.

For a bimolecular CNS^--S_8 scheme, the exchange rate constant is less than 10^{-6} l./mole-sec. in EtOH and Me_2CO. S^{35} tracer was carried by 10 parts of stable S.

1966
RATE OF FERROUS-FERRIC EXCHANGE IN D_2O. J. Hudis and R. W. Dodson. J. Am. Chem. Soc. 78, 911-13 (1956). C.A. 50, 9119i.

To investigate the hypothesis of a H transfer mechanism, the rate of ferrous-ferric exchange was studied in D_2O under the same conditions as for previous experiments in H_2O (C.A. 47, 2023g). This result supports the hypothesis of a H-atom transfer mechanism for electron exchange.

1967
DEUTERIUM ISOTOPE EFFECTS ON THE AIR OXIDATION OF CUMENE. C. E. Boozer, B. W. Ponder, J. C. Trisler, and C. E. Wightman, 3rd. J. Am. Chem. Soc. 78, 1506-7 (1956). C.A. 50, 9120d.

In order to study the stabilization of free radicals and the nature of the chain-terminating step, the rates of oxidation of cumene and deuteriocumenes were determined.

1968
REACTION CHAMBER FOR ISOTOPIC EXCHANGE REACTIONS. Rowland E. Johnson. Nucleonics 14, No. 4, 96, 98 (1956). C.A. 50, 9172g.

A Pyrex reaction vessel is described which allows an end-window Geiger-Muller tube to monitor radioactive Cl^{36} only when the latter is in the gas phase from a liquid-vapor reaction mixture. Preliminary experiments with Cl_2 in CCl_4 show a half-time of about 2 minutes to establish equilibrium.

1969
ON REACTION OF HYDROGEN EXCHANGE IN DIBASIC SATURATED CARBOXYLIC ACIDS. E. V. Bykova and V. N. Setkina. Doklady Akad. Nauk S.S.S.R. 103, 835-7 (1955). C.A. 50, 9295d.

Specimens of dicarboxylic acids in H_2SO_4 enriched in D_2SO_4 and containing 7% SO_3 showed the following % of D-H exchange in the acids after 100-300, 650, and 1560 hours, respectively: $(CH_2CH_2CO_2H)_2$, 85, 100, 103; $HO_2C(CH_2)_7CO_2H$, 77, 83, 91; $HO_2C(CH_2)_8CO_2H$, 54, 104, 106; $(CH_2CO_2H)_2$, 1, 2, 3.

1970
REACTIONS OF HYDROGEN EXCHANGE OF ALDEHYDES. D. N. Kursanov and Z. N. Parnes. Doklady Akad. Nauk S.S.S.R. 103, 847-9 (1955). C.A. 50, 9326d.

D-H exchange was studied in several aldehydes in dry dioxane treated with D_2O in the presence of N, N'-dimethylpyridonimine catalyst at 100° in sealed ampuls. The % exchange in 50 hours was enanthaldehyde 90, cyclamenal 92, BzH 1, PhCH:CHCHO 2, Citralal 70, Me_3CCHO 0.5, and jasminealdehyde 5.

1971
THE ISOTOPE EFFECT IN THE MUTUAL SOLUBILITIES OF LIQUID DEUTERIUM COMPOUNDS. I. B. Rabinovich, V. D. Fedorov, N. P. Pashkin, M. A. Avdesnyak, and N. Ya. Pimenov. Doklady Akad. Nauk S.S.S.R. 105, 108-11 (1955). C.A. 50, 9545f.

The isotope effect on the mutual solubilities of the components was studied in 10 binary systems at temperatures up to the critical solubility temperature. One of the compounds in the system was always heavy water, and the others were CH_3NO_2, furfural, EtOAc, MeOAc, $C_6H_5ND_2$, BuOD, sec-BuOH, PhOD, isodeuteriotartaric acid, and deuteriolactic acid, with the D always as component of the acid or alcohol OH group. The results were compared with the solubility values of the corresponding H compounds. The phase equilibrium diagrams invariably were displaced by the isotopes. The complete miscibility areas were invariably larger in systems containing D compounds than with H compounds. The usual increase was 5-20%, occasionally as much as 70%.

1972
THE EXCESS FREE ENERGY OF A MIXTURE OF ISOTOPES. J. Henry. Bull. classe sci., Acad. roy. Belg. 42, 163-72 (1956). C.A. 50, 9801b.

The excess free energy is due to 2 contributions: an effect at constant volume and one at constant pressure. With an expression due to Chester (C.A. 50, 3813b) the constant-volume term is shown to be small for a lattice of harmonic oscillators and for a gas composed of hard spheres. Therefore, the excess free energy is mainly due to the volume effect at constant pressure for a mixture of light particles at low temperature in accord with the result of Prigogine, et al. (C.A. 49, 10684gi 10685a).

1973
THE ISOTOPE EFFECT IN THE STUDY OF VAPOR PRESSURE OF LIQUID DEUTERIO COMPOUNDS. I. B. Rabinovich, N. N. Sokolov, and P. I. Artyukhin. Doklady Akad. Nauk S.S.S.R. 105, 762-5 (1955). C.A. 50, 9808i.

The temperature relations of vapor pressures were studied for the following compounds having deuterium substituted in the OH, NH_2, and COOH groups: iso- and n-PrOH, aniline, and acetic, butyric, isobutyric, and isovaleric acids. The heats of evaporation were calculated from the experimental vapor-pressure values by the Clapeyron-Clausius equation, and from it the isotope effect in heats of vaporization, or the difference between the heats of vaporization of the D and H compounds.

1974
THE DIAGRAM OF STATE OF THE LIQUID-GAS SYSTEM OF HELIUM ISOTOPES He^3-He^4. B. N. Esel'son and N. G. Bereznyak. Doklady Akad. Nauk S.S.S.R. 105, 454-7 (1955) (English Trans. Soviet Research in Physics 1956, 13-16). C.A. 50, 9809i.

The method was based on determination of the vapor pressure of the isotope mixtures and of pure He^4. The vapor pressure of 20 solutions of He^3 concentration varying between 0.4 and 90.8%, in relation to their dew points in 8 mixtures with the He^3 concentration varying between 1.9 and 82.4% was found for different temperatures.

1975
ISOTOPE EFFECTS IN CRYSTALS. J. Henry. Bull. classe sci., Acad. roy. Belg. 42, 51-62 (1956). C.A. 50, 9812g.

The zero-point energy of isotopic mixtures of diatomic crystals AB is studied. The zero-point energy of a lattice AB-A*B, where A and A* are isotopes, is shown to be higher than the zero-point energy of a lattice containing only A or A*. Therefore a lattice ABA*B...should present a phase separation into ABAB...and A*BA*B ...at sufficiently low temperature. These considerations should apply to crystals like LiF in which some of the Li atoms are replaced by their isotopes. This is the extension for diatomic lattices of the result previously obtained by Prigogine, et al. (C.A. 49, 10684g) for monoatomic lattices.

1976
ABSORPTION OF HYDROGEN AND DEUTERIUM BY METALLIC TITANIUM. Toshizo Chitani, Yoshihide Naito, and Atsuo Konishi. J. Chem. Soc. Japan, Pure Chem. Sect. 77, 295-7 (1956). C.A. 50, 9819f.

The absorption of H_2 and of D_2 by Ti was studied comparatively at 500 ~ 800° In this range D_2 is absorbed about 10% more than is H_2 at the same temperature and under the same pressure.

1977
EXCHANGE BETWEEN ADSORBED AND DISSOLVED SULFATE IONS. Cecil V. King and Boris Levy. J. Phys. Chem. 60, 374-6 (1956). C.A. 50, 9821c.

Conductometric and radioactive measurements were made before and after shaking solutions of $Na_2S^*O_4$ and $Ag_2S^*O_4$ with Ag_2S, ZnS, MnS, and Ag powders. No S^{--}-SO_4^{--} exchange was found.

1978
THE EFFECT OF THE SUBSTANCE CHARGE AND THE DIELECTRIC CONSTANT OF SOLVENTS ON THE HYDROGEN EXCHANGE VELOCITY. A. I. Shatenshtein and E. A. Yakovleva. Doklady Akad. Nauk S.S.S.R. 105, 1024-7 (1955). C.A. 50, 9835g

The rate of H exchange in the CH_3 group of AcOH was determined in 3 solvents that differ in dielectric constant. The H exchange in the AcOH-CH_3 group in D_2O and in ND_3 was of the same order of magnitude, and about 10 times as high as in $(ND_2)_2$. Similar results were obtained in tests with triphenyl- and diphenylmethane.

1979
THE FAST CHLORIDE EXCHANGE BETWEEN HYDROCHLORIC ACID AND CHLOROAURIC ACID IN BIS-(2-CHLOROETHYL) ETHER. D. G. Tuck, Charles D. Coryell, and John W. Irvine, Jr. J. Phys. Chem. 60, 378-9 (1956). C.A. 50, 9837h.

An upper limit of approximately 10 sec. exists for the half-time of the HCl-$HAuCl_4$ exchange in the 0.01 concentration region. Comparison of the results with those of Rich and Taube (C.A. 48, 3771f) suggests that there is reaction of the uncharged species in the organic solution.

1980
EXCHANGE OF OXIDE-MINERAL OXYGEN WITH CARBON DIOXIDE. E. I. Dontsova. Doklady Akad. Nauk S.S.S.R. 105, 305-8 (1955). C.A. 50, 9840e.

The O exchange in MnO_2, Fe_3O_4, and Al_2O_3 against O^{18} in CO_2 was studied at various temperatures for 20 min. to 6 hrs. The rate of exchange was progressively lower with time, and an equilibrium was reached in 1.5 to 2 hrs. The rate of exchange followed the order Fe_2O_3 > Al_2O_3 > SiO_2 at 1100° and the rate of exchange for MnO_2 was determined at 700°.

1981
MUTUAL EFFECT OF ATOMS IN MOLECULES OF SOME ETHYLENIC HYDROCARBONS ON THE EXCHANGE OF ISOTOPIC HYDROGEN. A. I. Shatenshteĭn and L. N. Vasil'eva. Doklady Akad. Nauk S.S.S.R. 95, 115-18 (1955). C.A. 50, 9841f.

In liquid ND_3, in the presence of KND_2 as catalyst, all H-atoms of alkenes can be exchanged for D. This was observed even in the case of hexadecenes. Allylic bond and asymmetry in the molecule facilitate the exchange. The exchange is accompanied by the migration of the double bond along the chain.

1982
ISOTOPIC EFFECTS AND COLLISIONAL DEACTIVATION IN THE MERCURY PHOTOSENSITIZED DECOMPOSITION OF ETHYLENE. A. B. Callear and R. J. Cvetanovic. J. Chem. Phys. 24, 873-8 (1956). C.A. 50, 9882f.

Hg photosensitized decomposition of C_2H_4, C_2D_4, cis-$C_2D_2H_2$, and C_2H_4 with excess Xe added, was investigated at room temperature. An isotopic effect in the intramolecular decomposition of C_2H_4 was established, as well as an extensive isotopic isomerization in the course of collisional deactivation of the energy-rich molecules.

1983
KINETICS AND MECHANISM OF THE EXCHANGE REACTION OF SULFUR BETWEEN TETRAMETHYLTHIURAM DISULFIDE AND ELEMENTARY SULFUR.

E. N. Gur'yanova and L. S. Kuzina. Zhur. Fiz. Khim. 28, 2116-28 (1954). C.A. 50, 10445b.

The rate of exchange (R) of S atoms between elementary S containing S^{35} and tetramethylthiuram disulfide (I) in naphthalene (II) solution was measured in the temperature range 110-50°. The temperature dependence of the exchange reaction did not follow the Arrhenius equation. R was proportional to the square root of the I concentration. R was also measured for tetrabutylthiuram disulfide (III) at 130°. All 4 S atoms of I as well as III were exchanged.

1984

THE DEPENDENCE OF SEPARATION IN A GAS CENTRIFUGE ON THE COUNTER-CURRENT CIRCULATION. H. G. Hertz and E. Nann. Z. Naturforsch. 10a, 170-1 (1955). C.A. 50, 10451d.

The ultracentrifuge, with Xe gas, is operated in such a way that the temperature at the top and at the bottom are different. The separation obtained is dependent on this temperature gradient which causes gas circulation in the centrifuge. The temperature relation and the maximum separation agree with theoretical calculations.

1985

THE STATISTICAL THERMODYNAMICS OF ISOTOPE EFFECTS. I. THEORY OF EQUILIBRIUM PROCESSES. Irwin Oppenheim. Phys. Rev. 98, 258 (1955); (NBS-3756). C.A. 50, 10455i.

Phys. Rev. abstract only.

1986

THE STATISTICAL THERMODYNAMICS OF ISOTOPE EFFECTS. II. THE EQUATION OF STATE OF THE HYDROGEN ISOTOPES AT INTERMEDIATE DENSITIES. Abraham S. Friedman and Irwin Oppenheim. Phys. Rev. 98, 258 (1955). C.A. 50, 10455i.

Phys. Rev. abstract only.

1987

THE ISOTOPIC EXCHANGE OF ARSENIC TRICHLORIDE AND CHLORINE. J. Harding Owen and Rowland E. Johnson. J. Inorg. Nuclear Chem. 2, 260-2 (1956). C.A. 50, 10478c.

The exchange was catalyzed by HCl; the latter may form $HAsCl_4$, a more likely intermediate than undetectable $AsCl_5$. Non-attainment of noncatalyzed reaction vitiated study of the mechanism.

1988

HOMOGENEOUS EXCHANGE REACTION BETWEEN HYDROGEN AND DEUTERIUM. G. Boato, G. Careri, A. Cimino, E. Molinari, and G. G. Volpi. J. Chem. Phys. 24, 783-91 (1956). C.A. 50, 10492i.

The homogeneous exchange reaction between H and D was reinvestigated in order to see whether a more satisfactory quantitative test of the transition state method could be obtained in this reaction. The reaction was studied over a temperature range of 916° to 1010°K., where the heterogeneous contribution from the walls was negligible. By preventing air from diffusing into the reaction vessel through the walls, exchange rates lower by a factor of 2.0 than those obtained by other authors were observed. The total activation energy was 59.8 kcal./mole.

1989

THE OXYGEN ISOTOPE EXCHANGE BETWEEN HEAVY-OXYGEN WATER AND SOME TUNGSTATES. V. I. Spitsyn, R. I. Aistova, and V. N. Vasil'ev. Doklady Akad. Nauk S.S.S.R. 104, 741-3 (1955). C.A. 50, 10494h.

Water enriched with the O^{18} isotope was used in structure investigations of the principal aquapolytungstates, $Na_{10}W_{12}O_{41}\cdot 28H_2O$ and the normal $Na_2WO_4\cdot 2.06H_2O$, which showed that the O of the water of hydration was the most accessible to the O^{18} exchange. NH_4 paratungstate becomes enriched with O^{18}, whereas Na_2WO_4 does not, and an O-isotope fractionation is therefore possible by reaction with the hydration OH or with the complex ion in solution.

1990

KINETICS OF THE CERIUM(IV)-CERIUM(III) EXCHANGE REACTION IN PERCHLORIC ACID. Frederick R. Duke and Frank R. Parchen. J. Am. Chem. Soc. 78, 1540-3 (1956). C.A. 50, 10494i.

The rate is 1st-order in Ce(III), 1st and 2nd order in Ce(IV), and of complex order in $[H^+]$.

1991

KINETICS OF THE SILVER(I)-SILVER(II) ISOTOPIC EXCHANGE REACTION IN PERCHLORIC ACID. Barry M. Gordon. Univ. Microfilms, Publ. No. 15722, 72 pp. Dissertation Abstr. 16, 465 (1956). C.A. 50, 10494i.

1992

REACTION OF METHYL RADICALS WITH DEUTERIUM. James R. McNesby, Alvin S. Gordon, and S. Ruven Smith. J. Am. Chem. Soc. 78, 1287-91 (1956). C.A. 50, 10543a.

An acetone-D_2 mixture in the ratio D/acetone = 1.977 is photolyzed by using a medium-pressure Hg arc over a range of temperature from 140 to 428°.

1993

CONCENTRATION OF HEAVY HYDROGEN BY THE EXCHANGE REACTIONS BETWEEN HYDROGEN CHLORIDE AND LIQUID WATER BY THE OVER-ALL FRACTIONATION METHOD. Ryohei Nakane. Repts. Sci. Research Inst. 31, 405-8 (1955). C.A. 50, 10558h.

Since the separation coefficient of D in the exchange reactions between HCl gas and liquid H_2O was calculated to be above 4, H_2O was poured into the packing tower from the top and allowed to react with $SOCl_2$ at the bottom to generate HCl gas which ascended in the tower and came into contact with the descending H_2O. Thus, by this over-all fractionation method D was exchanged between the gas and liquid and concentrated 20 fold at the bottom.

1994

STABLE ISOTOPE SEPARATIONS. J. R. Walton, et al. U. S. Atomic Energy Comm. 1952, 194 pp. (ORNL-1422). C.A. 50, 10558i.

All elements so far separated in the calutron, the equipment used, the charge materials selected, the unique problems experienced in the processing of each element, and the isotopic purities that have been attained are given. Relative isotopic abundances and proposed uses of enriched isotopes are also listed.

1995

THE SEPARATION TUBE. XIV. THE SEPARATION SWING. THERMODIFFUSION FACTORS IN THE

SYSTEM CO_2/H_2. P. A. Klaus Clusius and Max Huber. Z. Naturforsch. 10a, 230-8 (1955). C.A. 50, 11060a.

A new apparatus, the separation swing, is described which permits the determination of the thermal diffusion coefficient, α, because the temperature difference which is used is very small. α can be determined at various temperatures, pressures, and for different gas compositions. The new method is tested on CO_2/H_2 mixtures at 220, 294, and 387°K. The temperature dependence of α is much greater than expected. In comparison of the results with calculated values, one obtains very good agreement with Kihara's calculations which shows them to be a notable advance in the theoretical treatment of thermal diffusion.

1996

RELATIVE VOLATILITIES OF WATERS CONTAINING HEAVY AND LIGHT OXYGEN. Sadahiro Sakata and Noriyoshi Morita. Bull. Chem. Soc. Japan 29, 284-5 (1956). C.A. 50, 11073f.

The relative volatilities of H_2O^{16} and H_2O^{18} lie between 1.0043 and 1.0040 at 100°.

1997

ISOTOPIC-EXCHANGE REACTIONS OF NEPTUNIUM IONS IN SOLUTION. IV. THE EFFECT OF VARIATION OF DIELECTRIC CONSTANT ON THE RATE OF THE Np(V)-Np(VI) EXCHANGE. Donald Cohen, J. C. Sullivan, E. S. Amis, and J. C. Hindman. J. Am. Chem. Soc. 78, 1543-5 (1956). C.A. 50, 11085b.

The isotopic exchange reaction between Np(V) and Np(VI) ions was studied at 0° in aqueous $HClO_4$ (0.106M) containing varying weight percentages of ethylene glycol or sucrose. The calculated dielectric constants were 67.7-88.3. The exchange rate is negligibly affected by the variation of the macroscopic dielectric constant in these solvents.

1998

CARBON-ISOTOPE EXCHANGE BETWEEN SOME SOLID CARBONATES AND GASEOUS CARBON DIOXIDE. V. A. Shushunov and B. G. Zateev. Zhur. Fiz. Khim. 30, 321-8 (1956). C.A. 50, 11086h.

The exchange reaction was studied by passing CO_2 over the carbonates at a definite rate and carefully maintained temperature of 350-400°, or much below the decomposition temperature of the carbonates, and measuring the C^{14} content in the escaping gas. The rate of exchange is strongly affected by the method of preparing the sample. The presence of air or moisture with the gas did not affect the exchange rate. The reaction is of zero order with respect to the CO_2.

1999

ISOTOPIC EXCHANGE REACTIONS RELATED TO FRIEDEL-CRAFTS REACTIONS. I. STANNIC CHLORIDE AND HYDROGEN CHLORIDE. II. STANNIC CHLORIDE AND ORGANIC CHLORIDES. III. HYDROGEN CHLORIDE AND AROMATIC HYDROCARBONS. Reed A. Howald. Univ. Microfilms, Publ. No. 16172, 207 pp. Dissertation Abstr. 16, 668-9 (1956). C.A. 50, 11086i.

2000

ISOTOPIC EXCHANGE IN NONSTABLE SYSTEMS. C. P. Luehr, G. E. Challenger, and B. J. Masters. J. Am. Chem. Soc. 78, 1314-17 (1956). C.A. 50, 11087b.

A general expression was derived to represent the progress of a simple exchange reaction in a homogeneous system of nonconstant volume undergoing simultaneous chemical conversion of either exchanging species into the other. The method was applied to a number of specific examples, and quantitative results were obtained in good agreement with experimental values determined in the corresponding stable systems.

2001

KINETICS OF THE EXCHANGE OF ANTIMONY BETWEEN ANTIMONY TRICHLORIDE AND ANTIMONY PENTACHLORIDE IN CARBON TETRACHLORIDE. Franklin B. Barker and Milton Kahn. J. Am. Chem. Soc. 78, 1317-19 (1956). C.A. 50, 11087c.

A measurable exchange whose rate is accelerated by light and apparently independent of the glass surface area was observed between $SbCl_3$ and $SbCl_5$ in CCl_4.

2002

ENRICHMENT OF ISOTOPIC MOLECULES IN DIRECT CURRENT GLOW DISCHARGES. IV. THE PRIMARY EFFECT--DETERMINATION OF THE CONCENTRATION OF ATOMS IN HYDROGEN AND DEUTERIUM DISCHARGES. H. D. Beckey and P. Warneck. Z. Naturforsch. 10a, 62-7 (1955). C.A. 50, 11098g.

The concentration of H and D atoms during d.-c. discharges was measured as a function of pressure and current. The maximum difference under the same discharge conditions in the atom concentration (D-H)/H was 19%.

2003

DISCREPANCY BETWEEN THE SPECTROISOTOPIC AND THE MASS SPECTROMETRIC RESULTS FOR THE NATURAL ABUNDANCE RATIO OF THE LITHIUM ISOTOPES. A. H. Gillieson and R. P. Thorne. Nature 176, 1228-9 (1955). C.A. 50, 11101f.

The discrepancy between the 2 methods of measurements has been explained by the failure to correct for the peak line intensities measured for the lines of the 2 isotopes which is of the form $I_{max.}(Li^6)/I_{max.}(Li^7) = \sqrt{6/7}$. When this correction is made the result of 12.5 ± 0.3 is in good agreement with the mass spectrometric value of 12.4-12.9. It is pointed out that similar corrections should apply to C, O, and Ne.

2004

ISOTOPE EFFECTS DURING THE OXIDATION OF FORMATE BY PERMANGANATE. H. Aebi, W. Buser, and Chr. Lüthi. Helv. Chim. Acta 39, 944-50 (1956). C.A. 50, 11153a.

The course of the oxidation of $HCOO^-$ and $DCOO^-$ by MnO_4^- in strongly alkaline medium according to Stamm (C.A. 32, 1614[6]) was investigated and its considerable isotope effect examined. The ratio of the rate constants K_H/K_D lies between 6 and 10.

2005

THE CYCLE OF CARBON AND THE STABLE CARBON ISOTOPES. Frans E. Wickman. Geochim. et Cosmochim. Acta 9, 136-53 (1956). C.A. 50, 11189f.

The ratio C/organic C is calculated to be 3.45 ± 0.55. This value is obtained by using the following values of C^{12}/C^{13}: carbonate C, 88.55 ± 0.05; organic sedimentary C, 91.00 ± 0.10; crustal C, 89.11 ± 0.05.

2006
DEUTERIUM CONTENT OF SOME NATURAL ORGANIC SUBSTANCES. C. Bokhoven and H. H. J. Theeuwen. Koninkl. Ned. Akad. Wetenschap., Proc., Ser. B, 59, 78-83 (1956). C.A. 50, 11738.

The H/D ratio for various natural organic substances was measured with a mass spectrometer and it was possible to distinguish samples differing by at least 0.0002 mole % D. The results of mole % D content are tabulated and compared with the standard water sample containing 0.0150 mole % D.

2007
C^{14} INTRAMOLECULAR ISOTOPE EFFECTS OF MALONIC AND BROMOMALONIC ACIDS. E. C. M. Grigg. Australian J. Chem. 9, 252-7 (1956) C.A. 50, 11780c.

The average C^{14} effect on the decarboxylation of malonic acid is 5.77%; bromomalonic acid, 6.46 with standard deviations of 0.20 and 0.24, respectively. These results are higher than theoretical but lower than most results reported.

2008
ISOTOPIC EXCHANGE BETWEEN Pu(III) AND Pu(IV). Thomas K. Keenan. J. Am. Chem. Soc. 78, 2339 (1956). C.A. 50, 11780e.

The exchange reaction between Pu(III) and Pu(IV) in perchlorate was investigated. The Pu(III)-Pu(IV) system undergoes exchange more rapidly than do either Eu(II)-Eu(III) or Ce(III)-Ce(IV). The rapid Pu reaction may be due to increasing lability of the surplus electron in Pu(III).

2009
MERCURY EXCHANGE BETWEEN MERCURIC CHLORIDE AND p-CHLOROMERCURIBENZOIC ACID. H. Cerfontain and G. M. F. A. van Aken. J. Am. Chem. Soc. 78, 2094-5 (1956). C.A. 50, 11780f.

The exchange reaction is 2nd-order and the velocity constants at 5.0, 17.0, 25.0 and 49.5° are 1.09 ± 0.03, 2.70 ± 0.04, 5.4 ± 0.2, and 26.0 ± 1.6 l./mole/sec., respectively. The activation energy is 12.0 ± 0.6 kcal./mole.

2010
EXCHANGE STUDIES OF CERTAIN CHELATE COMPOUNDS OF THE TRANSITIONAL METALS. I. THE EXCHANGE OF ETHYLENEDIAMINE (C^{14}) WITH CERTAIN "LABILE" METAL-ETHYLENEDIAMINE COMPLEXES. D. S. Popplewell and R. G. Wilkins J. Chem. Soc. 1955, 4098-4103. C.A. 50, 11784b.

The exchange, in aqueous solution, of ethylenediamine (C^{14}) between ethylenediamine and the complex ions $(Zn\ en_3)^{++}$, $(Cu\ en_2)^{++}$, and $(Hg\ en_2)^{++}$, was complete within 5 sec. at 0° and consequently was not studied. Under suitable concentration conditions, the exchange with $(Ni\ en_3)^{++}$ was discernible at 0°, with $t_{\frac{1}{2}}$ exchange ~ 5 sec.

2011
RADIOIODINE EXCHANGE BETWEEN IODOSTEARIC ACID MONOLAYERS AND SUBSTRATE IODIDE. R. F. Robertson, C. A. Winkler, and S. G. Mason. Can. J. Chem. 34, 716-28 (1956). C.A. 50, 11786e.

The velocity of exchange of iodine between monolayers at the air/water interface of α-iodostearic acid and KI in the substrate was measured.

2012
ISOTOPE SEPARATION BY CURRENT PASSING THROUGH A LIQUID METAL. Pierre G. de Gennes. J. phys. radium 17, 343-6 (1956). C.A. 50, 11847b.

Analysis of ion-electron collisions in a liquid metal, containing 2 isotopes, proves that the lighter isotope has a higher cross section than does the heavier one. Hence the lighter isotope is carried by the electrons toward the plate. The quantitative computation of the isotope separation assumes as known the number of free electrons in the liquid metal, the ratio of diffusion and viscosity coefficients, and the mean oscillation frequency of an ion, without considering the electron mass. The computed result is half as large as the experimental measurements by Nief and Roth (cf. C.A. 48, 13463f) for Ga.

2013
CONCENTRATION OF ISOTOPES BY ELECTROMIGRATION ON ASBESTOS PAPER IMPREGNATED WITH MOLTEN SALTS. Marius Chemla and André Bonnin. Compt. rend. 241, 1288-91 (1955). C.A. 50, 11847d.

Concentration of the isotopes Na^{22} and Na^{24} was studied during electromigration of a molten mixture of 45% $NaNO_3$, 55% KNO_3 which had been deposited on asbestos paper. The lighter isotope was greater in mobility by 0.01, whereas the difference in mobilities between the 2 isotopes was only 0.003 in aqueous solution.

2014
ENRICHMENT OF BORON TRIFLUORIDE BY THERMAL DIFFUSION. A. De Troyer. Compt. rend. 27e congr. intern. chim. ind., Brussels 1954, 2; Industrie chim. belge 20, Spec. No., 273 (1955). C.A. 50, 12413g.

B^{10} in natural B was enriched from 18.2% to 27% by thermal diffusion of BF_3. BF_3 was sent through the inner of 2 concentric columns 2.5 m. long. The inner column was electrically heated to 600° with a Pt-Rh wire, while the outer tube was cooled with running water.

2015
THE HYDROGEN EXCHANGE MECHANISM. Ya. K. Syrkin. Doklady Akad. Nauk S.S.S.R. Ukrain Khim. Zhur. 105, 1018-20 (1955); 22, 23 (1956). C.A. 50, 12594g.

D-H exchange, according to all available information, proceeds very rapidly in alcohol-water mixtures both in the liquid and the vapor phases. It proceeds similarly in primary and secondary amines, and with a comparable velocity in the C-H bond and the N-H bond in amines. It is assumed that the molecular combination in hydroxyl H-exchange proceeds similarly, and an expression is derived for the activation energy of such compound formation, on the assumption of 6-member intermediate cyclic compounds.

2016
HETEROGENEOUS EXCHANGE OF CHLORINE-36 BETWEEN HYDROCHLORIC ACID AND METHYL CHLORIDE ON TUNGSTEN. R. Coekelbergs, A. Frennet, and P. A. Gosselain. Bull. soc. chim. Belges 65, 229-44 (1956). C.A. 50, 12610h.

Exchange of Cl^{36} between HCl and MeCl was studied on evaporated W surfaces at 262.2° in the pressure range 4 to 200 mm. Hg.

2017

X-RAY INDUCED Tl^{+++} - Tl^{+} EXCHANGE IN 0.8 N SULFURIC ACID. George E. Challenger and Burton J. Masters. J. Am. Chem. Soc. 78, 3012-18 (1956). C.A. 50, 12611h.

The exchange rate induced by 50 kv.p. x-rays is independent of $[Tl^{+}]$, 0.503 order dependent on $[Tl^{+++}]$, and 0.670 order dependent on radiation intensity. The proposed mechanism involves the formation of an intermediate Tl^{++} species that is presumed to exchange rapidly with Tl^{+} and more slowly with Tl^{+++}.

2018

THE INTRAMOLECULAR ISOTOPE EFFECT IN THE PYROLYSIS OF PROPANE-1-C^{14}. H. M. Frey, C. J. Danby, and Cyril Hinshelwood. Proc. Roy. Soc. 234A, 301-5 (1956). C.A. 50, 12613i.

Propane-1-C^{14} was pyrolyzed at temperatures from 550 to 603°, both in the presence and in the absence of added NO. It was possible to determine the relative rates of rupture of the bonds C^{12}—C^{12} and C^{12}—C^{14}. The former is found to break about 8% more frequently than the latter, in both the normal and in the inhibited reaction.

2019

ISOTOPIC EXCHANGE OF MANGANESE DURING THE REACTION BETWEEN MANGANESE (II) AND PERMANGANATE. James A. Happe and Don S. Martin, Jr. J. Am. Chem. Soc. 77, 4212-17 (1955). C.A. 50, 12614i.

The reaction of Mn(II) with MnO_4^- in acid solutions to give a hydrous oxide of Mn(IV) (Guyard reaction; $3Mn^{++} + 2MnO_4^- + 2H_2O = 5MnO_2 + 4H^+$) was investigated for isotopic exchange. $Mn(II)^{54}$ was used as the tracer and exchange between this species and MnO_4^- and freshly formed precipitates containing Mn(IV) was investigated.

2020

IDEAL GAS THERMODYNAMIC FUNCTIONS OF THE ISOTOPIC HYDROGEN SULFIDES. Lester Haar, Joe C. Bradley, and Abraham S. Friedman. J. Research Natl. Bur. Standards 55, 285-90 (1955). C.A. 50, 12627f.

The ideal gas thermodynamic functions for H_2S, D_2S, HDS, HTS, and DTS were calculated from molecular data. The recent spectroscopic data for H_2S and D_2S were used. The zero-order frequencies for the other isotopes were obtained by a normal coordinate treatment. Tables of C_p^o/R, $(H^o - E_0^o)/RT$, $-(F^o - E_0^o)/RT$, and S^o/R were calculated at close temperature intervals from 50 to 5000°K.

2021

THE RADIATION CHEMISTRY OF WATER VAPOR. THE INDIRECT EFFECT OF DEUTERIUM. Richard F. Firestone. J. Am. Chem. Soc. 78, 3226-7 (1956). C.A. 50, 12661d.

The rate of formation of HD in gaseous mixtures of HTO and D_2 was shown to be directly proportional to rate of formation of hydrogen atoms. G(HD) values for samples irradiated to 10% exchange averaged 11 molecules/100 ev.

2022

ISOTOPES, THEIR SEPARATION. Eduardo Vitoria. Afinidad 32, 138-47 (1955). C.A. 50, 12665a.

A brief discussion of the occurrence, characteristics, and separation of natural and artificially produced stable and radioactive isotopes including a table of principal isotopes.

2023

CHEAP HEAVY WATER. Howard K. Rae. Chemistry in Can. 7, No. 10, 27-32 (1955) C.A. 50, 12665b.

A review; 17 references.

2024

RATE OF RADIOACTIVE EXCHANGE BETWEEN ANTIMONY (III) AND ANTIMONY (V) IN HYDROCHLORIC ACID SOLUTION. H. M. Neumann and Harmon Brown. J. Am. Chem. Soc. 78, 1843-7 (1956). C.A. 50, 12720d.

By use of the known equilibrium and kinetic data for the Sb(V) system, it was shown that all of the exchange results can be interpreted on the assumption that $SbCl_6^-$ is the only species of Sb(V) that exchanges with Sb(III).

2025

See Reference Number 2028

2026

IDEAL GAS THERMODYNAMIC FUNCTIONS OF THE ISOTOPIC HYDROGEN CYANIDES. Joe C. Bradley, Lester Haar, and Abraham S. Friedman. J. Research Natl. Bur. Standards 56, 197-200 (1956). C.A. 50, 13539g. (Research Paper 2668).

The thermodynamic functions C_p^o/R, $(H^o - E_0^o)/RT$, $(F^o - E_0^o)/RT$, and S^o/R were calculated and tabulated at small temperature intervals from 50° to 5000°K. for HCN, DCN, and TCN. Spectroscopic and molecular data for HCN and DCN were used; the frequencies of TCN were obtained from a normal coordinate analysis.

2027

DISTRIBUTION COEFFICIENT OF SULFUR ISOTOPE IN THE CHEMICAL EXCHANGE IN THE SO_2-HSO_3^- SYSTEM. A. M. Agal'tsov and Ya. D. Zel'venskiĭ. Zhur. Fiz. Khim. 29, 2244-8 (1955). C.A. 50, 13571i.

The equilibrium constants of the isotope exchange S^{34}-S^{32} at 25° (1.0197 ± 0.0017) and at 35° (1.0190 ± 0.0021) were determined. The S-isotope distribution was determined mass-spectrometrically, and the results are assumed to demonstrate the applicability of Rayleigh's equation to the experimental determination of partition coefficients of isotope exchange.

2028

A REVIEW OF THE REACTION KINETICS OF DEUTERIUM AND TRITIUM COMPOUNDS. IV. EXCHANGE AND SUBSTITUTION REACTIONS. Lawrence M. Brown. May 25, 1956. 86 p. (NBS-4611). C.A. 50, 13573f.

A review with 108 references.

2029

THE EXCHANGE REACTION BETWEEN SUBSTITUTED BENZYL IODIDES AND POTASSIUM IODIDE. VI. p-BROMOBENZYL IODIDE. Milton Kahn and J. L. Riebsomer. Mar. 1956. 8 p. (LA-2107UNM). C.A. 50, 13575c.

A measurable exchange has been observed in CH_3OH and C_2H_5OH between the iodine atom in p-bromobenzyl iodide and the I^- in KI. The exchange reaction was investigated over a temperature range from 0 to 30.9°.

2030
KINETICS OF THE REACTION BETWEEN NEPTUNIUM(IV) AND NEPTUNIUM(VI) IN A MIXED SOLVENT. Donald Cohen, E. S. Amis, J. C. Sullivan, and J. C. Hindman. J. Chem. Phys. 60, 70-2 (1956). C.A. 50, 13576f.

The reaction Np(IV) + Np(VI) = 2Np(V) was studied in ethylene glycol-$HClO_4$ by following the increase in the absorption at 983 m μ characteristic of Np(V).

2031
INVESTIGATION OF THE EFFECTS OF MOLECULAR STRUCTURE ON THE RATE OF IONIC AND ATOMIC ISOTOPE-ESCHANGE REACTIONS. IV. STUDY OF RADICAL-CHAIN REACTIONS OF ISOTOPE EXCHANGE OF ALKYL IODIDES WITH ELEMENTARY IODINE. M. B. Neĭman, V. B. Miller, and Yu. M. Shapovalov. Zhur. Fiz. Khim. 30, 492-9 (1956). C.A. 50, 13577g.

The reaction was studied in a special apparatus with illumination by light from a quartz lamp, from which ultraviolet rays were screened out with glass plates. The alkyl iodides and (in parentheses) the values of the ion-exchange reaction constants, $k_{100^o} \times 10^3$ l./mol. sec. were: MeI* (1200); EtI* (175); PrI* (100); iso-PrI* (10); $CH_2I^*_2$ (2.3), and CHI^*_3 (1.2). The replacement of H in the MeI* molecules with hydrocarbon radicals increases the atomic isotope-exchange reactions.

2032
INVESTIGATION OF THE ISOTOPIC EXCHANGE OF BROMINE BETWEEN THE BROMIDES OF ELEMENTS AND THE ORGANIC BROMINE DERIVATIVES. A. N. Nesmeyanov, V. Ya. Kabanov, Yu. P. Trusov, and M. M. Privalova. Zhur. Fiz. Khim. 30, 566-76 (1956). C.A. 50, 13578a.

The activation energy was determined of the isotope exchange of NaBr, RbBr, $CaBr_2$, $BaBr_2$, and BuBr in absolute acetone, and NaBr with BuBr in MeCN. No exchange was found in absolute acetone in the $ZnBr_2$-BuBr, $CdBr_2$-BuBr, and $SbBr_2$-BuBr systems at 55°; nor in MeCN at 80.1° for $CdBr_2$-BuBr; nor in CCl_4 for $SbBr_3$-BuBr at 28 and 76.8°; nor in dioxane in the $SbBr_3$-BuBr system at 76.8 and 100°; nor in the $SbBr_3$-BuBr system at 37.2 and 100° with no solvent.

2033
THE ADSORPTION OF DEUTERIUM BY A PLATINUM CATALYST. G. C. Bond. J. Phys. Chem. 60, 702-3 (1956). C.A. 50, 13581a.

The fraction of total adsorbed D_2 which is exchangeable with H_2 increased exponentially with the temperature. At 200°C, almost complete exchange of adsorbed D_2 was observed; at 0°C, an appreciable fraction did not exchange.

2034
EXCHANGE AND ISOMERIZATION OF DEUTERIOETHYLENES ON NICKEL EQUILIBRATION. Ted B. Flanagan and B. S. Rabinovitch. J. Phys. Chem. 60, 730-2 (1956). C.A. 50, 13582d.

The time course of the equilibration of trans-ethylene-d_2 and of mixtures of ethylene and ethylene-d_4 on Ni wire was studied. Equations were derived that fit the experimental results. The departure of the equilibrium distribution of products from statistical was examined.

2035
EXCHANGE OF HYDROGEN BETWEEN ISOBUTANE AND A DEUTERIOATED CRACKING CATALYST. R. G. Haldeman and P. H. Emmett. J. Am. Chem. Soc. 78, 2922-8 (1956). C.A. 50, 13582h.

A deuteriated SiO_2-Al_2O_3 catalyst evacuated at 500° is capable of only a very slow rate of exchange with the H of isobutane at 150°. The exchange rate increased at least 25-fold when only 0.03% H_2O was added to the catalyst. The exchange rate goes through a maximum and then decreases as additional H_2O is added. The average number of D atoms picked up by each isobutane molecule undergoing exchange varied from 1 to 9, depending on the D_2O content and prior treatment of the catalyst samples.

2036
EXCHANGE OF DEUTERIUM BETWEEN GASEOUS HYDROGEN AND A LIQUID HYDROGEN COMPOUND. Brit. 748,991, May 16, 1956. C.A. 50, 13630d.

D is concentrated by a continuous process in which electrolysis of the enriched product produces H which is depleted of its D by a series of catalyzed isotope-exchange reactions with the gaseous phase of the liquid compound, e.g. H_2O. Catalysts such as Pt, Pd, Rh, Cd, Cu, Co, or chromites of Zn, Cu, Cd, or Ni on coconut charcoal or Al_2O_3 are used. The method is applicable to liquids such as H_2O, MeOH, and C_6H_6. The equilibrium distribution of D becomes less favorable at higher temperatures, but the water vapor-H ratio is higher.

2037
CONCENTRATION OF ISOTOPES OF LITHIUM BY ELECTROMIGRATION IN THE MOLTEN STATE. Marius Chemla. Compt. rend. 242, 1450-2 (1956). C.A. 50, 13631i.

Electromigration of $LiNO_3$ was carried out at 630 v., 150 ma., and 300° on asbestos paper impregnated with a molten mixture of 55% KNO_3-45% $NaNO_3$. After 2 hrs., the ratio Li^7/Li^6 attained a value of approximately 5.0 at 20 cm. (11.5 in the natural state). The relative difference of mobility, $\Delta \nu/\nu$, of the 2 isotopes was 0.03.

2038
GEOCHEMISTRY OF ISOTOPES. Shinya Koana. Kagaku 26, 331-6 (1956). C.A. 50, 13676f.

A review with 51 references.

2039
PHASE DIAGRAM LIQUID-GAS OF THE SYSTEM OF THE HELIUM ISOTOPES HELIUM-3-HELIUM-4. I. B. N. Esel'son and N. G. Bereznyak. Zhur. Eksptl. i Teoret. Fiz. 30, 628-39 (1956). C.A. 50, 14295b.

The temperature-vapor tension function was measured for 20 different solutions of He^3 in He^4, containing from 0.4 to 90.8% He^3, also the pressures at which the condensation started, for those solutions that contained 1.9 to 82.4% He. These values were used to plot the phase diagram: liquid-gas of the He^3-He^4 system, and the distribution function of He^3 between the liquid and gas states was determined both with respect to the temperature and the concentration in the liquid phase. 23 references.

2040
SOLUTIONS OF HELIUM-3 AND HELIUM-4. S. K. Trikha and V. S. Nanda. Progr. Theoret. Phys. 15, 178-80 (1956). C.A. 50, 14297c.

A theory of He^3 and He^4 solutions is developed. The calculated vapor pressures of the solution and vapor-liquid concentration ratio for various He^3 concentrations ranging from 0.58 to 13.00% agree well with the experimental results of Sommers (C.A. 47, 372f).

2041
ISOTOPE EXCHANGE REACTION BETWEEN POTASSIUM CYANIDE AND ORGANIC THIOCYANATES. Gastone Pajaro. Ricerca sci. 25, 2636-9 (1955). C.A. 50, 14326f.

For the exchange reaction of $Hg(C^*N)_2$ with MeCNS and EtCNS in solution in acetonitrile at 100°, $t_{\frac{1}{2}}$ was 105 and 118 min., respectively. At 25° in MeOH solution $t_{\frac{1}{2}}$ in min. for the reaction between $KC^{14}N$ and the following is: EtCNS 6, BuCNS 8, PhCNS 4, benzyl thiocyanate 7. At 47.7° in MeOH, $t_{\frac{1}{2}}$ for $KC^{14}N$ and iso-PrCNS is 45 min. No measurable exchange was observed between tert-BuCNS and KCN at 47.7°.

2042
ISOTOPIC EXCHANGE RATE BETWEEN ZINC AND ZINC IONS. Niro Matsuura. Sci. Papers Coll. Gen. Educ., Univ. Tokyo 5, 97-113 (1955). C.A. 50, 14326g.

(1) Heterogeneous exchange occurs uniformly within the interior of Zn dust that has been left in contact with $ZnSO_4$ solution labeled with Zn^{65}. (2) A few thousand atom layers in the surface of Zn foil are ready for exchange. (3) Adsorption of Zn ions is the rate-determining step in solutions more dilute than 10^{-3} M.

2043
THEORY OF REACTION MECHANISMS. THE EXCHANGE OF HALOGEN WITH THE CHLOROMETHYL DERIVATIVES OF AROMATIC HYDROCARBONS. Raymond Daudel and Odilon Chalvet. Compt. rend. 242, 2150-2 (1956). C.A. 50, 14326i.

A method is indicated for the calculation of an important term of the potential barrier intervening in this reaction. The value thus obtained is compared with the experimental reaction rate constant.

2044
THE EFFECT OF SOLVENT ON A SIMPLE ION-DIPOLE REACTION. I. THE ORDER AND MECHANISM OF THE METHYL IODIDE-IODIDE ION EXCHANGE REACTION IN DIFFERENT SOLVENTS. E. R. Swart and L. J. Le Roux. J. Chem. Soc. 1956, 2110-14. C.A. 50, 14327a.

The kinetics of the isotopic exchange of radioactive I between MeI and NaI was studied in H_2O and EtOH at 25° and 0°.

2045
THE MECHANISM OF THE HOMOGENEOUS THERMAL REACTION BETWEEN ETHYLENE AND DEUTERIUM. Robert E. Varnerin, John S. Dooling, and Francis Owen Rice. Am. Chem. Soc., Div. Petroleum Chem., General Papers No. 33, 27-34 (1955). C.A. 50, 14327b.

Equimolar amounts of C_2H_4 and D_2, each of 99.5% purity, were brought together in a quartz vessel in the range of 570° to 660° (initial partial pressure of each, 100 mm.) with control exercised to limit the reaction as far as possible to the initial stages. Extent of interaction was measured manometrically on the basis of pressure decrease during the reaction, and mass spectrometrically, on the basis of the product analysis.

2046
DEUTERIUM EXCHANGE OF SOME METHYL "ONIUM" SALTS. Arthur K. Hoffmann. Univ. Microfilms, Publ. No. 16917, 99 pp. Dissertation Abstr. 16, 1213 (1956). C.A. 50, 14327e.

2047
KINETICS AND CATALYSIS OF THE ISOTOPIC EXCHANGE REACTIONS OF CARBON BETWEEN CARBON MONOXIDE AND CARBON DIOXIDE. Fred Golob. Univ. Microfilms, Publ. No. 16916, 186 pp. Dissertation Abstr. 16, 1217 (1956). C.A. 50, 14332f.

2048
EXPERIMENTS TO ENRICH HELIUM WITH THE ISOTOPE HELIUM-3. V. P. Peshkov. Zhur. Eksptl. i. Teoret. Fiz. 30, 850-4 (1956). C.A. 50, 14402f.

Several installations are described. The first uses a separation by a heat current with a following rectification and produces an enrichment of He^3 to 0.2%. A volume of 0.75 l. liquid He could be treated in 4 hrs. The 2nd installation uses filtration and rectification and it enriches continuously to 0.02% He^3 at the rate of 3 cu. m./hr. The theory of superfluid filtration is developed. He^3 can be concentrated out of mixtures containing 0.1% by improved rectification to a concentration of 99.95-99.97%.

2049
DEUTERIUM CONCENTRATION IN WATER. Harold C. Urey. U. S. 2,741,543, Apr. 10, 1956. C.A. 50, 14408c.

The variation with temperature of the distribution coefficient (α) of D between water and a mercaptan (α = 2.19 at 0° and 1.77 at 95° for iso-PrSH) is used to concentrate D in a countercurrent flow system of at least 2 stages. The use of alkali accelerates the H-D exchange rate. For example, a mixture of iso-PrSH and 0.1M NaOH comes to 95% equilibrium in 15 sec. in contrast to the 10 hrs. required for a neutral solution.

2050
ELECTROLYTIC SEPARATION OF HYDROGEN ISOTOPES BY MIGRATION THROUGH A PALLADIUM MEMBRANE. O. N. Salmon. 1956, 26 pp. (KAPL-1272). C.A. 50, 14413d.

A process has been demonstrated for the separation of hydrogen isotopes by electrolytic migration through a Pd membrane. The H-D isotope separation factor at room temperature is between 4 and 5. The electrical energy requirement is about 1/3 of that required for separating hydrogen isotopes by electrolysis. The possible use of this process in a simple cascade arrangement is described.

2051
THE UPTAKE AND ISOTOPIC ENRICHMENT OF LITHIUM BY YEAST. H. J. M. Bowen. J. Nuclear Energy 2, 255-63 (1956). C.A. 50, 14858a.

Lithium can be enriched in its lighter isotope when it is taken up by yeast. This isotope appears to enter and leave the yeast cell more readily than Li^7. It is suggested that biologically enriched Li^6 may be discovered in nature.

2052
THE DISTILLATION CHARACTERISTICS OF LIQUID HYDROGEN. E. S. Sellers and D. R. Augood. Trans. Inst. Chem. Engrs. 34, 53-78 (1956). C.A. 50, 15136c.
Bubble-cap plate distillation efficiencies over a range of throughputs were determined for the HD/H_2, $O^{16}O^{18}/O^{16}O^{16}$, and O_2/N_2 systems by using a small diameter column with liquid seal depths of 0.5 and 1.0 in. The use of these data in the design of a large-scale H distillation plant for the production of heavy water is discussed.

2053
PHASE SEPARATION IN HELIUM-3-HELIUM-4 SOLUTIONS. G. K. Walters and W. M. Fairbank. Phys. Rev. 103, 262-3 (1956). C.A. 50; 15155c.
A phase diagram is proposed for He^3-He^4 solutions. The line rises from 0°K. at 0% He^3 to a smooth maximum near 0.8°K. and 60% He^3, and falls to 0°K. at 100% He^3.

2054
RECOMBINATION OF HYDROGEN ATOMS AT METAL SURFACES. K. G. Pickup and B. M. W. Trapnell. J. Chem. Phys. 25, 182 (1956). C.A. 50, 15169e.
The activities of metals in H chemisorption, H-D exchange, and C_2H_4 hydrogenation can be related to their electronic configuration.

2055
THE SULFATE-ION EXCHANGE IN BASIC CHROMIUM SULFATE. Yu. P. Nazarenko and Ya. A. Fialkov. Doklady Akad. Nauk S.S.S.R. 107, 413-16 (1956). C.A. 50, 15180g.
The coordination formula of basic Cr sulfate remains controversial. SO_4^{2-} exchange reactions were studied, therefore, by using exceedingly small additions of $Na_2S^{35}O_4$ to the Cr sulfate solution. The difference in the SO_4^{--} exchange rates is attributed not to the existence of 2 unequal bonds, but of 2 complexes, which differ in the number of OH^- in the inner coordination spheres.

2056
ISOTOPIC EXCHANGE REACTION BETWEEN HEAVY OXYGEN AND CARBON DIOXIDE ON SILVER CATALYST. Hisashi Mori, Kozo Hirota, and Yasushi Kobayashi. Bull. Chem. Soc. Japan 28, 532-3 (1955). C.A. 50, 15191d.
The exchange reaction proceeds at 175-220°, although the desorption of O is very slow at 175-188°; the rate-determining step is the desorption of O atoms. Even when the catalyst is reduced at 300° for 5 hrs. some chemical species containing O atoms remain in the subsurface or bulk phase of the catalyst.

2057
INTERACTION OF DEUTERIUM WITH OLEFINS AND ALKANES ON CHROMIUM OXIDE GEL. Robert L. Burwell, Jr., and Anthony B. Littlewood. J. Am. Chem. Soc. 78, 4170-1 (1956). C.A. 50, 15191i.
In reactions between hydrocarbons and D_2, Cr oxide gel yields products that are isotopically much simpler than those obtained with metallic catalysts.

2058
STUDY OF OXYGEN EXCHANGE ON VANADIUM CATALYSTS WITH THE USE OF OXYGEN-18. L. Ya. Margolis and E. G. Plyshevskaya. Izvest. Akad. Nauk S.S.S.R., Otdel. Khim. Nauk 1952, 415-21. C.A. 50, 15192g.
The kinetics of activated adsorption of O on vanadium oxide catalysts was studied at 250-450°. O exchange was investigated for V_2O_4, V_2O_5, and $MgCr_2O_4$ by use of mass spectrometric methods to analyze the gaseous products. In the absence of moisture, O exchange with V_2O_5 and $MgCr_2O_4$ was not observed at 350°. With V_2O_4, under the same conditions, a small O exchange was observed that was increased by the presence of water.

2059
ISOTOPES. Joseph Silverman and Karl Cohen. Ann. Rev. Phys. Chem. 7, 335-58 (1956). C.A. 50, 15204a.
Review article covering the literature for 1954-1955.

2060
HETEROGENEOUS EXCHANGE BETWEEN METHYL BROMIDE AND BROMINE-80 (18 min.) GENERATED BY ISOMERIC TRANSITION. R. Coekelbergs, P. A. Gosselain, and M. J. van der Venne. Bull. soc. chim. Belges 64, 798-812 (1955). C.A. 50, 15244.
The reaction rate between chemisorbed Br^{80} (18 min.) and physically adsorbed MeBr adsorbed at the wall agrees with experiment between 22.5-111°.

2061
ESTIMATE OF THE COST OF PRODUCING NITROGEN-15 BY CHEMICAL EXCHANGE. AMMONIA-AMMONIUM CARBONATE SYSTEM USING CALCIUM HYDROXIDE REFLUX. B. B. Klima and W. T. Ward. 1955, 152 pp. (CF-55-1-20), Oak Ridge National Laboratory. C.A. 50, 15246i.

2062
ISOTOPIC COMPOSITION OF HYDROGEN OF THE GAS OF LACQ. Étienne Roth. Compt. rend. 242, 3097-100 (1956). C.A. 50, 15276i.
The D content of the H extracted from the CH_4 fraction is 150 p.p.m. which corresponds to the value in the H of surface waters. The D content of the H extracted from the H_2S is 90 ± 10 p.p.m. This lower value probably results from an isotopic exchange reaction between H_2O and H_2S.

2063
ISOTOPE ENRICHMENT BY COUNTERCURRENT ELECTROMIGRATION IN MOLTEN SALTS. Arnold Lunden. Doktorsavhandl. Chalmers Tek. Högskola No. 12, 114 pp. (1956). C.A. 50, 15277d.
A review is given of the theory of the isotope enrichment process. The apparatus is described and data are presented for the enrichment of various isotopes of the cations of $ZnCl_2$, $ZnBr_2$, CuCl, $PbCl_2$, $LiNO_3$, LiBr, and KNO_3, and of the anions of $PbCl_2$, $PbBr_2$, and $ZnCl_2$. A summary is given of methods of enrichment of various isotopes of Li, Mg, Cl, K, Ca, Cu, Zn, Ga, Br, Rb, Sr, Ag, Cd, In, Sn, rare earths, Tl, and Pb. 272 references.

2064
OXYGEN ISOTOPE EFFECTS AT ANODES. Michael Anbar and Henry Taube. J. Am. Chem. Soc. 78, 3252-5 (1956). C.A. 50, 15293f.
The isotope fractionation factor for O liberated from H_2O at an anode showed considerable variation with the nature of the electrode material, but was independent of

current density, at least over a limited range. Mechanisms of the reaction were discussed. Tracer experiments with PbO_2 and MnO_2 as electrode material showed that none of the anode O appeared as O_2. Rapid exchange of the oxide electrode with H_2O was induced when the material functioned as an anode.

2065
ATOM TRANSFER AND ELECTRON EXCHANGE PROCESSES WITH COBALT COMPLEXES. Arthur W. Adamson. Rec. trav. chim. 75, 809-14 (1956). C.A. 50, 15318d.
The mechanism is discussed for various atom transfer and electron exchange reactions of cobalt complexes.

2066
THERMAL DIFFUSION COLUMN FOR CONCENTRATING TRITIUM IN TRITIUM-HYDROGEN MIXTURES. E. Almqvist, K. W. Allen, and J. H. Sanders. Rev. Sci. Instr. 26, 649-51 (1955). C.A. 50, 16189g.
Tritium concentrations in mixtures with H have been increased from 2 to 20% tritium by means of the hot wire diffusion column described. Following the design of Clusius and Dickel, the column, made of stainless steel and with a heating element of W wire, was 1.43 cm. in radius and 350 cm. long. By water-cooling the jacket and by using an operating temperature of 750° for the wire, a separation factor of 680 was obtained during the 5-hr. runs.

2067
BASIC CONSIDERATIONS IN THE CALUTRON PROCESS. E. Gardner and A. Guthrie. 1949 (decl. Apr. 15, 1955), pp. 3-10 (TID-5217). C.A. 50, 16189h.
Isotopic separations by using a magnetic deflection of an accelerated charged beam of U^{235} and U^{238} ions are described. The spacial separation of these isotopes at the collector was calculated and the necessity for beam focusing was discussed.

2068
THE ALPHA 3 AND 4 PROGRAMS. W. E. Parkins. 1949 (declassified Apr. 15, 1955), pp. 279-95 (TID-5217). C.A. 50, 16190e.
The cost of apparatus for separating U^{235} from U^{238} is described. The studies performed in the development of the apparatus are described.

2069
ISOTRON. R. R. Wilson. 1949 (declassified Apr. 15, 1955), pp. 299-333 (TID-5217). C.A. 50, 16190f.
The development of the isotron (an electromagnetic device for separating isotopes) is described. The theory and methods for using radiofrequency voltages for the separation of U^{235} and U^{238} are described.

2070
ISOTOPE EXCHANGE ON MANGANESE DIOXIDE WITH OXYGEN AND STEAM. L. A. Kasatkina and G. K. Boreskov. Zhur. Fiz. Khim. 29, 455-62 (1955). C.A. 50, 16225c.
Isotopic exchange was measured by variations in O^{18} concentration between active MnO_2 and O_2 at 200-350°C, active MnO_2 and water vapor at 200 to 300°C, and β-MnO_2 and O_2 at 350 to 400°C.

2071
DETERMINATION OF THE DISSOCIATION VELOCITY CONSTANT OF HYDROGEN ON A PALLADIUM SURFACE FROM THE DIFFUSION OF HYDROGEN THROUGH PALLADIUM. V. B. Kazanskiĭ, R. E. Mardaleishvili, V. P. Strunin, and V. V. Voevodskiĭ. Zhur. Fiz. Khim. 30, 821-6 (1956). C.A. 50, 16226c.
The numerical value of the constants and the activation energy were determined experimentally by measuring the diffusion rate of H through a Pd capillary at 140, 160, 180, and 200°, and at H_2 pressures of 100-600 mm. Hg. The rate and the activation energy of the H/D exchange from the k_0 value found, assuming a dissociative mechanism, and the calculations were compared with experimental results. The agreement between the 2 justified the conclusion that at 140-160° the reaction $H_2 + D_2 \rightarrow 2HD$ proceeds by a dissociation-association mechanism.

2072
THE DETERMINATION OF THE RELATIVE VAPOR PRESSURES OF $C^{13}H_4$ AND $O^{18}{}_2$ BY THE RAYLEIGH DISTILLATION METHOD. G. G. Devyatykh and A. D. Zorin. Zhur. Fiz. Khim. 30, 1133-9 (1956). C.A. 50, 16228b.
The apparatus constructed is shown in considerable detail, and the method of operation is described. The relative vapor pressure of $C^{12}H_4$ to $C^{13}H_4$ and of $O^{16}{}_2$ to $O^{18}{}_2$ were investigated from their normal b.ps. to their triple points. The results can be expressed by $\ln(P_{C^{12}H_4}/P_{C^{13}H_4}) = 0.00396 + (0.6689/T)$, and $\ln(P_{O^{16}{}_2}/P_{O^{18}{}_2}) = (0.849/T) - 0.000451$. It was concluded from these results that CH_4 is a convenient material for the C^{13} concentration, while molecular O_2 can hardly be used for the O^{18} concentration by fractional distillation.

2073
METHODS FOR THE HYDROGEN-ISOTOPE EXCHANGE STUDY IN LIQUID DEUTERIUM BROMIDE. V. R. Kalinachenko, Ya. M. Varshavskiĭ, and A. I. Shatenshteĭn. Zhur. Fiz. Khim. 30, 1140-3 (1956). (English translation AEC-tr-2976). C.A. 50, 16294d.
The apparatus used and the methods of study of H-isotope exchange between organic compounds and liquid DBr are described.

2074
EFFECT OF ISOTOPIC SUBSTITUTION IN HYDROGEN-BROMINE FLAMES. Mitchell Gilbert and David Altman. J. Chem. Phys. 25, 377-8 (1956). C.A. 50, 16298i.
The effect of isotopic substitution, D for H, was studied recently (Cooley and Anderson, C.A. 49, 3627h) and the ratio of flame speeds U_{HBr}/U_{DBr} was found by experiment to be 1.55 to 1.59. Flame equations based on the steady-state theory predict a value of 1.65.

2075
KINETICS OF DEUTERIUM EXCHANGE BETWEEN ACETYLENE AND WATER. Irving F. Stacy. Univ. Microfilms. Publ. No. 17099, 110 pp. Dissertation Abstr. 16, 1353 (1956). C.A. 50, 16299g.

2076
KINETICS OF THE THALLIUM(I)-THALLIUM(III) EXCHANGE REACTION IN THE PRESENCE OF BROMIDE. Lee G. Carpenter. Univ. Microfilms. Publ. No. 17044, 71 pp. Dissertation Abstr. 16, 1348 (1956). C.A. 50, 16299i.

2077
STUDY OF HYDROGEN EXCHANGE BY KINETIC METHODS. S. Z. Roginskiĭ. Ukrain. Khim. Zhur. 22, 24-33. C.A. 50, 16300i.

Comprehensive review with 17 references.

2078
HYDROGEN EXCHANGE OF ALDEHYDES, KETONES, AND ACIDS WITH MINERAL ACIDS. V. N. Setkina. Ukrain. Khim. Zhur. 22, 38-9. C.A. 50, 16300i.

Discussion.

2079
HYDROGEN BONDS AND TRANSFER OF PROTON. N. D. Sokolov. Ukrain. Khim. Zhur. 22, 19-22. C.A. 50, 16300i.

A discussion with 16 references.

2080
HYDROGEN EXCHANGE OF CARBONIUM IONS AND OF CARBONYL COMPOUNDS WITH ACIDS AND WITH DEUTERIUM OXIDE IN ALKALINE MEDIUM. D. N. Kursanov. Ukrain. Khim. Zhur. 22, 34-7. C.A. 50, 16300i.

Discussion.

2081
MECHANISM OF HYDROGEN EXCHANGE IN SOLUTIONS. A. I. Shatenshtein. Ukrain. Khim. Zhur. 22, 3-10 (1956). C.A. 50, 16300i.

A review with 20 references.

2082
HYDROGEN EXCHANGE IN SOLUTIONS. A. I. Brodskiĭ. Ukrain. Khim. Zhur. 22, 11-18. C.A. 50, 16300i.

A review with 27 references.

2083
MOBILITY OF HYDROGEN ATOMS IN THE TOLUENE NUCLEUS. A. I. Brodskiĭ and I. I. Kukhtenko. Problemy Mekhanizma Org. Reaktsiĭ, Akad. Nauk Ukr. S.S.R., Otdel. Fiz.-Mat. i Khim. Nauk 1953, 194-8. C.A. 50, 16301b.

No D-H exchange is found between the H atoms of the Me group and those of ortho positions in toluene in experiments in which toluene labeled with D in the ortho position was treated at room temperature with 6% HOBr and the resulting Br derivatives were oxidized to bromobenzoic acids which were then examined for D content.

2084
THE DEUTERIUM DISTRIBUTION IN THE HYDROGEN ISOTOPE EXCHANGE. Ya. M. Varshavskiĭ and S. E. Vaĭsberg. Zhur. Fiz. Khim. 29, 523-32 (1955). C.A. 50, 16301f.

The published results on the D distribution are analyzed. The D distribution coefficient between two components can be expressed as a ratio of 2 values (the "β-factor"), which are characteristic of the 2 components, and can be computed from the principal vibration frequencies. The values of the β-factors have been calculated for a large number of H-containing substances; also the D distribution coefficient between the vapors of these substances, and the temperature dependence of the β-factor.

2085
THE EFFECT OF SOLVENT ON THE RATE OF ISOTOPE EXCHANGE OF THE REACTION $C_3H_7I + I^{131}$ AT PRESSURES OF UP TO 2500 KG./SQ. CM. M. G. Gonikberg, V. B. Miller, M. B. Neĭman, F. S. D'yachkovskiĭ, G. I. Likhtenshteĭn, and A. A. Opekunov. Zhur. Fiz. Khim. 30, 784-8 (1956). C.A. 50, 16304c.

The reaction kinetics of the interaction of PrI with I^{131} in anhydrous and in aqueous EtOH solutions of 0.1M KI and 0.5M PrI solutions and a 0.005M concentration of both substances in acetone were studied at pressures up to 500 kg./sq. cm. in a specially designed apparatus.

2086
THE REACTION OF DEUTERIUM ATOMS WITH ETHYLENE. S. Toby and H. I. Schiff. Can. J. Chem. 34, 1061-73 (1956). C.A. 50, 16308b.

The reactions of H atoms and D atoms with C_2H_4 were very rapid. The effects on the yields of the products and on their isotopic composition of variations of reactant flow rate, atom concentration, pressure, and atom detector position were studied.

2087
HYDROGEN EXCHANGE IN SATURATED HYDROCARBONS DURING ACTION ON THEM OF SULFURIC ACID. V. N. Setkina, D. N. Kursanov, O. D. Sterligov, and A. L. Liberman. Problemy Mekhanizma Org. Reaktsii, Akad. Nauk Ukr. S.S.R., Otdel. Fiz.-Mat. i Khim. Nauk 1953, 199-205. C.A. 50, 16314f.

Treatment of a variety of alkanes with 1 to 3 parts H_2SO_4 at room temperature with the use of D-labeled H_2SO_4 showed that hydrocarbons with tertiary C atoms are capable of D-H exchange, whereas other types are not.

2088
RESONANCE METHOD. J. R. Richardson. 1949 (declassified Apr. 15, 1955), pp. 396-419 (TID-5217). C.A. 50, 16364e.

Isotope separation by imparting energy to an ion by using an oscillating electric field perpendicular to a static magnetic field is described. The equation describing the motion of an ion in the crossed fields is given.

2089
RATE OF ELECTRON EXCHANGE BETWEEN CUPROUS AND CUPRIC IONS IN HYDROCHLORIC ACID SOLUTIONS BY NUCLEAR MAGNETIC RESONANCE. H. M. McConnell and H. E. Weaver, Jr. J. Chem. Phys. 25, 307-11 (1956). C.A. 50, 16374b.

A determination of the Cu^{63} nuclear resonance line width in concentrated HCl solutions containing both Cu^+ and Cu^{++} chloride yielded a value of $k = 0.5 \times 10^8$ l./mole-sec. for the reaction, $Cu^{++} + Cu^+ = Cu^+ + Cu^{++}$. This rate presumably represents the fastest electron-exchange process between metallic ions yet measured in aqueous solution.

2090
SEPARATION OF ISOTOPES OF SILICON BY THE METHOD OF RECTIFICATION OF SILICON TETRACHLORIDE. V. Yu. Orlov and N. M. Zhavoronkov. Zhur. Priklad. Khim. 29, 959-60 (1956). J. Appl. Chem. U.S.S.R. 29, 1047-9 (1956)(English translation). C.A. 50, 16451g.

An attempt was made to separate the isotopes of Si by rectification of $SiCl_4$. Rectification under atmospheric pressure was continued for 12 days in a glass column 25 mm. in diameter and 1.5 m. high packed with stainless steel wire spirals at 57° ± 0.5 to 1°. The proportion of the isotopic composition of Si, 28, 29,

and 30 was 92.16 ± 0.04, 4.70 ± 0.02, and 3.14 ± 0.03. The enrichment was low and this method of separation was not considered practicable.

2091
MASS-SPECTROSCOPIC ISOTOPE ENRICHMENT. James M. Carter and Martin D. Kamen. U. S. 2,758,006, Aug. 7, 1956. C.A. 50, 16460b.

Two-stage use of Lawrence's calutron (U.S. 2,709,222) results in a product with a $U^{238}:U^{235}:U^{234}$ ratio of 257:737:6 from natural U. The enrichment factor of 400 is obtained by use of a large number of 1st-stage calutrons with an enrichment factor of 20 and of a small number of 2nd stage calutrons operating similarly.

2092
NATURE OF SOME NITROSYL CHLORIDE ADDITION COMPLEXES. J. Lewis and D. B. Sowerby. Rec. trav. chim. 75, 615-19 (1956). C.A. 50, 16512c.

The exchange of Cl^{36} between solvent NOCl and $NOCl \cdot FeCl_3$, $NOCl \cdot SbCl_5$, $AsCl_3$, and CCl_4 was investigated. The exchange with the Sb and Fe complexes is rapid as would be expected since they have been shown to exist as $NO^+(FeCl_4)^-$ and $NO^+(SbCl_6)^-$. No exchange was observed in CCl_4, where there are no orbitals available for complexing. Complete exchange was observed between $AsCl_3$ and NOCl, which could involve either $AsCl_2^+$ or $AsCl_4$.

2093
SULFUR ISOTOPE ABUNDANCES IN SULFIDE MINERALS. J. L. Kulp, W. U. Ault, and H. W. Feely. Econ. Geol. 51, 139-49 (1956). C.A. 50, 16581b.

The S^{32}/S^{34} ratios of about 80 sulfides were measured. A high ratio in hydrothermal sulfides suggests a source initially high in sedimentary sulfide; a low ratio, one initially high in sulfate. The S isotope abundances seem to bear no relation to mineral species, crystal habit, and rate and temperature of deposition. For most sulfides, the S^{32}/S^{34} ratio is about 22.2.

2094
EQUILIBRIUM PROPERTIES OF ISOTOPE EXCHANGE REACTIONS OF WATER AND HYDROGEN. Joe C. Bradley. Oct. 15, 1955. 8 p. (NBS-3329). NSA 10, 63.

Tables are given from which various equilibrium properties involving isotopic exchange reactions for molecular H and isotopic water molecules can be calculated.

2095
THE PRODUOTION OF HEAVY WATER AT TRAIL, B.C. E. A. Barlow. Mar. 8, 1948. 17 p. (CRE-374). NSA 10, 628.

The heavy water plant was built as an addition to an electrolytic hydrogen production plant. The combined plants consist of 3 parts: a primary plant of 4 stages including the original electrolytic H plant plus certain modifications and the catalytic exchange towers; a secondary plant of 3 stages built especially for D_2O production; and a control laboratory. The plants are described, and flowsheets and typical operating data are presented.

2096
ELECTROMAGNETIC SEPARATION OF ISOTOPES IN COMMERCIAL QUANTITIES. R. K. Wakerling and A. Guthrie, eds. June 1949 (Decl. Apr. 15, 1955) 434 p. (TID-5217). NSA 10, 1863.

Papers have been selected and compiled for the purpose of giving a complete picture of the history and development of electromagnetic isotope separation. Calutron considerations, space charge and beam plasma, magnetic shimming, electric focusing, accelerating electrode focusing, the isotron, the ionic centrifuge, radial magnetic separators, resonance separation, and grid-slit systems are discussed.

2097
THE HYDROGEN-WATER VAPOR EXCHANGE REACTION ON METAL CATALYSTS. Progress Report. Mar. 10, 1942.(Decl. Dec. 6, 1955). 9 p. (A-149). NSA 10, 2305.

The velocity of the exchange reaction, $H_2(g) + HDO(g) = H_2O(g) + HD(g)$, was measured in the forward and reverse directions, at 56.5, 64.5 and 80°C using metallic catalysts of Pt and Ni.

2098
PLATE EFFICIENCY IN THE EXCHANGE OF DEUTERIUM BETWEEN AMMONIA AND HYDROGEN. Morris L. Perlman and Jacob Bigeleisen. Dec. 3, 1951. (Decl. Dec. 3, 1955). 7 p. (BNL-143). NSA 10, 2306.

Data on Murphree plate efficiencies under flow conditions comparable with those considered for the production of deuterium by the exchange of D between ammonia and H are given.

2099
THE CONCENTRATION OF DEUTERIUM BY CHEMICAL EXCHANGE BETWEEN HYDROGEN AND AMMONIA. J. Bigeleisen and M. L. Perlman. Dec. 15, 1951. (Decl. Dec. 6, 1955). 5 p. (BNL-146). NSA 10, 2307.

A process is described for the production of deuterium using the exchange of hydrogen between hydrogen gas and liquid ammonia.

2100
AN EVALUATION OF THE FEASIBILITY OF UTILIZING THE EXCHANGE OF HYDROGEN BETWEEN PHOSPHINE AND WATER FOR THE PRODUCTION OF D_2O. J. Bigeleisen and R. E. Weston, Jr. Feb. 1952. (Decl. Dec. 5, 1955). 5 p. (BNL-156). NSA 10, 2308.

The relative efficiencies of the H_2S-H_2O and PH_3-H_2O systems when operated in a set of dual-temperature columns were evaluated from the equilibria $HDS(g) + H_2O(g) = H_2S + HDO(g)$ and $PH_2D(g) + H_2O(g) = PH_3(g) + HDO(g)$. Advantages of the two systems are discussed.

2101
THE SEPARATION OF THE STABLE ISOTOPES OF NICKEL. J. R. Patton and C. P. Keim. Aug. 9, 1948.(Decl. Dec. 6, 1955.) 33 p. (Y-328). NSA 10, 2336.

A comprehensive report is given covering the concentration of nickel isotopes 58, 60, 61, 62 and 64. Calutron operations, chemical refinement, isotopic assays, enhancement, and inventory quantities are included.

2102
INVESTIGATION OF THE PHOTOCHEMICAL METHOD FOR URANIUM ISOTOPE SEPARATION. H. C. Urey. July 10, 1943. (Decl. Dec. 8, 1955) 97 p. (A-750). NSA 10, 2471.

2103
AN ATTEMPTED SEPARATION OF MERCURY ISOTOPES. Walter Kauzmann. Apr. 30, 1942. (Decl. Dec. 21, 1955). 5 p. (AECD-3726). NSA 10, 2797.

Equilibrium of heavy atoms between two states was investigated as a possible means for the separation of isotopes. It was planned to apply the method in the separation of U isotopes. Preliminary studies were conducted on the partition of Hg between aqueous solution and metallic Hg. After a careful check of results, it was concluded there is no basis, either theoretical or experimental, for expecting any considerable separation by processes of the type employed.

2104
CALUTRONS. E. O. Lawrence. U. S. Patent 2,727,150. December 13, 1955. NSA 10, 3077.

A calutron transmitter having an ion source at a high positive potential with respect to the calutron tank is modified to minimize the high voltage current drain to reduce wear and erosion of the electrodes.

2105
EXCHANGE OF DEUTERIUM BETWEEN MERCAPTANS AND WATER. Clyde Hutchison and Daniel Gillies. July 9, 1943. (Decl. Dec. 8, 1956.) 40 p. (A-754). NSA 10, 3462.

Isopropyl mercaptan was investigated as a possible substance for use in the extraction of deuterium from water by the dual temperature process. Data are presented from studies on the equilibrium separation coefficients for the exchange of D between water and mercaptans at various temperatures; the rates of exchange of D between mercaptans and water; the settling rates of water-mercaptan emulsions; the solubility of isopropyl mercaptan in water and the solubility of water in isopropyl mercaptan; the corrosive action of mercaptans on steel; and the hydrolysis of alkaline solutions of isopropyl mercaptan.

2106
EVALUATION OF HEAVY WATER PRODUCTION AT GASEOUS DIFFUSION PLANT SITES. S. Blumkin, R. W. Dehoney, and J. Shacter. Nov. 26, 1951. (Decl. Dec. 27, 1955.) 16 p. (K-843). NSA 10, 3464.

The production of heavy water by distillation, utilizing heat available from other process sources--specifically at a gaseous diffusion site--is discussed. The high temperature-high pressure process, because of the low relative volatility, requires a very large and costly cascade of distillation columns. The low temperature-low pressure process, involving larger relative volatility, appears to be more economical. On a quick design basis, neither process can furnish heavy water at unit costs which compete with those predicted for other methods of separation.

2107
EXCHANGE OF URANIUM BETWEEN U^{4+} AND UO_2^{2+} IN DILUTE ACID SOLUTION. R. W. Woodard, D. A. Lee, and J. S. Drury. June 21, 1948. (Decl. Dec. 6, 1955.) 25 p. (Y-184) NSA 10, 3571.

By the use of tracer technique it was found that under certain conditions an interchange of U atoms takes place between uranous, U^{4+}, and uranyl, UO_2^{2+}, ions. Quantitative experiments were carried out to find the effect of various factors on the rate of U interchange. The factors investigated were H ion concentration, temperature, and light.

2108
RATE OF EXCHANGE OF URANIUM BETWEEN URANOUS AND URANYL IONS IN AQUEOUS SOLUTION. D. G. Hill. Sept. 2, 1949. (Decl. Dec. 6, 1955) 16 p. (Y-478). NSA 10, 3576.

A mechanism is proposed for the reaction on the assumption that the rate measured is the rate of combination of U^{4+} and UO_2^{2+} to form UO_2^{+}. The measured dependence of the reaction rate upon acidity is that predicted by this mechanism.

2109
THE EXCHANGE REACTION BETWEEN SUBSTITUTED BENZYL IODIDES AND POTASSIUM IODIDE. V. p-CHLOROBENZYL IODIDE. Milton Kahn and J. L. Riebsomer. Nov. 1955. 8 p. (LA-1972UNM). NSA 10, 3998.

A measurable exchange has been observed in CH_3OH and C_2H_5OH between the iodine atom in p-chlorobenzyl iodide and I^- in KI. The exchange reaction was investigated over a temperature range from 0 to 30.9°C.

2110
PROGRESS REPORT OF THE CHEMISTRY DEPARTMENT. CONCENTRATION OF DEUTERIUM BY CHEMICAL EXCHANGE PROCESSES. Interim Report for April 15-July 1, 1951. Jacob Bigeleison, Norman Elliott, Lewis Friedman, A. P. Irsa, Arthur Kant, Morris L. Perlman, and Herbert C. Prosser. Aug. 1951. (Decl. Jan. 5, 1956.) 20 p. (BNL-118). NSA 10, 5126.

Equilibrium in the reaction $NH_3(g) + HD(g) \rightleftharpoons NH_2D(g) + H_2(g)$ was measured in the temperature range 210 to 295°K. The zero point energy difference between NH_3 and NH_2D is calculated. Calculations show that the NH_3-HD exchange is 6 times as efficient as the HDS-H_2O exchange under proposed plant operating conditions. Data are included on the effect of various contacting conditions on the exchange of D_2 between hydrogen and liquid NH_3 catalyzed by KNH_2.

2111
ELECTROLYTIC P-9 PRODUCTION OPERATING MANUAL. W. M. Harty. Sept. 1, 1945. (Decl. Jan. 12, 1956.) 84 p. (M-3132). NSA 10, 5127.

Operating procedures for the concentration of D_2O and eventual production of 99.8% D_2 are outlined.

2112
DEUTERIUM SEPARATION STUDY. DISTILLATION OF AMMONIA AND OF METHANE. Progress Report No. 3 (on HEAVY WATER MANUFACTURE SURVEY). William P. Drews. Oct. 4, 1955. (Decl. Jan. 12, 1956) 22 p. (NYO-7522). NSA 10, 5128.

Attached to this report is a letter containing pertinent data to Morris Goldberg from Frank T. Barr. Oct. 4, 1955. 3 p.

An evaluation of the distillation-type process for the production of heavy water

is presented. Neither ammonia nor methane distillation appears to be economically feasible.

2113
P-10 CHEMICAL EQUILIBRIA. W. C. Roesch. Mar. 23, 1950. (Decl. Jan. 12, 1956.) 4 p. (HW-17318). NSA 10, 5186.
Information is briefly noted on equilibria of T_2-H_2O and HT-H_2O exchange reactions.

2114
ISOTOPE ENRICHMENT BY COUNTERCURRENT ELECTROMIGRATION IN MOLTEN SALTS (thesis). Arnold Lundén. 1956. 114 p. (NP-5992). NSA 10, 5810.
Up to the present date isotopes of Li, Cl, K, Cu, Zn, Br, Ag, Cd, Tl, and Pb have been enriched by countercurrent electromigration in molten chlorides, bromides and nitrates. The theory of the experiments is reviewed briefly and systematical relations between the observed mass effects are discussed. Different properties of the separation columns are studied. Glass packed columns have 20 to 50 theoretical plates per cm length while quartz packed columns have 5 to 10. Attempts by various methods to enrich isotopes of Li, Mg, Cl, K, Ca, Cu, Zn, Ga, Br, Rb, Sr, Ag, Cd, In, Sn, rare earths, Tl, and Pb are reviewed.

2115
DISTRIBUTION COEFFICIENT OF D_2O BETWEEN TRIETHYLAMINE AND WATER. H. C. Carlson. Aug. 31, 1943. (Decl. Jan. 30, 1956.) 3 p. (AECD-4085). NSA 10, 6137.
Deuterium was not preferentially concentrated by a triethylamine extraction of enriched water.

2116
AN INVESTIGATION OF THE ACTIVATED CELLULOSE COLUMN AS AN ISOTOPE SEPARATION DEVICE. John S. Drury. June 8, 1951. (Decl. Jan. 6, 1956.) 13 p. (Y-777). NSA 10, 6329.
An investigation was made to determine whether a significant isotope partition could be observed by eluting certain lithium compounds through a column packed with treated cellulose. No significant change was found in the isotopic ratio of the leading edges of five runs made under various conditions.

2117
THE VAPOR PRESSURE OF A MIXTURE OF H_2O AND D_2O. C. F. Hale and George D. Oliver. Nov. 24, 1952. (Decl. Jan. 5, 1956.) 7 p. (K-979). NSA 10, 6341.
The vapor pressure of a 50-50 mole % mixture (HDO) of H_2O and D_2O and the difference in pressure of H_2O and HDO from 160 to 3143 psia. have been determined by means of a high pressure ebulliometer. A plot of the data shows the vapor pressures of H_2O, D_2O, and HDO to be equal at 220.7° C. and 340.9 psia. The vapor pressure of HDO is an average of that of H_2O and D_2O.

2118
HEAVY-WATER PRODUCTION METHODS. A SURVEY OF SOME KNOWN PROCESSES. Nuclear Power 1, 9-16 (1956). NSA 10, 6560.
After discussion of the principles involved, the article describes in some detail plants which have been used for heavy-water production or which are projected, and concludes with some suggestions on the form which future plants might take.

2119
GENERAL REPORT OF STABLE ISOTOPE SEPARATION. W. R. Ketler, L. G. Chelius, and C. P. Keim. Jan. 20, 1947. (Decl. Jan. 27, 1956.) 30 p. (AECD-4157). NSA 10, 7284.
The calutron was successfully employed to separate the stable isotopes of twenty-one elements.

2120
CALCULATION OF THE PERFORMANCE OF EXCHANGE TOWER IN THE PRODUCTION OF HEAVY WATER. Harrison C. Carlson and J. O. Maloney. Oct. 7, 1942. (Decl. May 14, 1954.) 51 p. (A-327). NSA 10, 7504.
Procedures are outlined for the concentration of D_2O from natural water by an electrolytic-oxidation treatment. A rapid graphic method is presented for analyzing the performance of the concentrating cascades used.

2121
THE DESIGN OF CASCADES FOR THE CONCENTRATION OF DEUTERIUM. Irving Kaplan and Karl Cohen. Oct. 19, 1942. (Decl. May 14, 1954.) 31 p. (A-335). NSA 10, 8231.
An analytical theory of the design of cascades for the concentration of deuterium is worked out. The cascades considered are made up of stages, each consisting of an exchange tower and a bank of electrolytic cells. Section II deals with the operation of a single exchange tower of the Barr type. Section III contains an analysis of a single stage, i.e., of a tower in series with cells. The design of the cascade as a whole is developed in Section IV. The number of sections and the volume of catalyst in a tower are found as functions of temperature, percentage attainment of equilibrium per section and over-all percentage recovery. Examples of the practical application of the theory, with special reference to the Trail plant, are given.

2122
HEAVY WATER PRODUCTION BY NATURAL WATER DISTILLATION. I. GENERAL CONSIDERATIONS. H. K. Rae. Oct. 1, 1954. 34 p. (CEI-73) NSA 10, 8232.
The economical production of heavy water by the distillation of natural water is discussed. A vapor compression cycle is suggested for heat recovery. Equipment requirements include grid-packed or wetted-wall distillation columns, inclined tube natural circulation evaporators, and an electric-motor-driven centrifugal compressor.

2123
A PRELIMINARY STUDY OF SOME ASPECTS OF A HEAVY WATER PLANT. Technical Memorandum No. 30. P. C. Vander Arend. Feb. 11, 1955. 20 p. (NBS-3519). NSA 10, 8233.
Even with the few distillation data in existence it appears that fractional distillation of hydrogen isotopes provides a very efficient process for the production of heavy water or deuterium gas of high purity.

2124
ISOTOPE EXCHANGE OF SULPHUR ATOMS IN ACCELERATING AND VULCANISING MATERIALS

IN THE PRESENCE OF DIPHENYLGUANIDINE AND PHENYL-β-NAPHTHYLAMINE. G. A. Bloch, E. A. Golubkova, and K. V. Kurskaya. Translated by S. Botcharsky from Doklady Akad. Nauk S.S.S.R. 105, 275-8 (1955). 7 p. (AERE-Lib/Trans-725). NSA 10, 8292.

The exchange of sulfur between elemental S and mercaptobenzothiazol (Captax) at 100 and 125°C in the presence of diphenylguanidine (DPG) and phenyl-β-naphthylamine was investigated. Results indicated that DPH increased the rate of isotopic exchange while phenyl-β-naphthylamine had no effect on the exchange rate.

2125
OPTIMUM DESIGN OF CATALYTIC TOWERS. Harris Mayer. Mar. 12, 1943. (Decl. May 14, 1954). 9 p. (AECD-3739). NSA 10, 8521.

An arithmetic method is given for computing the number of sections required in a catalytic tower to produce a given enrichment. It also enables one to calculate the enrichment of a tower with a given number of sections. The problem of the most economical design of catalytic towers is solved. Methods are given for determining the temperature, the efficiencies of catalyst beds and strippers, the relative production rate, and the water vapor-hydrogen gas ratio which give the optimum combination of operating pressure, cross sectional area, number of sections, and volume of catalyst in the tower.

2126
LOW TEMPERATURE DISTILLATION OF HYDROGEN ISOTOPES. B. M. Abraham and H. E. Flotow. Dec. 1953. (Decl. Dec. 5, 1955). 10 p. (ANL-5204). NSA 10, 8922.

In low-temperature distillation of T, the distillation column must dissipate the heat generated by the β decay. It consists of a double Dewar cryostat, a glass distillation column, and a vacuum line. The external Dewar contained N_2 and the inner, liquid H_2. A manometer measured the pressure in the still. A mixture of 17 at. % H and 83 at. % D was distilled, with the changing pressure indicating changing isotopic composition. Tabulated results show that 99.7% pure D_2 can be obtained.

2127
THE KINETICS OF TWO ISOTOPIC EXCHANGE REACTIONS BETWEEN DIBORANE AND PENTABORANE (11) (thesis). Thomas Eugene Larson. June 1956. 70 p. (MCC-1023-TR-207). NSA 10, 9119.

The kinetics of two gas-phase isotopic exchange reactions between diborane and dihydropentaborane were studied. One reaction was the exchange of deuterium between diborane and dihydopentaborane. The second reaction was the exchange of B^{10} between the same two compounds. It was found in the study of the first reaction that all eleven of the hydrogens in dihydropentaborane will undergo exchange. In the second reaction it was found that all five of the borons in dihydropentaborane will undergo exchange.

2128
ENRICHMENT OF HEAVY WATER BY A BIOLOGICAL METHOD. John Webb. Nature 177, 988-9 (1956) May 26. NSA 10, 9454.

Separation factors varying from 1.15 to 3.0 were observed in the water percolation of barley.

2129
ECONOMIC PROBLEMS IN THE PRODUCTION OF HEAVY WATER BY DISTILLATION OF NATURAL WATER, USING THE THERMOELECTRIC CENTER. R. Casini. Energia nucleare (Milan) 3, 188-203 (1956). NSA 10, 10045.

2130
PRODUCTION OF D_2O FOR USE IN THE FISSION OF URANIUM. Harold C. Urey, Aristid V. Grosse, and George Walden. June 23, 1941. (Decl. May 21, 1956.) 32 p. (A-94). NSA 10, 10724.

Brief discussions of experimental methods, kinetics, and the catalysts used in the production of D_2O are presented.

2131
PRELIMINARY STUDIES FOR THE SEPARATION OF HD FROM H_2 BY RECTIFIED ABSORPTION. D. N. Hanson, C. d'A. Hunt, M. W. Cook, and J. L. Fick. Mar. 17, 1952. (Decl. Apr. 6, 1956.) 25 p. (UCRL-1723). NSA 10, 10777.

The feasibility of rectified absorption for the recovery and purification of HD from H_2 streams has been investigated. The absorbent considered was liquid nitrogen. The process appears to present no major engineering or operational problems. Cost calculations indicate that the process may be economically competitive with other processes. Process design was based on an estimated separation factor between H_2 and HD in this system. Experimental work has been undertaken to check the validity of this estimate and to investigate the possibility of using other absorbents such as hydrocarbons and fluorocarbons.

2132
THE CRYSTALLIZATION OF VITREOUS WATER AND HEAVY WATER. H. J. de Nordwall and L. A. K. Staveley. Trans. Faraday Soc. 52, 1061-6 (1956). NSA 10, 11090.

2133
COMPARISON OF DIFFERENT METHODS APPLICABLE TO THE SEPARATION OF THE URANIUM ISOTOPES. Harold C. Urey. [1942?] (Decl. with deletions Feb. 12, 1957). 22 p. (A-49 (del.)) NSA 10, 11593.

The effectiveness of thermal diffusion, Hertz diffusion, Maier diffusion, distillation, and chemical exchange methods for the separation of uranium isotopes is discussed.

2134
CHEAPER WAYS TO MAKE D_2O. Paul Harteck. Nucleonics 14, No. 9, 97-9 (1956). NSA 10, 11729.

General considerations involved in present D_2O production processes are reviewed. New methods are described and the economic feasibility discussed. The new methods involve distillation of liquid H_2, dual temperature H_2-H_2O exchange catalyzed by HCl radiation catalyzed exchange reactions, and radiation catalyzed production of H_2 from hydrocarbons.

2135
THERMAL DIFFUSION IN KRYPTON AND ARGON. J. W. Corbett and W. W. Watson. J. Chem. Phys. 25, 385-8 (1956). C.A. 51, 24g.

The mathematical description of a 2-bulb thermal diffusion experiment was extended to the case of multicomponent isotopic mixtures.

2136
INVERSION TEMPERATURE OF GASEOUS THERMAL DIFFUSION FACTORS. E. Kyle and C. J. G. Raw. J. S. African Chem. Inst. 9, 1-4 (1956). C.A. 51, 24i.
The thermal diffusion factor, α, of a binary mixture of gases including isotopic mixtures as the function of the temperature is discussed theoretically.

2137
CARBON-14 ISOTOPE EFFECT ON THE ION-EXCHANGE CHROMATOGRAPHY OF AMINO ACIDS. K. A. Piez and Harry Eagle. J. Am. Chem. Soc. 78, 5284-7 (1956). C.A. 51, 41g.
The ion-exchange chromatography on Dowex 50 of amino acids labeled with C^{14} was studied. Labeling of the C atom adjacent to an ionized atom, such as the 1- or 2-position in an α-amino acid slowed movement of the labeled molecules on the column with the result that the specific activity of successive fractions within the amino acid band increased.

2138
KINETICS OF COMPETITIVE ISOTOPIC EXCHANGE REACTIONS. L. R. Darbee, F. E. Jenkins, and G. M. Harris. J. Chem. Phys. 25, 605 (1956). C.A. 51, 53e.
Competitive reactions were treated mathematically. The procedure was used in a recent study of the relative rates of exchange of alkyl iodides with I^{131}-labeled molecular iodine.

2139
ISOTOPE EXCHANGE BETWEEN HEAVY WATER AND SOME HYDRATED POLY COMPOUNDS OF TUNGSTEN. V. I. Spitsyn and Yu. F. Berezkina. Doklady Akad. Nauk S.S.S.R. 108, 1088-91, (1956). Proc. Acad. Sci. U.S.S.S.R., Sect. Chem. 108, 331-4 (1956)(English trans.). C.A. 51, 53f.

2140
ISOTOPIC EXCHANGE OF OXYGEN BETWEEN FREE HYDROXYL RADICALS AND WATER. I. A. Kazarnovskiĭ, N. P. Lipichin, and M. Tikhomirov. Nature 178, 100-1 (1956). C.A. 51, 53h.
KO_3 reacts instantaneously with H_2O^{18}-enriched water according to the following reactions: $KO_3 + H_2O^{18} = KO^{18}H + OH + O_2$; $2OH = H_2O + \frac{1}{2}O_2$, and some H_2O_2; $OH + H_2O^{18} = O^{18}H + H_2O$; $2O^{18}H = H_2O^{18} + \frac{1}{2}O^{18}_2$. Not more than 15% of the OH forms H_2O_2. The degree of enrichment of the evolved O, referred to the total OH minus that used in the formation of H_2O_2, is 9.9 ± 1% at 20° and 10.9 ± 1% at 0°. The error in the determination of O^{18} is ± 2% of the measured amount. The exchange is independent of the pH of the solution.

2141
ISOTOPIC EXCHANGE BETWEEN DEUTERIUM AND HYDROCARBONS ON NICKEL-SILICA CATALYSTS. Robert L. Burwell, Jr., and Richard H. Tuxworth. J. Phys. Chem. 60, 1043-9 (1956). C.A. 51, 58g.
The effect of temperature of the ratio of D_2 to hydrocarbon, and of Ni crystallite size on the isotopic exchange reaction between hydrocarbon and D_2 was reported for $NiSiO_2$ catalysts that were characterized by the magnetic method of Selwood (S. et al., C.A. 49, 8644a). Cyclohexane and, to a lesser extent, heptane, cyclopentane, and (+) 3-methylhexane were used as test hydrocarbons.

2142
NITROGEN-15 COST WHEN PRODUCED BY THE AMMONIA-AMMONIUM CARBONATE SEPARATION PROCESS. B. B. Klima and W. T. Ward. Chem. Eng. Progr. 52, 381-7 (1956). C.A. 51, 10le.
Two plants were considered: one was designed to produce 1 lb. of 95 atom % N^{15}/day and the other, 50 lb./day. The cost of producing 1 lb./day of N^{15} is between $4,014 and $4,289, depending on process variations.

2143
EFFECT OF RADIATION UPON THE EXCHANGE OF HYDROGEN AND ETHANOL. John G. Burr, Jr. J. Chem. Phys. 25, 587 (1956). C.A. 51, 102h.
Sealed ampuls containing about 1.75 ml. of H_2, 5 μc. of T, and 1 ml. of dry, degassed EtOH were irradiated with γ-rays of approximately 10^{23} e.v./mole of EtOH. The exchange of H atoms was less than 0.002% of the H atoms available for exchange.

2144
SEPARATION OF $C^{14}O^{16}$ AND $C^{12}O^{18}$ BY THERMAL DIFFUSION. A. E. de Vries, A. Haring, and W. Slots. Physica 22, 247-8 (1956). C.A. 51, 638g.
A 5-m. column was used to measure the separation of a mixture of $C^{14}O^{16}$, $C^{12}O^{18}$, and $C^{12}O^{16}$ (the $C^{14}O^{16}$ being added in trace quantities and the $C^{12}O^{18}$ present in the natural concentration of 0.2%). The $C^{14}O^{16}$ is slightly more enriched at the bottom of the column than is the $C^{12}O^{18}$, the thermal diffusion factor between the $C^{14}O^{16}$ and $C^{12}O^{16}$ being about 15 ± 3% larger than for the $C^{12}O^{18}$:$C^{12}O^{16}$ mixture.

2145
OPTIMUM ENRICHMENT OF HEAVY WATER IN HOT-COLD COMBINATION COLUMNS. I. THE SINGLE-STAGE HOT-COLD COLUMN SYSTEM. K. Bier. Chem. Ing. Tech. 28, 625-32 (1956). (English translation, AEC-tr-2887). C.A. 51, 774.
The principles of the operation of a hot and a cold column in series are discussed for the countercurrent contact of water (containing a dispersed catalyst for D exchange) and H_2 gas. The upper column is operated at approximately 70° and the lower column at approximately 200°. Theoretical equations are developed for the effects of operating variables.

2146
THE MICROPORE FLOW OF H_2O AND D_2O THROUGH ACTIVATED CARBON RODS. M. E. Huber, E. A. Flood, and R. D. Heyding. Can. J. Chem. 34, 1288-1301 (1956). C.A. 51, 798i.
The flow rates of water adsorbed on activated charcoal were measured at temperatures between -24 and +35° and compared with the flow rate of adsorbed D_2O at 25°. The micropore flow rate of adsorbed water was described previously as a laminar flow of liquid adsorbate under a high-pressure gradient due to surface forces. The experimental results confirm this picture.

2147
THE EFFECT OF MOLECULAR STRUCTURE ON THE RATES OF ATOMIC AND IONIC ISOTOPE EXCHANGE REACTIONS. II. THE EFFECTS OF RADICAL ISOMERIZATION AND OF THE PRESENCE OF A DOUBLE BOND ON THE RATE OF ISOTOPE EXCHANGE OF HALOGEN RADICALS WITH HALIDE

IONS. M. B. Neĭman, V. B. Miller, and Yu. M. Shapovalov. Zhur. Fiz. Khim. 29, 892-7 (1955). C.A. 51, 819a.

The isotope exchange rate of iso-PrBr and iso-PrI with the corresponding halide isotope ions in 90% EtOH, and the effects of the π-σ linkage on the isotope exchange rate were studied. III. THE EFFECTS OF AN ACCUMULATION OF HALOGEN ATOMS ON A CARBON ATOM ON THE RATE OF ISOTOPE EXCHANGE OF METHANE HALOGEN DERIVATIVES. Ibid. 1042-9. The alkyl isotope exchange with the halide ions may proceed by an ionic-molecular mechanism, accompanied by a configuration inversion, or by an ionization mechanism. The ionization mechanism was proven for the CBr_4 ionic exchange in an alkaline solution. The ionic halogen exchange is slowed down when the halogen atoms are grouped around one C atom.

2148

ISOTOPE FRACTIONATION STUDIES OF REACTIONS WITH CLEAVAGE OF A CARBON-14 TO HYDROGEN BOND IN THE RATE-DETERMINING STEP. Gus A. Ropp and Ernest M. Hodnett. J. Chem. Phys. 25, 587-8 (1956). C.A. 51, 819d.

The chromic acid oxidation of $MeHC^{14}OHMe$ to $MeC^{14}OMe$ and of $PhC^{14}H_2OH$ to $PhC^{14}HO$ were studied at 37.5°. In the former oxidation, k_{C12}/k_{C14} had a mean value of 1.035 whereas the 2nd oxidation exhibited no measurable fractionation. The competitive C^{14} isotope effect in the oxidation of 2-propanol may be a composite of (a) the isotope effect in the oxidation of 1 molecule of 2-propanol by $HCrO_4^-$ and (b) the subsequent and more rapid oxidation of 2 molecules of 2-propanol by Cr(IV) and Cr(VI).

2149

THE KINETICS OF HYDROGEN-ISOTOPE EXCHANGE REACTIONS. V. PARTIAL RATE FACTORS FOR THE HYDROGEN-ISOTOPE EXCHANGE REACTION BETWEEN TOLUENE AND SULFURIC ACID. V. Gold and D. P. N. Satchell. J. Chem. Soc. 1956, 2743-6. C.A. 51, 819f.

2150

EXCHANGE OF TRITIUM BETWEEN TCl AND TOLUENE WITH AND WITHOUT CATALYST. Alan E. Comyns, Reed A. Howald, and John E. Willard. J. Am. Chem. Soc. 78, 3989-93 (1956). C.A. 51, 824i.

Mixtures of tritium-labeled HCl with toluene showed no isotopic exchange when heated at 140° for 40 hrs. The addition of either NO_2 or $SnCl_4$ resulted in exchange even at room temperature. Mixtures of tritium labeled HCl with mesitylene at 140° gave erratic exchange, with the rate, in the absence of impurities, always being less than 0.03% per sec.

2151

ISOTOPE EXCHANGE BETWEEN DIFFERENT TYPES OF SALTS OF NIOBIC ACID. V. A. Pchelkin, A. V. Lapitskiĭ, and V. I. Spitsyn. Zhur. Neorg. Khim. 1, 841-51 (1956). C.A. 51, 924d.

The isotopic exchange in a heterogeneous system of the hexaniobate and of the hydrated metaniobate was determined at 20° by using Nb^{95}. It was established that the exchange between the solid salt and its saturated solution in either case occurs instantaneously for an average of 60%. This value of the degree of exchange does not increase with time. The exchange between the hexaniobate and the metaniobate was only 5-6%. The exchange between solid sodium hexaniobate and anhydrous barium metaniobate and their saturated solutions was studied. The exchange in the first case is instantaneous and the degree of exchange is 25-30%. In the 2nd case there is no noticeable exchange.

2152

THE EFFECT OF π-ELECTRONS IN HYDROCARBON MOLECULES ON THE HYDROGEN-ISOTOPE EXCHANGE DURING CATALYSIS WITH POTASSIUM AMIDE. A. I. Shatenshteĭn and E. A. Izrailevich. Doklady Akad. Nauk S.S.S.R. 108, 294-7 (1956). C.A. 51, 1669i.

The supposition was to be verified that all H atoms in branched alicyclic hydrocarbons can be exchanged during the catalysis with KND_2, regardless of whether they are located in the ring or in the side branches, and also to confirm the previously noted regularities in the H-atom exchange in aromatic and naphthenic hydrocarbons, and in olefins of various lengths and double-bond location. The tests were run at various temperatures and KND_2 concentrations, and a practically complete H replacement was obtained in varying lengths of time.

2153

RADIOCHLORINE EXCHANGE REACTIONS IN ACID CHLORIDE SOLVENTS AND IN LIQUID SULFUR DIOXIDE. B. J. Masters, N. D. Potter, D. R. Asher, and T. H. Norris. J. Am. Chem. Soc. 78, 4252-5 (1956). C.A. 51, 1701i.

Cl^{36}-exchange reactions of acid and basic solutes in the nonaqueous solvents $SOCl_2$, $SeOCl_2$, and $POCl_3$ were fairly rapid and complete. The results support self-ionization schemes that have been advanced for these solvents. The exchange between $SOCl_2$ and Me_4NCl in solution in liquid SO_2 was very fast. $SOCl_2$ in solution in SO_2 ionizes slightly to form $SOCl^+$ and Cl^-.

2154

KINETICS OF DISPLACEMENT REACTIONS AT THE SULFUR ATOM. I. ISOTOPIC EXCHANGE BETWEEN SULFITE AND ALKYL THIOSULFATES. Antonino Fava and Gastone Pajaro. J. Am. Chem. Soc. 78, 5203-8 (1956). C.A. 51, 1702a.

The exchange of sulfite between tagged Na_2SO_3 and organic thiosulfates was measured.

2155

OXYGEN EXCHANGE BETWEEN OXY ANIONS AND WATER; BROMATE AND IODATE IONS. T. C. Hoering, R. C. Butler, and H. O. McDonald. J. Am. Chem. Soc. 78, 4829-31 (1956). C.A. 51, 1702d.

The rate of exchange of O between BrO_3^- and water was studied by measuring the change in O^{18} content of tagged BrO_3^- as a function of time. The reaction proceeded faster in D_2O with $k_D/k_H = 1.72$. The corresponding exchange between IO_3^- and water at room temperature was completed in the sampling time of one minute.

2156

COUPLING REACTIONS. IX. KINETIC HYDROGEN-ISOTOPE EFFECT AND GENERAL BASE CATALYSIS OF AZO COUPLING. Hch. Zollinger. Helv. Chim. Acta 38, 1597-1616 (1955). C.A. 51, 1709a. X. DEPENDENCE OF KINETIC ISOTOPE EFFECT OF AZO COUPLING ON BASE CONCENTRATION AND DIAZO COMPONENT. Ibid. 1617-22. C.A. 51, 1709c.

2157
ISOTOPE EXCHANGE IN SOLUTIONS OF THE GREEN MODIFICATION OF THE CHROMIUM SALTS. YA. A. Fialkov and Yu. P. Nazarenko. Zhur. Neorg. Khim. 1, 565-78 (1956). C.A. 51, 1759e.

The exchange between the SO_4^{--} and Br^- between the internal and external coordination spheres of the green modification of the Cr salts was studied at 20°. The time required to exchange ½ of the ions $t_{\frac{1}{2}}$ was 1200 minutes for the SO_4^{--}. The time was less for solutions of the basic sulfate. The value of $t_{\frac{1}{2}}$ for the green bromide was ~ 149.8 minutes at 25°.

2158
A REVIEW OF THE REACTION KINETICS OF DEUTERIUM AND TRITIUM COMPOUNDS. VI. SOLVOLYSIS REACTIONS. Lawrence M. Brown. 1956, 18 pp. (NBS-4712). C.A. 51, 1901h.

2159
APPLICATION OF OXYGEN ISOTOPES IN CHEMICAL STUDIES. Henry Taube. Ann. Rev. Nuclear Sci. (Annual Reviews, Inc., Palo Alto, Calif.) 6, 277-302 (1956). C.A. 51, 2343i.

A review with many references.

2160
DEUTERIUM ATOM REACTIONS WITH ALKENES. THE RELATION OF METHANE DEUTERIZATION TO DEUTERIUM ATOM CONCENTRATIONS IN THE SYSTEM. R. E. Mardaleĭshvili, G. B. Pariĭskiĭ, V. A. Poltorak, and V. V. Voevodskiĭ. Izvest. Akad. Nauk S.S.S.R. Otdel. Khim. Nauk 516-24 (1956). C.A. 51, 2366h.

Tabulations are given for methane deuterization in the $(D + D_2)$ RH system with various D-atom concentrations. Mass spectrometric analysis was used to obtain the quantitative data to confirm the theory of free radical exchange with molecular deuterium. It has been shown that deuterium atoms do not participate actively in free radical exchange. In combination of hydrogen atoms (H or D) with alkenes, radicals of both possible types are formed.

2161
HYDROGEN-ISOTOPE EXCHANGE. D. R. Augood. Nature 178, 754-5 (1956). C.A. 51, 2367d.

The derivation and application of relationships involving the separation factor for H_2 and D_2 exchange processes are given.

2162
KINETICS OF THE FERRICYANIDE-FERROCYANIDE EXCHANGE REACTION. Charles F. Deck. Univ. Microfilms (Ann Arbor, Mich.). Publ. No. 17182, 59 pp. Dissertation Abstr. 16, 1578 (1956). C.A. 51, 2367g.

2163
THE EXCHANGE REACTION BETWEEN SUBSTITUTED BENZYL IODIDES AND POTASSIUM IODIDE. VII. P-FLUOROBENZYL IODIDE. Milton Kahn and J. L. Riebsomer. 1956, 9 p. (LA-2048UNM). C.A. 51, 2367h.

The exchange of radioactive I between p-fluorobenzyl iodide and KI was measured in MeOH and in EtOH from 0 to 30.9°.

2164
RECOMBINATION RATES OF SUBSTITUTED PHENYLGLYOXYLATE IONS WITH HYDRONIUM AND DEUTERIUM IONS. Mary S. Wheatley. Experientia 12, 339-40 (1956). C.A. 51, 2367i.

The ratio, $k_{(H_3O^+)}/k_{(D_3O^+)}$ is 4.7.

2165
ISOTOPE EXCHANGE OF IRON ATOMS IN PRUSSIAN BLUE. I. A. Korshunov and Z. M. Lebedeva. Zhur. Neorg. Khim. 1, 1912-14 (1956). C.A. 51, 2446g.

Radioactive Fe^{59} was caused to react (as $FeCl_3$) with $K_4Fe(CN)_6$ to yield Prussian blue which was then washed, dried, and stored at varying temperatures from 15 to 250°. By subsequent hydrolysis the 2 Fe atoms could be separated and the degree of isotope exchange measured. The degree of exchange increases with temperature up to 200° (0.7% in 1392 hrs. at 15-20°; 11% at 195°). Similar experiments attempted with Turnbull blue were less productive because of comparative instability of that compound on heating. Turnbull blue at low temperatures exhibits greater isotope exchange than does Prussian blue.

2166
SEPARATION NOZZLE. A NEW ELEMENT FOR GAS AND ISOTOPE SEPARATION. E. W. Becker, K. Bier, and H. Burghoff. Z. Naturforsch. 10a, 565-72 (1955). (English translation-AEC-tr-2415). C.A. 51, 3196b.

If a gas or isotope mixture streams through a nozzle, a certain separation into components occurs. This can be used to separate the materials physically by adding a peel diaphragm to the system. The behavior of the separation nozzle which is a combination of a nozzle and peel diaphragm is discussed and experiments are carried out on different gas and isotope mixtures. The separation factor obtained is the same as that obtained with a Hertz separation wall. However, the replacement of a porous wall by the separation nozzle gives a safer operation and much greater gas flow through one separation element.

2167
THE SEPARATION TUBE. XVI. PREPARATION OF THE ISOTOPE XENON-136. K. Clusius, H. H. Bühler, H. Hürzeler, and E. Schumacher. Z. Naturforsch. 10a, 809-14 (1955). C.A. 51, 3203g.

To study the behavior of a Xenon lamp 1.35 g. Xe^{136} of 99% purity was separated in a separation system of 48 meter length.

2168
CALCULATION OF THE KINETIC ISOTOPE EFFECT FROM EXPERIMENTAL DATA. A. I. Brodskiĭ. Ukrain. Khim. Zhur. 22, 417-19 (1956). C.A. 51, 3249g.

Mathematical derivation of formulas that can be used to calculate the isotopic effect (α) from the extent of the reaction (s), the fraction of labeling isotope in the starting material (a), in the product (y), and in the amount of product produced between s_1 and s_2 (z). The simplifications resulting if x, s, and $s_2 - s_1$ are very small are also given.

2169
OXYGEN-ISOTOPE EXCHANGE WITH ALKALI METAL SULFATES AT HIGH TEMPERATURES. V. I. Spitsyn and V. G. Finikov. Doklady Akad. Nauk S.S.S.R. 108, 491-4 (1956). Proc. Acad. Sci. U.S.S.R., Sect. Chem. 108, 293-6 (1956) (English trans.). C.A. 51, 3249h.

The exchange of O^{18} with the O of alkali

sulfates was investigated in order to compare the O-bonding strength in these compounds. The apparatus used in the tests is shown schematically, and the % O exchanged with Li_2SO_4, Na_2SO_4, K_2SO_4, Rb_2SO_4, and Cs_2SO_4 was determined at 680-820° after proving that O^{18} does not interact with fused quartz at temperatures below 830°.

2170
A REVIEW OF THE REACTION KINETICS OF DEUTERIUM AND TRITIUM COMPOUNDS. V. ASSOCIATION ADDITION AND ELIMINATION REACTIONS. Lawrence M. Brown. June 15, 1956. 27 p. (NBS-4674). C.A. 51, 3250a.

A review of the literature on the kinetics of association-addition and elimination reactions of deuterium compounds has been prepared. The experimental data are summarized.

2171
FINE STRUCTURE OF REACTION BETWEEN ETHANE AND DEUTERIUM ON VARIOUS EVAPORATED METAL FILMS. Koshiro Miyahara. J. Research Inst. Catalysis, Hokkaido Univ. 4, 143-51 (1956). C.A. 51, 3257b.

The data of Anderson and Kemball (C.A. 48, 7965g) relating to catalyzed exchange reactions between ethane and D over evaporated films of various metals are explained on the basis of the fine-structure theories of Horiuchi (C.A. 43, 6494c) and Keii (C.A. 48, 8006e).

2172
INFRARED STUDY OF THE EXCHANGE OF DEUTERIUM BETWEEN DECABORANE AND DIBORANE. Joyce J. Kaufman and W. S. Koski. J. Am. Chem. Soc. 78, 5774-5 (1956). C.A. 51, 3291d.

From an infrared study of the 5.17-μ absorption band, which was due to a B—D stretch vibration, and the 8.72-μ band, which was due to a B—D—B bridge vibration, it has been found that the D exchange reaction between deuteriated diborane and decaborane mixed at 100° proceeded preferentially into the non-bridge positions.

2173
HEAVY WATER—SURVEY OF HEAVY-WATER PRODUCTION PROCESSES. Manson Benedict. Progress in Nuclear Energy - Series 4: Technology and Engineering. R. Hurst and S. McLain, Eds. McGraw-Hill Book Co., Inc., New York, N. Y. 1, pp. 3-56. C.A. 51, 3302b.

Review with references.

2174
FINAL CONCENTRATION OF HEAVY WATER BY RECTIFICATION. P. Baertschi and W. Kuhn. Progress in Nuclear Energy - Series 4: Technology and Engineering. R. Hurst and S. McLain, Eds. McGraw-Hill Book Co., New York, N. Y., 1, pp. 57-61. C.A. 51, 3302b.

References.

2175
ISOTOPE ENRICHMENT OF Cl THROUGH ELECTROLYTIC TRANSFERENCE IN $PbCl_2$. A. Klemm and A. Lundén. Z. Naturforsch. 10a, 282-4 (1955). C.A. 51, 3315h.

Through electrolytic diffusion of Cl^- ions in molten $PbCl_2$ with a solution anode made of molten Pb and with a current density of 5 amperes/square centimeter in 7 days, an enrichment of Cl^{35} with a separation coefficient of 2 was obtained. The diffusion velocities of the Cl isotopes differ by (0.29 ± 0.02) %. The mass effect for electrolytic diffusion of Cl is, therefore, in molten Pb $\mu^- = -0.052 \pm 0.003$.

2176
ISOTOPE EFFECT IN THE ELECTROLYTIC DIFFUSION OF POTASSIUM IONS IN MOLTEN POTASSIUM NITRATE. Arnold Lundén, Carl Reuterswärd, and Nils Sjöberg. Z. Naturforsch. 10a, 279-81 (1955). C.A. 51, 3315i.

By electrolysing molten KNO_3, K^{41} was enriched at the anode compared to K^{39}. The relative difference in the electrolytic diffusion velocity of these 2 isotopes was 0.0018. The mass defect is $\mu = -0.036$.

2177
THE CASCADING PROBLEM IN A WATER-DISTILLATION PLANT FOR HEAVY WATER PRODUCTION. E. Cerrai, M. Silvestri, and S. Villani. Z. Naturforsch. 11a, 694-701 (1956). C.A. 51, 4065b.

A criterion for the design of minimum separation volume cascades is generalized to be applicable in the case of large enrichments of the stages. The practical solution of the cascading problem is also described for a water-distillation plant for heavy water production which is supposed to use geothermal steam from the Larderello zone (Tuscany); the variability of the separation factor within the columns attributable to the pressure drop is taken into account. Mathematical.

2178
γ-RAY-INDUCED EXCHANGE BETWEEN TRIVALENT AND SEXIVALENT CHROMIUM IONS IN AQUEOUS ACID SOLUTION. Marc Lefort and Michel Lederer. Compt. rend. 242, 2458-61 (1956). C.A. 51, 4102a.

An attempt was made to clarify the effect of ionizing radiation on a solution of Cr by using radiochromium-51. The exchange between Cr^{+++} and Cr^{6+} induced by γ-radiation was evidenced; this proved the existence of a reaction oxidizing Cr^{+++} by OH radicals, originating from radiolysis of water.

2179
ABSOLUTE DETERMINATION OF THE RATE OF THE EXCHANGE REACTION BETWEEN CADMIUM AMALGAM AND CADMIUM CYANIDE SOLUTION. Sture Fronaeus. Acta Chem. Scand. 10, 490-2 (1956). C.A. 51, 4107g.

To attain sufficiently high accuracy in the isotopic exchange determinations, the measurements were taken while the amalgam and the solution were shaken under reproducible conditions, the average area of the interface being kept constant. According to F., when the "naked" Cd ion leaves the amalgam, 2 CN^- ions are coordinated consecutively without an intermediate coordination of H_2O, and then the more loosely bound H_2O ligands are coordinated; this forms an activated complex with its center in the rigid part of the electrode double layer. For the reverse process, the same stages, occurring in the reverse order (splitting off ligands), are assumed.

2180

THE KINETICS OF HYDROGEN-ISOTOPE EXCHANGE REACTIONS. VI. THE REACTIVITY OF ANISOLE IN AQUEOUS AND NONAQUEOUS ACIDIC MEDIA. D. P. N. Satchell. J. Chem. Soc. 1956, 3911-18. C.A. 51, 4107i.

The rates of H isotope exchange of the 3 nuclear monodeuteriated anisoles were determined in H_2SO_4-H_2O mixtures, AcOH-H_2SO_4 mixtures, and in the case of the meta isomer with $HClO_4$-H_2O mixtures.

2181

SEPARATION TUBE. XVII. PREPARATION OF RARE ISOTOPE NEON-21 OF 99.6% PURITY. K. Clusius, M. Huber, H. Hürzeler, and E. Schumacher. Z. Naturforsch. 11a, 702-9 (1956). C.A. 51, 4765f.

Enrichment of Ne^{21} corresponding to a separation factor 96700 was achieved. From 60 l. Ne, in 5 steps, a concentrate of 12.6% Ne^{21} was obtained. Subsequently a deuteriated methane mixture, CD_4 + CD_3H + CD_2H_2, was used as the auxiliary gas in the thermodiffusion of the methane-Ne mixture. After 175 days this resulted in a concentrate of 92.9% Ne^{22}, 3.95% Ne^{21} and 3.15% Ne^{20}. Finally the even Ne isotopes were eliminated and 99.6% Ne^{21} was obtained. The addition of the auxiliary gas permits the use of a larger separation apparatus for a limited amount of gas and the establishment of the most favorable isotope distribution. It also improves the performance of an existing apparatus by increasing the pressure range of operation.

2182

SEPARATION TUBE. XVIII. PREPARATION OF PURE RARE ISOTOPES OF ARGON, ARGON-36, AND ARGON-38. K. Clusius, E. Schumacher, H. Hürzeler, and H. U. Hostettler. Z. Naturforsch. 11a, 709-15. C.A. 51, 4765h.

Enrichment of A^{36} and A^{38}, corresponding to separation factors of 296000 to 790000, respectively, was achieved. From 1000 l. tech. A a concentrate of 14.5% A^{38} was obtained. The concn. distribution of the system $A^{36}/A^{38}/A^{40}$ was measured and confirmed the theory of the separation tube. Further separation by addition of an auxiliary gas mixture DCl/HCl resulted in 99.9% A^{36} and 99.6% A^{38}. The distribution function of the A isotopes is independent of the auxiliary gas $DCl^{37}/DCl^{35}/HCl^{37}/HCl^{35}$ but the latter increases the effective separation tube length by 45%. The thermal diffusion of HCl with respect to A disappears if HCl is lighter by 1.1 mass units. This effect is explained by different effective cross sections and different deviations from ideal gas behavior. An auxiliary gas of DCl^{35} with addition of DCl^{37} is especially suitable for A^{38}/A^{40} separation, whereas HCl^{35} with addition of DCl^{35} is most suitable for separation of A^{36}/A^{38}.

2183

ANALOGY BETWEEN THE ISOTOPIC EXCHANGE IN COUNTERCURRENT FLOW AND ADSORPTION PROCESSES. A. M. Rozen. Doklady Akad. Nauk S.S.S.R. 108, 122-5 (1956). Proc. Acad. Sci. U.S.S.R., Sect. Chem. Technol. 108, 45-8 (1956)(English translation). C.A. 51, 4768h.

Calculations and diagrams are given for comparative analysis of sorption processes and the isotopic exchange in countercurrent flow.

2184

THE TEMPERATURE DEPENDENCE OF THE ISOTOPE EFFECT DUE TO CURRENT FLOW IN MOLTEN INDIUM METAL. A. Lodding, A. Lunden, and H. von Ubisch. Z. Naturforsch. 11a, 139-42 (1956). C.A. 51, 4782h.

Direct current was carried through capillaries filled with molten In at various temperatures. In^{115} was enriched at the cathode and In^{113} was enriched at the anode. This Haeffner effect (C.A. 48, 3159g) showed a marked temperature dependence. The increase in the mass effect (10^{-5} at 210°; 6 x 10^{-5} at 820°) with temperature corresponds to the calculated order of magnitude.

2185

NITROGEN-ISOTOPE EFFECT IN THE DISTILLATION OF N_2O_4. G. M. Begun. J. Chem. Phys. 25, 1279-80 (1956). C.A. 51, 4784g.

N_2O_4 was distilled in a 30-plate bubble-cap column at 21° and atmospheric pressure. Isotopic analyses were made on the N_2O_4 directly or after reduction to molecular N_2. N^{14} tended to concentrate in the NO_2 gaseous phase. The total separation (N^{14}/N^{15} at top)/(N^{14}/N^{15} at bottom) was 1.078.

2186

NITROGEN ISOTOPIC FRACTIONATION BETWEEN NITRIC OXIDE AND NITROGEN DIOXIDE AND MASS DISCRIMINATION IN MASS ANALYSIS OF NITROGEN DIOXIDE. G. M. Begun and C. E. Melton. J. Chem. Phys. 25, 1292-3 (1956). C.A. 51, 4813g.

Mixtures of NO and NO_2 were admitted to the expansion chamber at a pressure of 0.05 to 0.1 mm. and a temperature of 23°. The prior history of the samples was not given. The equilibrium constant $\alpha = N^{15}O_2/N^{14}O_2/N^{15}O/N^{14}O$ was determined to be 1.028. No N mass discrimination was found in the electron impact ionization of NO_2.

2187

NUCLEAR MAGNETIC NITROGEN-14 RESONANCE SPECTRA, MOLECULAR STRUCTURES, AND EXCHANGE REACTIONS IN THE SYSTEM N_2O_5-NO_2^+-NO_3^--H_2O. Richard A. Ogg, Jr., and James D. Ray. J. Chem. Phys. 25, 1285-6 (1956). C.A. 51, 4818g.

HNO_3 solutions of N_2O_5 displayed only a single N^{15} resonance, coincident in position with that expected from the averaging of the species NO_2^+, HNO_3, and NO_3^-. The breadth of the single resonance line reflects the averaging of the line widths of the 3 species.

2188

PREPARATION OF HIGHLY CONCENTRATED NITROGEN-15 BY CHEMICAL EXCHANGE. W. Spindel and T. I. Taylor. Trans. N. Y. Acad. Sci. 19, 3-16 (1956). C.A. 51, 4839g.

The method is based on the reaction $HN^{14}O_3 + N^{15}O \rightleftharpoons HN^{15}O_3 + N^{14}O$, where $HN^{15}O_3$ tends to concentrate in the solution phase. The NO is produced by adding SO_2 to the HNO_3. At the waste end of the column, NO is converted to HNO_3 by reaction with air and H_2O. In the laboratory-scale model, HNO_3 enters the packed

product refluxer and reacts with SO_2. Excess NO_2 production is controlled by a photometer cell which opens a bypass solenoid valve in the SO_2 line when the NO_2 color becomes too intense. Ten molar HNO_3 gives the optimum over-all isotope separation. The system is operated at atmospheric pressure, and can be operated at pressures twice as great as atmospheric. A 2-stage "tapered" cascade system was operated on these principles for 14 days when a steady state separation of 99 + % N^{15} was obtained. Operation was continued for another 11 days. During this time about 6 g. N containing 99 + % N^{15} was withdrawn as HNO_3 or as NO containing some NO_2. 22 references.

2189

CHEMICAL AND ISOTOPIC STUDIES OF THE CLOSED CYCLE CARBONATE SYSTEM FOR NITROGEN-15 ENRICHMENT. A. A. Palko, L. L. Brown, G. M. Begun, and E. F. Joseph. 1956, 20 pp. (ORNL-2138). C.A. 51, 4839e.

Enriched N^{15} can be produced in a closed cycle by exchange between NH_3 and $(NH_4)_2CO_3$ with N^{15} concentrating in the aqueous phase. $(NH_4)_2CO_3$ solution is neutralized with $Ca(OH)_2$ to form $CaCO_3$ and NH_3. The NH_3 is boiled off, the $CaCO_3$ is calcined, and the resultant CO_2 is combined with H_2O and NH_3 to form $(NH_4)_2CO_3$ for recycling. The effective separation factor at atmospheric pressure is slightly temperature-dependent, increasing from 1.015 at 15.6° to 1.022 at 44.3°. Rapid exchange was found between NH_2COO^- and other N species. Flow diagrams and data for column operation are given. Since the chemicals are recycled from one end of the system to the other, only heat is consumed.

2190

THE ISOTOPE EFFECT IN ELECTROLYTIC MIGRATION OF LITHIUM IONS IN MOLTEN LITHIUM NITRATE. Arnold Lundén, Ernst Ulrich Monse, and Nils G. Sjoberg. Z. Naturforsch. 11a, 75-9 (1956). C.A. 51, 4848h.

By electrolyzing molten $LiNO_3$, Li^7 was enriched on the anode. The relative difference of the electrolytic migration velocities of the 2 isotopes Li^7 and Li^6 is 0.77%. The mass effect is, therefore, $\mu = -(0.050 \pm 0.013)$(95% probability). The mass effect is larger than found in the migration of K ions in molten KNO_3. The difference is discussed and explained.

2191

THE ISOTOPE EFFECT OF A DIRECT ELECTRIC CURRENT THROUGH LIQUID AND SOLID METALS. E. Haeffner, Th. Sjoborg, and S. Lindhe. Z. Naturforsch. 11a, 71-5 (1956). C.A. 51, 4849g.

The isotope separation effect of a direct current in a liquid metal is demonstrated by passing a current through mercury, which is enclosed in a capillary tube. A very small isotope effect is found when direct current is passed through a U wire.

2192

OXYGEN ISOTOPES AND PALEOTEMPERATURE DETERMINATIONS. C. Emiliani. Actes 4th congr. intern. quaternaire, Rome-Pisa 1953, 831-44. (Pub. 1956). C.A. 51, 4897c.

A review with 22 references.

2193

SEPARATION OF HYDROGEN AND DEUTERIUM BY THE REACTION OF IRON WITH STEAM. Hilton A. Smith and John C. Posey. J. Am. Chem. Soc. 79, 1310-13 (1957). C.A. 51, 5246c.

Measurements were made over the range 118-340°. Separation factors from 1.4 to 3.2 were observed. The data were found to be correlated by the equation $\log \alpha = 273.1/T - 0.2039$, where α is the isotope separation factor. Values obtained with Cd agreed within experimental error with those obtained with Fe. The separation of H and D occurring during the reduction of magnetic Fe_3O_4 was measured and found to approach the equilibrium value. This was believed to have been caused by isotope exchange catalyzed by the freshly reduced Fe.

2194

KINETICS OF THE ISOTOPE EXCHANGE BETWEEN MERCURY SALTS AND PHENYLMERCURIC CHLORIDE LABELED BY Hg^{203}. Antonietta Ansaloni, Giorgio Belmondi, and Ugo Croatto. Ricerca sci. 26, 3315-20 (1956). C.A. 51, 5517a.

From water-saturated benzene solution of $HgCl_2$ and phenylmercuric chloride (Hg^{203}) aliquot samples were centrifuged and $HgCl_2$ was extracted in benzidine. The rate of reaction was studied and exchange by two simultaneous mechanisms proposed.

2195

KINETICS OF THE EXCHANGE REACTION BETWEEN TWO OXIDATION STATES OF CERIUM. Frank R. Parchen, Jr., and F. R. Duke. U. S. Atomic Energy Comm. ISC-671, 34 pp (1955). C.A. 51, 5517c.

The kinetics of the exchange of Ce^{3+} and Ce^{4+} in $HClO_4$ was studied using tributyl phosphate to separate the reactants. The rate was first order with respect to Ce^{3+} in 5 to 6 F $HClO_4$. The reaction was not catalyzed by Pt, platinized Pt, light, glass, polyethylene, or O_2.

2196

MECHANISM OF THE EXCHANGE REACTION OF OXYGEN ATOMS BETWEEN GASEOUS OXYGEN AND WATER VAPOR CATALYZED BY CALCIUM OXIDE. Sadahiro Sakata and Noriyoshi Morita. Bull. Chem. Soc. Japan 29, 824-9 (1956). C.A. 51, 5521f.

The change in rate of the exchange reaction over CaO with various molar O/H_2O ratios was studied. The results indicate that the O_2 is adsorbed with dissociation and that the rate-controlling step is either the dissociative adsorption or the recombination of the O to desorption. Both show an activation energy of 33 kcal./mole, as compared to 30.6 kcal./mole for the over-all exchange.

2197

ISOTOPIC EXCHANGE BETWEEN STANNIC CHLORIDE AND 2-CHLOROBUTANE. Reed A. Howald and John E. Willard. J. Am. Chem. Soc. 78, 6217-20 (1956). C.A. 51, 5517e.

The homogeneous exchange of Cl^{36} between $SnCl_4$ and 2-chlorobutane occurs at a measurable rate in heptane solution at 140° and faster at 160°. In heptane at room temperature, exchange was observed only in the presence of HCl and of the white solid that is formed when water is added to $SnCl_4$.

2198
THE EXCHANGE OF OXYGEN BETWEEN SULFURIC ACID AND WATER. Thomas C. Hoering and Joseph W. Kennedy. J. Am. Chem. Soc. 79, 56-60 (1957). C.A. 51, 5517f.

The kinetics of the exchange of isotopic O between H_2SO_4 and H_2O was studied.

2199
REACTION OF ETHYLENE WITH DEUTERIUM OVER VARIOUS TYPES OF PLATINUM CATALYST. G. C. Bond. Trans. Faraday Soc. 52, 1235-44 (1956). C.A. 51, 5520i.

The catalysts were: Pt (5%) on pumice, platinized Pt foil, colloidal Pt (1%) on precipitated Al_2O_3, Al_2O_3-SiO_2 cracking catalyst, and SiO_2 gel. The reactions with D_2 between 0 and 52° were analyzed mass-spectrometrically over a range of partial pressures.

2200
EXCHANGE REACTION BETWEEN DEUTERIUM AND AMMONIA ON SYNTHETIC-AMMONIA CATALYSTS PROMOTED SINGLY, DOUBLY, AND TRIPLY. Hiroshi Uchida and Naoyuki Todo. Bull. Chem. Soc. Japan 29, 762-7 (1956). C.A. 51, 5521d.

Mixtures of NH_3 and D_2 were passed over NH_3 catalysts. After freezing the exit gas from NH_3, the mixture was analyzed for D by means of a thermal-conductivity gage. The catalysts were Fe promoted by 5% Al_2O_3; 5% Al_2O_3, 1% K_2O; and 4% Al_2O_3, 1% CaO, and 1% K_2O.

2201
THE EFFECT OF PRETREATMENT ON THE ACTIVITY OF γ-ALUMINA. II. HYDROGEN-DEUTERIUM EXCHANGE. S. W. Weller and S. G. Hindin. J. Phys. Chem. 60, 1506-12. C.A. 51, 5521h.

γ-Al_2O_3 catalyzes H-D exchange at temperatures as low as -124°, far below the temperature at which exchange with catalyst H occurs. The catalytic activity is increased by vigorous drying, and it is poisoned by addition of water back to the dried catalyst. The poisoning effect of water increases with the temperature of addition, up to about 350°; chemisorbed H poisons the exchange reaction, whereas O shows no effect. The results suggest that the activity of γ-Al_2O_3 does not arise from an O-deficient structure, but instead from a high-energy, strained surface remaining after dehydration.

2202
THE HETEROGENEOUS EXCHANGE REACTION BETWEEN HYDROGEN CHLORIDE AND CHLORINE ON GLASS AND FLUOROCARBON. J. R. Walton and W. H. Johnston. J. Am. Chem. Soc. 78, 5991-2 (1956). C.A. 51, 5522c.

Evidence is presented to show that the heterogeneous exchange reaction between HCl and Cl^{36} on Pyrex, Vycor, and fluorocarbon is catalyzed by adsorbed H_2O. In the experiments, H_2O was removed both by evacuations at elevated temperature and by treatment with diborane at room temperature. The rate of exchange on Vycor can be explained as equilibrium adsorption and a 2nd-order rate-controlling surface reaction.

2203
THE REACTIONS OF TRIFLUOROMETHYL RADICALS WITH HYDROGEN ISOTOPES. P. B. Ayscough and J. C. Polanyi. Trans. Faraday Soc. 52, 960-70 (1956). C.A. 51, 5570c.

The photolytic decomposition of hexafluoroacetone has been used to produce trifluoromethyl radicals for a study of their reactions with hydrogen isotopes. Activation energies for the four reactions: $CF_3 + H_2 \rightarrow CF_3H$, $CF_3 + HD \rightarrow CF_3H$, $CF_3 + HD \rightarrow CF_3D$, and $CF_3 + D_2 \rightarrow CF_3D$ were found to be, respectively, 9.5 ± 0.7, 10.5 ± 1.5, 10.2 ± 1.5, and 10.2 ± 0.7 kcal/mole.

2204
SEPARATION OF CHLORINE ISOTOPES BY THERMODIFFUSION IN THE FLUID PHASE. Karl F. Alexander and Rolf Dreyer. Z. Naturforsch. 10a, 1034 (1955). C.A. 51, 5588b.

Experiments are described to separate Cl^{35} from Cl^{37} by passing trichloroethylene through a fluid-phase thermodiffusion apparatus. The coefficient of self-diffusion was estimated at 1.8×10^{-5} sq.-cm./sec. The process was carried out in several steps, each yielding an enrichment in Cl^{37} of 1.15→. The effects were measured by density measurements by means of a capillary pycnometer. The separation factor was found to be 1.0×10^{-2}.

2205
ISOTOPIC EFFECT AT THE PASSAGE OF CURRENT THROUGH MELTED POTASSIUM METAL. Arnold Lundén, Carl Reuterswärd, and Alex Lodding. Z. Naturforsch. 10a, 924-6 (1955). C.A. 51, 5597d.

Direct current of a current density of 2900 amp./sq. cm. was passed during 14.8 days through a capillary tube (length 400, diam. 0.60 mm.) containing melted K at 158°. K^{41} was enriched at the cathode, K^{39} at the anode. The separation factor between cathode and anode was 1.12, the mass effect $\mu \geq 9 \times 10^{-6}$.

2206
PARALLEL CASCADE SECTIONS. J. Shacter. 1956, 32 pp. (K-1312). C.A. 51, 6235f.

The possibility of operating diffusion cascade sections in parallel, rather than only in series, is theoretically evaluated. Net circular flow can seriously lower efficiency.

2207
A COUNTERCURRENT GASEOUS DIFFUSION PROCESS; THEORY OF THE SEPARATION AT EQUILIBRIUM. Juan A. McMillan. Z. Naturforsch. 11a, 284-5 (1956). C.A. 51, 6252g.

An experimental device is proposed for obtaining a gaseous diffusion countercurrent process. The theory of the separation at equilibrium for a binary isotopic mixture is developed on the basis of the transport up the tube, the total transverse transport, and the transverse transport of the desired molecules. The solution is given for any value of the relative abundances.

2208
ISOTOPIC FRACTIONATION IN THE SYSTEM IODINE CYANIDE/CYANIDE BY A COMBINED EQUILIBRATION PRECIPITATION PROCESS. F. E. Jenkins and G. M. Harris. J. Am. Chem. Soc. 79, 276-7 (1957). C.A. 51, 6291h.

The equilibrium constant for the reaction $CNI + C^{14}N^- \rightleftharpoons C^{14}NI + CN^-$, as predicted by statistical thermocynamics, is K = 1.05 at 30°. The experimental values obtained by examination of the activity of precipitated

AgCN are always larger than the predicted value, and vary with the composition of the dioxane-water solvent used. These results are interpreted in terms of a combination of isotope effects in the equilibration and precipitation reactions.

2209

CHLORINE EXCHANGE BETWEEN ALUMINUM CHLORIDE AND γ-1,2,3,4,5,6-HEXACHLOROCYCLOHEXANE. Geo. W. Pearce and Sonja Krause. J. Am. Chem. Soc. 79, 271-3 (1957). C.A. 51, 6294b.

Cl exchanges readily between $AlCl_3$ and γ-1,2,3,4,5,6-hexachlorocyclohexane (γ-HCC) at temperatures above 100° with some decomposition and isomerization, primarily to α- and δ-HCC.

2210

KINETICS OF THE REACTION BETWEEN CARBON DIOXIDE AND CARBON, AND ISOTOPE EXCHANGE. V. A. Evropin, N. V. Kul'kova, and M. I. Temkin. Zhur. Fiz. Khim. 30, 348-65 (1956). C.A. 51, 6294c.

The paper which consists of two parts: (1) determination of the reaction velocity, and (2) determination of exchange between CO_2 and CO of O^{18}.

2211

THE TEMPERATURE RELATION OF THE PARTITION COEFFICIENT OF NITROGEN ISOTOPES DURING THE CHEMICAL EXCHANGE (REACTION) BETWEEN AMMONIA AND AMMONIUM NITRATE SOLUTION. V. Yu. Orlov and N. N. Tunitskiĭ. Zhur. Fiz. Khim. 30, 2085-9 (1956). C.A. 51, 6294h.

The temperature coefficient of the partition coefficient, α, between $N^{14}H_4^+$ (solution) + $N^{15}H_2$ (gas), and $N^{14}H_3$ (solution) + $N^{15}H_3$ (gas) in the NH_4NO_3-NH_3-H_2O system was calculated from the equation $\alpha = K_1 + (K_2 - K_1)M$, where K_1 and K_2 are equilibrium constants of the 2 reactions, and M is the molar proportion of dissolved NH_3, and was determined mass-spectrometrically by use of a 50% NH_4NO_3 solution and 100 mm. NH_3 gas pressure. The experimental results agree well with the calculated results. The value of α increased with the temperature from 1.014 at 5° to 1.025 at 40°, and dropped at still higher temperatures.

2212

THE EFFECT OF SUBSTITUTION OF HYDROGEN ATOMS BY BROMINE ATOMS IN THE METHYL BROMIDE MOLECULE ON THE RATE OF IONIC ISOTOPE EXCHANGE. M. B. Neĭman, Yu. M. Shapovalov, and V. B. Miller. Doklady Akad. Nauk S.S.S.R. 97, 703-6 (1954). C.A. 51, 6295e.

Isotope exchange of CH_3Br, CH_2Br_2, $CHBr_3$, and CBr_4 with Br^- was studied.

2213

EXCHANGE OF CHLORINE-36 BETWEEN CHLORIDE ION AND PHOSPHORUS OXYCHLORIDE, ARSENIC TRICHLORIDE, OR SELENIUM OXYCHLORIDE. J. Lewis and D. B. Sowerby. J. Chem. Soc. 1957, 336-42. C.A. 51, 6295g.

Complete exchange was observed with the time of separation between ionic chlorides containing Cl^{36} and the solvents $POCl_3$, $AsCl_3$, and $SeOCl_2$. A kinetic study of exchange between labeled Et_4NCl and $POCl_3$ in $CHCl_3$, $PhNO_2$, and MeCN indicates that the exchange occurs by a bimolecular mechanism, being 1st order with respect to Et_4NCl and $POCl_3$. The exchange in pure $POCl_3$ and $AsCl_3$ is considered to proceed by the formation of $[POCl_4]^-$ and $[AsCl_4]^-$ rather than by self-ionization of the solvent.

2214

ISOTOPIC EXCHANGE REACTIONS BETWEEN COMPOUNDS OF UNI- AND BIVALENT SILVER. Maria Bruno, Vittoria Santoro. Ricerca sci. 26, 3072-74 (1956). C.A. 51, 6295h.

The exchange reaction of the radioactive Ag^{110} ion between $AgNO_3$ and 2 complex Ag compounds with 2,2'-bipyridine and 1,10-phenanthroline were investigated. A total exchange occurred after 2 minutes.

2215

ELECTROMAGNETICALLY ENRICHED ISOTOPES AND MASS SPECTROMETRY. PROCEEDINGS OF THE CONFERENCE HELD IN THE COCKCROFT HALL, HARWELL, 13-16 SEPTEMBER 1955. M. L. Smith, ed. London, Butterworths Scientific Publications, New York, Academic Press, Inc., 1956, 272 pp. C.A. 51, 6346e.

A summary is given of developments and future work in the field of electromagnetic isotope separation. The topics covered are ion sources, collector problems, chemical aspects and target preparation, utilization, isotopic abundance analysis, design of electromagnetic separators, and separation of active materials.

2216

SEPARATION OF CARBON ISOTOPES BY COUNTER-CURRENT CHEMICAL EXCHANGE IN THE GAS PHASE. G. M. Panchenkov, I. A. Semiokhin, A. G. Maurina, and N. P. Ershova. Zhur. Fiz. Khim. 30, 2070-6 (1956). C.A. 51, 6384e.

The isotope exchange was studied in a thermal diffusion column in the reaction $C^{12}O_2 + C^{13}O = C^{13}O_2 + C^{12}O$, which has an equilibrium constant of 1.086 at 25°. The variables introduced in the test were: Pt or nichrome heating wire, 350, 500, and 700 mm. pressure, water vapor at partial pressures of 1, 3, 10, and 15 mm. Hg; H at 1, 3, 5, and 10 mm. pressure. The optimum isotope separation conditions were obtained with a Pt heating wire, at 500 mm. total pressure. The separation effect was increased by higher H_2O pressure, but reached a maximum at 1 mm. H pressure, and became lower at higher H pressures.

2217

CONCENTRATION OF THE CARBON-13 AND OXYGEN-18 ISOTOPES IN CARBON MONOXIDE BY THE METHOD OF THERMAL DIFFUSION. G. M. Panchenkov and V. D. Moiseev. Zhur. Fiz. Khim. 30, 1662-7 (1956). C.A. 51, 6384h.

A thermodiffusion column is described for the concentration of O^{18} and C^{13} isotopes in CO. Six experiments were carried out at pressures of 200-751 mm. Hg. The rate of attaining equilibrium increases with a decrease in pressure. The maximum coefficient of separation is attained at 675 mm. Hg. An apparatus was also described for converting the CO enriched in C^{13} to CO_2.

2218

PREPARATION OF NITROGEN-15 CONCENTRATES IN A CASCADE APPARATUS BY THE METHOD OF CHEMICAL EXCHANGE. B. V. Ottesen and M. E. Aerov. Zhur. Fiz. Khim. 30, 1356-66 (1956). C.A. 51, 6384i.

A detailed description is given of a 3-column cascade apparatus for obtaining N^{15} concentrates, and the results of 3 years of its operation are reviewed. The concentration is accomplished by means of the exchange reaction $(N^{14}H_4)^+$soln. + $N^{15}H_3$gas. $\leq$ $(N^{15}H_4)^+$soln. + $N^{14}H_3$gas. The concentrate contains up to 40 atom % of N^{15} (natural concentration of N^{15} is 0.38 atom %).

2219
DETERMINATION OF THE CONSTANTS OF SULFUR DIOXIDE WHICH ARE SIGNIFICANT FOR DIFFUSION TUBE SEPARATION. H. Wullkopf. Z. Physik 146, 389-92 (1956). C.A. 51, 6385b.

The characteristic constants of SO_2 were determined according to the theory of David (C.A. 47, 9805g). For 1 atmosphere pressure in the tube: characteristic radius R_0 = 0.25 cm., characteristic separation distance L_0 = 870 cm., characteristic throughput S_0 = 1.2 cc./day, power used by heat conduction Q_0 = 0.58 w./cm., mean thermal diffusion coefficient $\alpha = 0.22 \times 10^{-3}$, turbulence starts at = $(R_a - R_i)/R_0 = 1.7$, where R_a and R_i are not defined. These results show that, in order to produce 80% S^{34} one needs a tube, 180 m. long, using 15 kw. for heating. After a year of operation, this tube could deliver 1.8 cc. of enriched gas per day.

2220
ISOTOPE SEPARATION PROCESS. Raymond N. Fleck. U. S. 2,780,526, Feb. 5, 1957. C.A. 51, 6388g.

Isotope separations are achieved by a selective adsorption process employing a compact moving bed of granular adsorbent, such as silica gel, alumina, magnesia, and charcoal. By following procedures described, for example, a 99% D_2O product can be obtained. The following separations can be achieved: H^1 from H^2, Li^6 from Li^7, B^{10} from B^{11}, C^{12} from C^{13}, N^{14} from N^{15}, and O^{16} from O^{17} from O^{18}. A volatile compound is required for isotope separation by selective adsorption.

2221
ISOTOPE ENRICHMENT OF BROMINE THROUGH ELECTROLYTIC TRANSFERENCE IN MOLTEN LEAD BROMIDE. A. E. Cameron, W. Herr, W. Herzog, and A. Lundén. Z. Naturforsch. 11a, 203-5 (1956). C.A. 51, 6400f.

Br^{79} was enriched through electrolytic transference in molten $PbBr_2$ in front of a liquid anode. With a current density of 5.3 amp./sq. cm., a separation factor of 1.28 was obtained in 7.8 days. The relative difference of the diffusion velocities of the Br isotopes was 0.11% which corresponds to a mass effect μ = -0.044 ± 0.001. The isotope concentration was determined with a mass spectrometer and through neutron activation.

2222
THE ISOTOPE EFFECT IN ELECTROLYTIC DIFFUSION OF LEAD IONS IN MOLTEN LEAD CHLORIDE. A. Lundén, G. Horlitz, and P. Signer. Z. Naturforsch. 11a, 280-3 (1956). C.A. 51, 6400g.

By electrolyzing salt cells containing molten $PbCl_2$ the light and heavy Pb isotopes were enriched. The relative difference in diffusion velocity of Pb^{206} and Pb^{208} was 0.023%, and the mass effect -0.024. The relation between mass effect and self transference number are discussed.

2223
THE ISOTOPIC COMPOSITION OF THE OXYGEN OF NATURAL SULFATES. R. V. Teĭs. Geokhimiya 1956, No. 3, 28-32. C.A. 51, 6458c.

2224
HEAVY-WATER PRODUCTION BY NATURAL-WATER DISTILLATION. I. GENERAL CONSIDERATIONS. H. K. Rae. Atomic Energy Can. Ltd., Chalk River Project No. 322, 31 pp. (1954). C.A. 51, 7085a. II. PRELIMINARY COST ESTIMATE. H. K. Rae and A. H. Stenning. Ibid. No. 323, 54 pp.

2225
ISOTOPIC EXCHANGE BETWEEN HYDROGEN AND WATER ON PLATINUM. RELATIVE RATES OF EXCHANGE OF ISOTOPIC HYDROGEN MOLECULES. Kåre Hannerz. Acta Chem. Scand. 10, 655-66 (1956). C.A. 51, 7100a.

The rate of HD formation in the isotopic exchange between D- and T-containing H and D-free H_2O vapor on Pt, investigated by mass spectrometric and radiotracer techniques, shows that the exchange cannot be due to the interaction of a D_2 molecule, from the gas phase or from the van der Waals layer, with a chemisorbed H atom or OH radical. It is necessary to assume that both the H molecule and the H_2O undergo a dissociative chemisorption on the surface.

2226
CALCULATIONS OF THE EXPERIMENTAL RESULTS ON ISOTOPE EXCHANGE FOR HYDROGEN. Ya. M. Varshavskiĭ and V. R. Kalinachenko. Zhur. Fiz. Khim. 30, 1376-9 (1956). C.A. 51, 7116a.

Mathematical. General formulas are derived for calculating the coefficient of distribution for D and for determining the number of atoms that are exchanged; the inequality of the different H atoms in a molecule is taken into account.

2227
THE MECHANISM OF EXCHANGE OF HYDROGEN BETWEEN AMMONIUM AND HYDROXYL GROUPS. C. Gardner Swain and Mortimer M. Labes. J. Am. Chem. Soc. 79, 1084-8 (1957). C.A. 51, 7116b.

The rate of D exchange between NH_4Br and MeOH in $HCONMe_2$ solution containing HBr at 0° was investigated. II. C. Gardner Swain, James T. McKnight, and V. Peter Kreiter. Ibid. 1088-93. The rate of exchange of H between substituted ammonium salts and alcohols was studied as a function of the isotope used as tracer, of the concentration and structure of the acid, the substituted ammonium salt, the alcohol, and the solvent, and as a function of the temperature. The results are consistent with the mechanism proposed in part I.

2228
EXTREMELY SLOW REACTIONS. I. THE ISOTOPIC EXCHANGE REACTION BETWEEN IODOBENZENE AND POTASSIUM IODIDE. P. J. Manno and W. H. Johnston. J. Am. Chem. Soc. 79, 807-11 (1957). C.A. 51, 7116d.

The isotopic exchange reaction between PhI and KI^{131} was studied over the ranges 16-46° and 0.0001-0.1 f KI. The reaction had an exchange half-time of 390 years and proceeded by a combination of heterogeneous and homogeneous mechanisms.

2229
KINETICS AND C^{13} ISOTOPE EFFECT IN THE DECOMPOSITION OF SUBSTITUTED UREAS. Ellington M. Magee and Farrington Daniels. J. Am. Chem. Soc. 79, 829-32 (1957). C.A. 51, 7116f.

Decomposition in propionic acid of urea, sym-dimethylurea, phenylurea, sym-diphenylurea, and 3,3'-dimethylcarbanalide was measured at temperatures near 400° absolute, and the C^{13} isotope effect was determined.

2230
KINETICS OF THE THIOL-DISULFIDE EXCHANGE. Antonino Fava, Antonio Iliceto, and Ettore Camera. J. Am. Chem. Soc. 79, 833-8 (1957). C.A. 51, 7116h.

The kinetics was studied by means of S^{35}. The reaction is 1st order with respect to disulfide and to mercaptide ion. A slow heterogeneous exchange was observed between thiol and disulfide in the gas phase.

2231
ISOTOPE EXCHANGE OF OXYGEN BETWEEN FREE HYDROXYL RADICALS AND WATER. I. A. Kazarnovskii, N. P. Lipikhin, and M. V. Tikhomirov. Zhur. Fiz. Khim. 30, 1429-30 (1956). C.A. 51, 7117c.

2232
THE ISOTOPIC EFFECT IN THE FRACTIONAL DECOMPOSITION OF POTASSIUM FLUOBORATE. Maurice d'Hont and Andre de Lattre. Nuclear Phys. 2, 736 (1956/57). C.A. 51, 7117h.

The vibration frequencies of Goubeau and Bues (C.A. 46, 10718e) were used to show that for the reaction $B^{10}F_3 + B^{11}F_4^- = B^{11}F_3 + B^{10}F_4^-$, $(B^{11}F_3)/(B^{10}F_3) = K(B^{11}F_4^-)/(B^{10}F_4^-)$ with K = 1.05. The deviation of K from unity is due almost entirely to the zero-point energy effects.

2233
PHOTOCHEMICAL SEPARATION OF MERCURY ISOTOPES. I. EMISSION AND ABSORPTION HYPERFINE LINES OF MERCURY AT 2537 A. K. R. Osborn, C. C. McDonald, and H. E. Gunning. J. Chem. Phys. 26, 124-33 (1957). C.A. 51, 7160a.

Proper operating conditions were defined for the unique excitation of Hg^{202} to the $6(^3P_1)$ state in a substrate of natural Hg and a foreign gas.

2234
PREPARATION OF PURE MERCURY ISOTOPES FROM NATURAL MERCURY BY MERCURY PHOTOSENSITIZATION. R. Pertel and H. E. Gunning. J. Chem. Phys. 26, 219 (1957). C.A. 51, 7160b.

Mixtures of water vapor and butadiene, presaturated with natural Hg vapor, traversed a quartz cell irradiated with an Hg^{202} source. At a total pressure of 13 mm., the yield of Hg^{202} in the HgO formed was as high as 77%. Butadiene apparently served to suppress secondary reactions which degrade the isotopically-pure oxide formed in the primary reaction.

2235
MOLECULAR STILL OF THE COUNTERCURRENT REFLUX TYPE. Aubrey K. Brewer and T. Ivan Taylor. U. S. 2,780,589, Feb. 5, 1957. C.A. 51, 7162f.

The high vacuum apparatus is designed for controlled distillation of U polyalkoxides.

2236
THE EXPERIMENTAL DETERMINATION OF THE THERMAL DIFFUSION CONSTANT FOR ISOTOPES. Stanislaw Szpikowski. Ann. Univ. Mariae Curie-Sklodowska, Lublin-Polonia, Sect. AA 8, 35-56 (1953). C.A. 51, 7186a.

The thermal diffusion constant α was determined with a 2-bulb experiment. An expression for α is given if equilibrium is reached after n diffusion cycles. Neglect of the 2nd term of the power series in this expression results in an error of 3%. When the lineal drop of temperature in the connecting tube is neglected, the error is about 2%.

2237
ISOTOPE ENRICHMENT IN LITHIUM BY ELECTROLYTIC TRANSFERENCE IN MOLTEN LITHIUM BROMIDE. Arnold Lunden. Z. Naturforsch. 11a, 590-2 (1956). C.A. 51, 7186b.

Through electrolytic transference between molten LiBr and $PbBr_2$ Li^7 was enriched compared to Li^6 in 14 hours by a factor of 3.63. The mass effect was -0.26 ± 0.02, which is almost twice as much as the value found with LiCl.

2238
CONCENTRATION OF THE HEAVY ISOTOPE OF NITROGEN BY THERMAL DIFFUSION. B. A. Geller. Zhur. Fiz. Khim. 30, 1871-6 (1956). C.A. 51, 7186c.

The concentration of N^{15} was carried out in thermal diffusion apparatus consisting of 7 columns with a total length of 22 meters. The time of the experiment was 213 hours and the maximum concentration of N^{15} was 12.9%. The kinetics of the concentration process were studied.

2239
ISOTOPE ENRICHMENT IN CHLORINE THROUGH ELECTROLYTIC TRANSFERENCE IN MOLTEN ZINC CHLORIDE. A. Lunden and W. Herzog. Z. Naturforsch. 11a, 520 (1956). C.A. 51, 7186d.

Cl isotopes were separated by using molten $ZnCl_2$ as a carrier; the tube was operated at 600°, 15 v. and a c.d. of 3.6 amp./sq. cm. The enrichment in Cl isotopes was determined by transferring them to AgCl and irradiating this with neutrons. The data obtained give for the 2 Cl isotopes $\Delta\omega/\omega = 0.00241$ and $\mu = -0.043 \pm 0.003$.

2240
ENRICHMENT OF THE RADIOACTIVE ISOTOPES OF MERCURY. V. D. Nefedov, E. N. Sinotova, and V. I. Katsapov. Zhur. Fiz. Khim. 30, 1867-70 (1956). C.A. 51, 7186c.

A method is described for enriching radioactive Hg by means of Et_2Hg which gives an enrichment factor of 2.5×10^5 and a 67% yield of radioactive Hg. The use of other organo-Hg compounds (e.g., Me_2Hg) is discussed.

2241
SEPARATION OF URANIUM ISOTOPES WITH THE SEPARATION NOZZLE. E. W. Becker and R. Schütze. Z. Naturforsch. 11a, 679-80 (1956). (English translation, AEC-tr-2660). C.A. 51, 7186f.

U^{235} and U^{238} were separated in a separation nozzle (C.A. 51, 3196b) by the fluorides. A displacement of the natural U^{235} concentration of about 1.3 ± 0.2% was observed, which agrees with values extrapolated from experiments carried out with CO_2. The analysis was carried out with a mass spectrometer.

2242
ELECTROLYTIC SEPARATION OF METALLIC ISOTOPES. James H. Andrews, Ivan Ceresna, F. A. Rohrman, and Wm. F. Utlaut. Chem. Eng. Progr. Symposium Ser. 52, No. 19, 49-52 (1956). C.A. 51, 7198d.

By use of Ni^{63} as a radioactive tracer it was found possible with electro-chemical techniques to enrich the concentration of this Ni in the cathodic deposit. Attempts to enrich Cd, Ag, and U by similar electrolytic means have not been successful up to this time. Counting techniques were employed to follow the Ni, Cd, and Ag electrolyses, and the mass spectrometer was used for the U isotopes.

2243
HYDROLYSIS OF ETHYLENE OXIDE DERIVATIVES IN DEUTERIUM OXIDE-WATER MIXTURES. J. G. Pritchard and F. A. Long. J. Am. Chem. Soc. 78, 6008-13 (1956). C.A. 51, 7301a.

The hydrolysis of several simple epoxides by the acid-catalyzed, the base-catalyzed and the uncatalyzed hydrolysis paths has been studied in deuterium oxide-water mixtures as solvent. For the acid-catalyzed reaction k_{D_2O}/k_{H_2O} varies from 1.9 to 2.2. For the base-catalyzed reaction the effect of deuterium oxide as solvent is small, k_{D_2O}/k_{H_2O} varying from about 1.0 to 1.1. For the uncatalyzed hydrolysis the values of k_{D_2O}/k_{H_2O} vary from 0.8 to 0.9.

2244
CONCENTRATION OF RUBIDIUM ISOTOPES BY ELECTROMIGRATION IN FUSED SODIUM NITRATE. Chawki Mangalo, Harirao Jeevan Arnikar, and Marius Chemla. Compt. rend. 244, 2796-8 (1957). C.A. 51, 7537b.

The method of electromigration in asbestos impregnated with molten $NaNO_3$ was applied to Rb isotopes. The relative difference in mobilities of Rb^{85} and Rb^{87} has been found to be 0.00117. The mass effect measurement, $M\Delta v/v\Delta M = 0.05$, is well below that obtained with Na and Li isotopes.

2245
KINETICS OF SILVER-SILVER ION EXCHANGE. Cecil V. King and Ann Mari Simonsen. J. Electrochem. Soc. 104, 194-7 (1957). C.A. 51, 7811d.

Ag exchanges rapidly with its own ions on initial immersion in solution, with much slower exchange continuing through a sluggish layer of adsorbed salt.

2246
EQUILIBRIUM DISTRIBUTION OF LIGHT AND HEAVY WATERS IN A FREEZING MIXTURE. John C. Posey and Hilton A. Smith. J. Am. Chem. Soc. 79, 555-7 (1957). C.A. 51, 7812a.

The equilibrium distribution of the D content of a mixture of light and heavy water between the solid and liquid phases was determined. The D concentrates in the ice phase. The separation factor in solutions containing approximately 18 mole % of the total H as D was 1.0211 ± 0.0007.

2247
ISOTOPE EXCHANGE OF HYDROGEN BETWEEN BOUND WATER AND SOME HETEROPOLY COMPOUNDS IN HEAVY WATER, CONTAINING DEUTERIUM. V. I. Spitsyn and Yu. F. Berezkina. Zhur. Neorg. Khim. 1, 2642-5 (1956). C.A. 51, 7812c.

H interchange between 2.64 $Na_2O \cdot P_2O_5 \cdot$ - $23.66WO_3 \cdot 32.98H_2O$ and heavy water (containing D) was measured at 20° and at 99°.

2248
REACTION KINETICS OF DEUTERIUM AND TRITIUM COMPOUNDS. VII. OXIDATION-REDUCTION REACTIONS. Lawrence M. Brown. 1956, 25 pp. (NBS-4877). C.A. 51, 7813a.

Review. 48 references.

2249
THE EXCHANGE KINETICS IN COMPLEX PLATINUM BROMIDES. A. A. Grinberg and G. A. Shagisultanova. Izvest. Akad. Nauk S.S.S.R., Otdel Khim. Nauk 1955, 981-7. C.A. 51, 7813b.

Isotopic exchange of Br in $K_2[PtBr_4]$ and $K_2[PtBr_6]$ was studied in aqueous solutions. Dependence of the exchange on concentration of the complex, concentration of Br^-, age of solutions, temperature, and illumination were determined.

2250
THERMAL ISOTOPIC EXCHANGE BETWEEN ETHYL IODIDE AND MOLECULAR IODINE IN THE LIQUID PHASE. L. R. Darbee and G. M. Harris. J. Phys. Chem. 61, 111-12 (1957). C.A. 51, 7817e.

The apparent activation energy for the process was 19,500 cal./mole over the temperature range 45-70°. The relative rates of exchange of Me, Et, and Pr iodides were 8.5, 1.0, and 0.74 when the measurements were made 3 days after the start of the experiment (temperature not given). The catalytic effect of EtOH probably results from the rapid reduction of a fraction of the I to yield I^- ions, either by the alcohol or some impurity in it.

2251
HYDROGEN-DEUTERIUM EXCHANGE IN CLAYS AND PROBLEMS IN THE ASSIGNMENT OF INFRARED FREQUENCIES IN THE HYDROXYL REGION. Della M. Roy and Rustum Roy. Geochim. et Cosmochim. Acta 11, 72-85 (1957). C.A. 51, 7858g.

2252
ISOTOPIC RATIO OF $SULFUR^{32}/SULFUR^{34}$ IN SULFIDES. A. P. Vinogradov, M. S. Chupakhin, and V. A. Grinenko. Geokhimiya 1956, No. 4, 3-9. C.A. 51, 7966k.

It has been shown that sulfide minerals, such as pyrite, pyrrhotite, chalcopyrite, and troilite, have different S^{32}/S^{34} ratios depending on their genesis. The purpose of the present report was a more detailed study of the isotopic S ratio for ores of high-temperature sulfide minerals from different deposits of the U.S.S.R. A three-page table gives isotopic composition of S

of sulfide deposits, including percentage deviation from standard age, location of deposit, and description of the mineral.

2253
A RECTIFICATION COLUMN FOR THE PRODUCTION OF HEAVY-OXYGEN WATER. O. V. Uvarov, V. A. Sokol'skii, and N. M. Zhavoronkov. Khim. Prom. 1956, 404-5. C.A. 51, 8483d.
A rectification column is shown with which a concentration of 20.4 mol. % of H_2O^{18} was obtained after 2877 hours of continuous operation, without reaching the equilibrium state.

2254
KINETICS OF THE MANGANATE-PERMANGANATE EXCHANGE REACTION. John C. Sheppard and Arthur C. Wahl. J. Am. Chem. Soc. 79, 1020-4 (1957). C.A. 51, 8517i.

2255
ISOTOPIC EXCHANGE REACTIONS OF IODINE CYANIDE. F. E. Jenkins and G. M. Harris. J. Phys. Chem. 61, 249-50 (1957). C.A. 51, 8518b.
The following 3 exchange reactions were studied in aqueous and nonaqueous media: $ICN + I^{131-} = I^{131}CN + I^-$, $ICN + C^{14}N^- = IC^{14}N + CN^-$, $ICN + I^{131}I = I^{131}CN + I_2$. All 3 reactions went to completion within the few minutes required for separation.

2256
MAGNETOIONIC EXPANDER ISOTOPE SEPARATOR. Joseph Slepian. J. Franklin Inst. 263, 129-39 (1957). C.A. 51, 8540f.
A review of the development and principles of operation of an isotope separator based on the expansion, in a magnetic field, of ions from a high-current arc.

2257
EXCHANGE OF CARBONATODIAMINECOBALT(III) IONS WITH CARBONATE ION. James Edward Boyle. Univ. Microfilms (Ann Arbor, Mich.). Publ. No. 18748, 82 pp. Dissertation Abstr. 16, 2320 (1956). C.A. 51, 8571i.

2258
THEORETICAL CONSIDERATIONS ON THE POSSIBILITY OF A NEW METHOD FOR SEPARATING MIXTURES AND ISOTOPES. A. Witkowski. Bull. acad. polon. sci. Classe III, 5, 75-8 (1957). Acta Phys. Polon. 16, 79-91 (1957)(In English). C.A. 51, 9222c.
Theoretical analysis of a combination of gravitational thermodiffusion and of rectification is presented. The separation unit should consist of 2 plates or two concentric tubes, the temperature of the colder one being so low as to ensure the presence of a permanent liquid film. The numerical example shows that the method should be more effective than thermodiffusion or distillation alone.

2259
HEAVY-WATER PRODUCTION BY NATURAL-WATER DISTILLATION. III. WETTED-WALL-COLUMN DEVELOPMENT. A. R. Bancroft and H. K. Rae. 1955, 58 pp. (CRCE-608); (AECL-230). C.A. 51, 9246a.
Of the types of Al sheet packing that were investigated a series of parallel vertical Al sheets was the most satisfactory. The sheets were fabricated in structurally strong units suitable for packing large distillation columns. Initial results of a 4-foot air-water column are listed. These results indicate the method to be successful in producing cheap heavy water by natural-water distillation. Successful operation of a long distillation column is required to confirm the method.

2260
USE OF RADIOISOTOPE STRONTIUM-89 TO DETERMINE EXTENT OF EXCHANGE. Carlo Bettinali, Franco Salvetti, and Dante Cordischi. Ricerca sci. 26, 2801-2 (1956). C.A. 51, 9268i.
Sr^{89} is well-suited for determination of the extent of ionic exchange. Three types of alkaline materials having different cation-exchange properties were tested with Sr^{89}. These results were compared with those obtained by chemical methods using $Ba(OAc)_2$, with good agreement.

2261
ISOTOPIC EXCHANGE REACTIONS BETWEEN IONIC COBALT AND A COBALT COMPLEX. Maria Bruno and Umberto Belluco. Ricerca sci. 26, 2711-13 (1956). C.A. 51, 9269a.
The isotopic exchange of Co ion and its complex with ethylenediaminetetraacetic acid was studied at 0° in a solution having pH = 4.5. Co^{60} was used as a tracer. A plot of fraction of exchange compound vs. time indicated that the half-life for the reaction is about 13 min.

2262
ISOTOPE EXCHANGE OF MERCURY IN CH_3HgBr-$HgBr_2$-C_2H_5-OH SYSTEM. V. D. Nefedov, E. N. Sinotova, and N. Ya. Frolov. Zhur. Fiz. Khim. 30, 2356-60 (1956). C.A. 51, 9271c.
The isotope exchange in the CH_3HgBr-Hg^*Br_2-C_2H_5OH proceeds as a bimol. reaction with an activation energy of 18,300 cal./mole.

2263
TEMPERATURE DEPENDENCE OF SILVER-SILVER CHLORIDE EXCHANGE. T. W. Olcott. 1956, 22 pp. (AECU-3372). C.A. 51, 9271f.
The exchange reaction between radioactive Ag-110 in 2M HNO_3 and AgCl coated on Pt gauze was measured at 8 temperatures between 2° and 96°. The half time for exchange varies from 115 seconds at 2° to 22 seconds at 96°.

2264
STUDIES OF THE MECHANISM OF THE CATALYTIC HYDROGENATION OF ORGANIC SULFUR COMPOUNDS ON AN IRON-CHROMIUM CATALYST BY THE METHOD OF TAGGED ATOMS. II. THE STUDY OF THE ISOTOPE EXCHANGE REACTION. F. P. Ivanovskiĭ R. S. Kal'varskaya, G. S. Beskova, and N. P. Sokolova. Zhur. Fiz. Khim. 30, 2353-5 (1956). C.A. 51, 9275f.
In the absence of catalysts, the S isotope exchange in CS^{35}_2-H_2S^{32}-N_2 proceeds very slowly, and only 5-6% is exchanged at 400° in 3 hours. The rate of exchange is much higher with Fe-Cr-S^{35} catalyst, and CS_2 in N_2 exchanges 26% of S^{32} for S^{35} at a space velocity of 1200/hr. at 400°, H_2S^{32} under the same reaction conditions 73%, and COS^{32} 45% at 300°. The rate is lower at lower temperatures. $C_4H_4S^{32}$ is considerably more stable than are other organic S compounds, and the S^{32} exchange starts at 32° and becomes very rapid at 400°.

2265
THE EXCHANGE OF FLUORINE-18 BETWEEN METALLIC FLUORIDES AND GASEOUS FLUORINE COMPOUNDS. T. A. Gens, John A. Wethington, Jr., A. R. Brosi, and E. R. Van Artsdalen. J. Am. Chem. Soc. 79, 1001-2 (1957). C.A. 51, 9278i.

Exchange at moderate temperatures was observed in a number of systems such as $CF_3CF{:}CF_3 + RbF^{18} \rightleftharpoons C_3F^{18}{}_6 + RbF$. For alkali fluorides, the order of reactivity/square meter of surface was Cs > Rb > K, Na, Li. $CF_3CF{:}CF_2$ with any single salt exchanged more readily than did CF_4, C_4F_{10} and $(C_2F_5)_2O$; appreciable exchange was observed in all cases. SF_6 did not exchange with any of these salts below 300°; above 300° complicated reactions set in. SiF_4 exchanged rapidly at room temperature with the alkali fluorides but manometric measurements showed complex fluoride formation at higher temperatures.

2266
ISOTOPE EFFECT IN A PHASE TRANSITION IN SOLID METHANE. Marvin J. Freiser. Univ. Microfilms (Ann Arbor, Mich.). Publ. No. 18848, 148 pp. Dissertation Abstr. 16, 2485 (1956). C.A. 51, 9279e.

2267
LITHIUM HYDRIDE, DEUTERIDE, AND TRITIDE SYSTEMS. F. K. Heumann and O. N. Salmon. 1956, 54 pp. (KAPL-1667). C.A. 51, 9280d.

The pressure-composition isotherm curves for H_2 in equilibrium with Li-LiH at 700°, 750°, and 800° were determined. Similar curves were obtained for the LiD and the LiT systems.

2268
CARBON-13 ISOTOPE EFFECT IN THE PHOTOLYSIS OF ETHYL BROMIDE. H. L. Friedman, R. B. Bernstein, and H. E. Gunning. J. Chem. Phys. 26, 528-32 (1957). C.A. 51, 9332e.

The photolysis of EtBr in a 10-fold excess of cyclopentane was studied over a temperature range of 30-250°. The C^{12} enrichment in the ethane product was 1.0070, and invariant in temperature. The fractionation effect was attributed to higher absorption of C^{12}-C^{12}-Br over C^{12}-C^{13}-Br in the long-wave-length region.

2269
RADIATION-INDUCED EXCHANGE OF DEUTERIUM BETWEEN HEAVY WATER AND DISSOLVED HYDROGEN. J. Bardwell and P. J. Dyne. Can. J. Chem. 35, 82-8 (1957). C.A. 51, 9333c.

Co^{60} γ-rays induced the exchange, so that the equilibrium was much higher in favor of HD formation than the thermal equilibrium. A steady state is reached in which the concentration of D in the gas approaches that in the liquid. A plot of log(1 - F) vs. t was linear, and exchange yield is independent of dose rate.

2270
CHEMICAL ISOTOPIC-EXCHANGE PROCESS. Richard W. Woodard. U. S. 2,787,587, Apr. 2, 1957. C.A. 51, 9368f.

A method is given for obtaining the isotopic concentration of U by effecting isotopic exchange between ionic uranium maintained in different valence states. Aqueous solutions of uranous and uranyl ion in the form of strong mineral acid salts are maintained at a pH of approximately 2.0. The heavier isotope concentrates in the lower valent state and the lighter isotope in the higher valent state. In 9 enrichment stages, the U^{235} content increased from 0.7052 to 0.7090%.

2271
RADIOSULFUR EXCHANGE REACTIONS BETWEEN SULFUR OXYHALIDES. Leroy F. Johnson, Jr., and T. H. Norris. J. Am. Chem. Soc. 79, 1584-6 (1957). C.A. 51, 9390h.

The S^{35} exchange reaction between $SOCl_2$ and $SOBr_2$ was studied at -20 and -50°, both in liquid SO_2 solution and in the 2 pure mixed compounds. The exchange is rapid and complete, except for the pure compounds at -50°, where a measurable rate is observed. The S^{35} exchange between thionyl chloride and sulfuryl chloride is insignificant in 5 days at 0°.

2272
SEARCH FOR VARIATIONS IN THE RELATIVE ABUNDANCE OF THE ZINC ISOTOPES IN NATURE. R. Blix, H. v. Ubisch, and Frans E. Wickman. Geochim. et Cosmochim. Acta 11, 162-4 (1957). C.A. 51, 9438a.

No variations could be detected in 18 samples of various minerals in the ratio Zn^{64}/Zn^{68}. If any exist, they are <0.1% of the ratio.

2273
FRACTIONATION OF STABLE ISOTOPES OF SULFUR BY MICROORGANISMS AND THEIR ROLE IN DEPOSITION OF NATIVE SULFUR. Galen E. Jones and Robert L. Starkey. Appl. Microbiol. 5, 111-18 (1957). C.A. 51, 9438b.

The degree of fractionation of the stable S isotopes, S^{32} and S^{34}, resulting from reduction of sulfate to sulfide by Desulfovibrio desulfuricans and oxidation of elemental S to sulfate by Thiobacillus thiooxidans was determined. About 1.4-2.7% fractionation was obtained. Fractionation was greatest when rate of reduction was low. No fractionation of the S isotopes was noted during oxidation of S by T. thiooxidans.

2274
NATURAL VARIATIONS IN THE RELATIVE ABUNDANCES OF THE NITROGEN ISOTOPES. A. Parwel, R. Ryhage, and Frans E. Wickman. Geochim. et Cosmochim. Acta 11, 165-70 (1957). C.A. 51, 10145h.

Two samples of NH_4Cl, two of caliche, eight of Wealden coal, five of Carboniferous coal, three of living trees and one air sample were studied. The NH_4Cl samples formed a distinct group about 1% heavier than the air sample. The other samples showed variations of some parts per thousand from the air sample. The Wealden-coal nitrogen is heavier than the Carboniferous-coal nitrogen, this being contrary to the results found for the carbon isotopes.

2275
VAPOR PRESSURE STUDIES INVOLVING SOLUTIONS IN LIGHT AND HEAVY WATERS. III. THE SEPARATION FACTOR FOR THE ISOTOPES OF HYDROGEN DURING DISTILLATION FROM SALT SOLUTIONS IN THE MIXED WATERS AT ROOM TEMPERATURE. John M. Googin and Hilton A. Smith. J. Phys. Chem. 61, 345-50 (1957). C.A. 51, 10155h.

The possibility of changing the separation factor for the fractionation of the isotopes of hydrogen during the distillation of water by the addition of various solutes to the system was investigated. The addition of ionic compounds decreased the separation factor in all cases. The reduction in the separation factor amounted to more than 60% of its excess over one when zinc iodide was used as solute.

2276
MEASUREMENT OF THE VAPOR PRESSURE FOR He^3-He^4 MIXTURES CONTAINING LARGE CONCENTRATIONS OF He^3. V. P. Peshkov and V. N. Kachinskiĭ. Zhur. Eksptl. i Teoret. Fiz. 31, 720-1 (1956). C.A. 51, 10157c.
The coefficient of separation was calculated from the data of 2 series of experiments with mixtures containing 97.0 and 94.0% He^3 in the vapor and 93.6% in the liquid in the temperature range 1.45-2.0°K. The coefficient was calculated to be 3.0 (± 20%).(Eng. Trans. Ref. No. 2332).

2277
EXCHANGE REACTION BETWEEN TIN(IV) CHLORIDE AND TIN(II) CHLORIDE IN ABSOLUTE METHANOL. E. Gerald Meyer and Mitchell A. Melnick. J. Phys. Chem. 61, 367-9 (1957). C.A. 51, 10205c.
Measurements were made at 33.1, 40.5, and 47.2° by the use of Sn^{121} with a 1.1-day half-life. The over-all rate of exchange equation was $R = 5.5 \times 10^{10} e^{-20,900/RT}$ mole/l.-sec. The molar activation entropy was -11.5 e.u.

2278
KINETIC ISOTOPE EFFECT IN THE DECOMPOSITION OF SUBSTITUTED UREAS AND IN THE HYDROGEN-IODINE REACTION. Ellington McF. Magee. Univ. Microfilms (Ann Arbor, Mich.). Publ. No. 18424, 125 pp. Dissertation Abstr. 16, 1808 (1956). C.A. 51, 10205f.

2279
SEPARATION OF ISOTOPES BY SURFACE DIFFUSION IN POROUS MEDIA. W. G. Trawick and A. S. Berman. J. Chem. Phys. 26, 709-10 (1957). C.A. 51, 10263h.
Experiments similar to those of Haul (C.A. 49, 5071e) were carried out. During the transient portion of the flow the time dependence of the flow and separation factor were qualitatively the same as those observed by H. When a steady state was obtained, a separation factor less than that for free molecular flow was obtained.

2280
CONCENTRATION OF LITHIUM ISOTOPES BY ELECTROPHORESIS. André Bonnin and Marius Chemla. Compt. rend. 243, 1112-15 (1956). C.A. 51, 10263i.
After an electrophoresis the isotopic ratio, Li^7/Li^6, was found to vary from 7.6 to 15.0. The relative difference of mobility was about 0.004.

2281
SEPARATION OF BORON ISOTOPES BY THERMAL DIFFUSION. G. M. Panchenkov, V. D. Moiseev, and Yu. A. Lebedev. Zhur. Fiz. Khim. 30, 2348-52 (1956). C.A. 51, 10264a.
Pure BF_3 was subjected to thermal diffusion in a cascade apparatus with a total column length of 1140 cm. The separation efficiency was very low at gas pressure not higher than atmospheric. The existing theories of thermal diffusion agree poorly with the results of experimental separation of BF_3 isotopes.

2282
ENRICHMENT OF URANIUM ISOTOPES IN A COUNTERCURRENT GAS CENTRIFUGE. W. Groth, E. Nann, and K. H. Welge. Z. Naturforsch. 12a, 81 (1957). C.A. 51, 10264b.
On the principle of the axial temperature gradient (cf. C.A. 50, 10451d) it is possible with the given centrifuge to work up 155 kg. UF_6 yearly with a shift of the ratio of U-235 concentration of enriched/impoverished fraction by 20%. Some construction details of a centrifuge, which is expected to yield a shift of 60%, are mentioned.

2283
THEORETICAL PRINCIPLES OF ISOTOPE METHODS FOR INVESTIGATING CHEMICAL REACTIONS. S. Z. Roginskiĭ. Publishing House of the Academy of Sciences, U.S.S.R. Moscow, 1956. 611 p. (English translation AEC-tr-2873). C.A. 51, 10266e.
Information is included on thermodynamic isotopic effects, kinetics of noncomplicated isotopic exchange, mechanisms and stages of isotopic exchange, isotopic effects in chemical kinetics, kinetics of complex isotopic exchange, and the basic areas of applications and perspectives of development of isotopic methods in chemical kinetics. Tables of thermodynamic functions, isotopic exchange equilibrium constants, and tables developed according to the kinetic isotopic effects of isotopic exchange are included in the appendix.

2284
THE INFLUENCE OF TEMPERATURE ON ISOTOPIC SEPARATION UNDER THE EFFECT OF A CONTINUOUS CURRENT IN MOLTEN GALLIUM. Maurice Goldman, Guy Nief, and Étienne Roth. Compt. rend. 243, 1414-16 (1956). C.A. 51, 10275h.
The effect of isotopic separation by passage of direct current through molten Ga increases with temperature in contradiction to the theoretical predictions.

2285
MAXIMIZING THE SEPARATION FACTOR OF A THERMAL DIFFUSION COLUMN. J. W. Corbett and W. W. Watson. Phys. Rev. 99, 634 (1955). C.A. 51, 10974h.
Brief abstract only contained in Phys. Rev.

2286
VAPOR PRESSURE STUDIES INVOLVING SOLUTIONS IN LIGHT AND HEAVY WATERS. IV. SEPARATION FACTOR AND CROSSOVER TEMPERATURE FOR SALT SOLUTIONS OF THE MIXED WATERS AND FOR A MIXTURE OF THE PURE WATERS FROM 100° TO THE CRITICAL TEMPERATURE. Robert L. Combs and Hilton A. Smith. J. Phys. Chem. 61, 441-7 (1957). C.A. 51, 10989b.
The separation factor for a mixture of light and heavy water is presented and agrees well with the square root of the ratio of the vapor pressures of pure H_2O to pure D_2O. The addition of a salt to the mixed waters lowers the separation factor and the crossover temperature (the temperature at which the separation factor becomes 1). The lowest separation factor

obtained (0.966) indicated that it might be possible to produce heavy water above the crossover temperature by a process of extractive distillation using either LiI or K_3PO_4.

2287
ISOTOPE EFFECT OF HYDROGEN IN AROMATIC SULFONATION. II. TEMPERATURE DEPENDENCE. Ulla Berglund-Larsson. Arkiv Kemi 10, 549-60 (1957). C.A. 51, 11016a. cf. C.A. 48, 11377i.
In order to test the reaction scheme proposed in part I to account for the extremely weak isotope effect encountered in aromatic sulfonation, the temperature dependence of the isotope effect was studied for the couples T-H and D-H at 0, 25 and 50°. The isotope effects obtained from the T and D experiments agreed very well with each other and supported the reaction scheme proposed in part I.

2288
HYDROGEN EXCHANGE BETWEEN AROMATIC HYDROCARBONS AND LIQUID DEUTERIUM BROMIDE. A. I. Shatenshteĭn, V. R. Kalinachenko, and Ya. M. Varshavskiĭ. Zhur. Fiz. Khim. 30, 2093-7 (1956). C.A. 51, 11025e.
The rate of hydrogen exchange between liquid deuterium bromide and aromatic hydrocarbons with both condensed and linearly connected rings (benzene, naphthalene, anthracene, phenanthrene, pyrene, diphenyl, p-terphenyl) has been measured. The results were compared with data on hydrogen exchange with liquid deuteroammonia catalyzed by potassium amide.

2289
HYDROGEN EXCHANGE BETWEEN BENZENE AND NAPHTHALENE DERIVATIVES AND LIQUID DEUTERIUM BROMIDE. A. I. Shatenshteĭn, V. R. Kalinachenko, and Ya. M. Varshavskii. Zhur. Fiz. Khim. 30, 2098-2105 (1956). C.A. 51, 11025h.
The rate of hydrogen exchange between benzene and naphthalene derivatives and DBr has been measured to determine the effect of substitutes (CH_3, NO_2, CN, COOH, Cl, Br) on the reactivity of aromatic compounds in electrophilic hydrogen substitution reactions. Rates of exchange of the unequivalent types of hydrogen in the monoalkyl benzenes (CH_3, C_2H_5, iso-C_2H_7, t-C_4H_9, and n-C_4H_9) were compared and the effects produced by alkyl group branching and by the second reagent on the reactivity were discussed. The isotopic hydrogen exchange in polymethylbenzenes (m-xylene, mesitylene, durene, penta- and hexabenzene) was also considered.

2290
PROBLEMS OF LARGE-SCALE PRODUCTION OF NITROGEN-15. T. I. Taylor and W. Spindel. 1955, pp. 94-115 (NYO-6242). C.A. 51, 11118a.
A schematic diagram of a cascade system is presented which is capable of producing N^{15}.
SEPARATION OF NITROGEN ISOTOPES BY CHEMICAL EXCHANGE BETWEEN NITRIC OXIDE AND NITRIC ACID. W. Spindel, T. I. Taylor, G. Gashurov, and R. Froeder. Ibid. pp. 7-74.
The exchange reaction between NO and HNO_3 is favorable for the concentration of N^{15}. Complete details of the system are given as well as effect of flow rates, concentration, pressure, packing, column type, hold-up, throughput, variation in gas phase composition, temperature, etc.

2291
BEHAVIOR OF SULFUR DIOXIDE IN A THERMAL DIFFUSION COLUMN. K. Clusius and H. U. Hostettler. Z. Naturforsch. 12a, 83-4 (1957). C.A. 51, 11118d.
Experiments are carried out with $S^{34}O_2$-$S^{32}O_2$ in a 10-m. column 0.85 cm. in diameter. Under certain conditions of temperature the thermal diffusion factor α is negative, and the heavy molecules collect at the head of the column.

2292
THE CHEMISTRY OF NITROSYL COMPLEXES. III. EVIDENCE FOR COMPOUND FORMATION IN LIQUID NITROSYL CHLORIDE FROM TRACER STUDIES. J. Lewis and D. B. Sowerby. J. Chem. Soc. 1957, 1617-22. C.A. 51, 11147a.
The rapid exchange of Cl^{36} between the nitrosyl chloride addition compounds of $FeCl_3$ and $SbCl_5$ with liquid nitrosyl chloride was in agreement with the formation of these compounds as nitrosonium salts. With $AsCl_3$, $POCl_3$, and CCl_4, more covalent chlorides, exchange is rapid with $AsCl_3$ but very slow with $POCl_3$ and CCl_4. The rapid exchange of Cl^{36} between $AsCl_3$ and NOCl is attributed to the formation of a compound which behaves as a very weak electrolyte in the nitrosyl chloride solvent system. The slow exchange of NOCl with nonelectrolyte $POCl_3$ was assumed to occur through the presence of free Cl^-.

2293
ABUNDANCE RATIO OF OXYGEN ISOTOPES IN SILICEOUS ROCKS. Taneki Tokuda and Takeo Ao. Yogyo Kyokaishi 64, 12-18 (1956). C.A. 51, 11202g.
Deviations of O^{18}/O^{16} in waters prepared from Tamba chert, Mikawa quartz schist, and Tamba vein quartz, etc., were + 1.2-+ 13.5%, while those of igneous minerals such as microcline, augite, and tourmaline of Japan showed negative values.

2294
PRELIMINARY NOTE ON THE ISOTOPIC COMPOSITION OF CARBON IN SOME SWEDISH ROCKS. Sture Landergren. Geol. Fören. i Stockholm Forh. 79, 274-5 (1957). C.A. 51, 11202i.
Organic origin for the C in all samples is indicated.

2295
SELECTIVE SOLVATION AND DIELECTRIC SATURATION AS RELATED TO ELECTRON-EXCHANGE REACTIONS. Edward S. Amis. J. Chem. Phys. 26, 880-1 (1957). C.A. 51, 11792h.
The Np(V)-Np(VI) electron-exchange reaction is independent of the composition and of the gross properties such as dielectric constant, n, and viscosity of 2 mixed solvents.

2296
DIFFUSION AND EXCHANGE OF ZINC IN CRYSTALLINE ZINC OXIDE. Etalo A. Secco and Walter J. Moore. J. Chem. Phys. 26, 942-8 (1957). C.A. 51, 11800c.
The sample of $Zn^{65}O$ was exposed to Zn vapor at temperatures between 900 and 1025°, and the residual radioactivity was determined at various times. Except for

the initial stages, the exchange reaction appeared to be controlled by the diffusion of Zn in ZnO.

2297
SOLUBILITY OF HYDROGEN AND DEUTERIUM IN NONPOLAR SOLVENTS. M. W. Cook, D. N. Hanson, and B. J. Alder. J. Chem. Phys. 26, 748-51 (1957). C.A. 51, 11816e.
Data are presented for the solubility of H_2 and D_2 in eight nonpolar solvents from -25°C to 35°C, and show that D_2 is about 2.5% more soluble. The data are accurate to 0.1% and correlate successfully with the solubility parameter of the solvent. The various thermodynamic functions are calculated.

2298
THERMAL EXCHANGE OF RADIOACTIVE IODINE WITH HYDROGEN IODIDE AND WITH METHYL IODIDE IN THE GAS PHASE. Henry Schmied. Univ. microfilms (Ann Arbor, Michigan). Pub. No. 20606, 100 pp; Dissertation Abstr. 17, 973-4 (1957). C.A. 51, 11825a.

2299
MEASUREMENTS OF ISOTOPIC EXCHANGE EQUILIBRIUMS. Lois Nash Kauder, W. Spindel, and T. I. Taylor. 1955, pp. 82-93 (NYO-6242). C.A. 51, 11825b.
The exchange reaction of the NO-HNO_3 system is discussed. The best value of α for a system of 10M acid saturated with NO at atmospheric pressure and room temperature is 1.062 ± 0.005.

2300
THE THEORY OF OXIDATION-REDUCTION REACTIONS INVOLVING ELECTRON TRANSFER. II. APPLICATIONS TO DATA ON THE RATES OF ISOTOPIC EXCHANGE REACTIONS. R. A. Marcus. J. Chem. Phys. 26, 867-71 (1957). C.A. 51, 11825c.
The rates of some homogeneous isotopic exchange reactions in solution were considered in the light of a recently developed quantitative theory of oxidation-reduction processes (C.A. 50, 11780i).

2301
CHEMICAL EXCHANGE EFFECTS ON ISOTOPE SEPARATIONS IN THERMAL DIFFUSION COLUMNS. Ivan Chasalow and T. I. Taylor. 1955, pp. 116-35 (NYO-6242). C.A. 51, 11830d.
In order to obtain a significant chemical exchange effect the rate of exchange must be rapid. The systems CO-CO_2 and NO-NO_2 are discussed in relation to catalysts and temperatures. The associated problem of thermal diffusion in the exchange is discussed.

2302
THERMODYNAMIC FUNCTIONS FOR THE ISOTOPIC HYDROGEN SELENIDES AND HYDROGEN TELLURIDE. A. P. Altshuller. J. Phys. Chem. 61, 509-11 (1957). C.A. 51, 11833b.
Calculations of the thermodynamic functions of H_2Se, HDSe, D_2Se, and H_2Te are given.

2303
NUCLEAR MAGNETIC RESONANCE STUDY OF THE B_2D_6-B_5H_9 EXCHANGE REACTION. Walter S. Koski, Joyce J. Kaufman, and Paul C. Lauterbur. J. Am. Chem. Soc. 79, 2382-5 (1957). C.A. 51, 11847h.
The exchange of deuterium between diborane and pentaborane is investigated by nuclear magnetic resonance. The exchange proceeds preferentially in the terminal H positions in pentaborane. The rate of exchange of the apex H is within 10% the same as the exchange of the base terminal H. The bridge H atoms in pentaborane do not exchange.

2304
POSSIBILITY OF SEPARATION OF BORON ISOTOPES BY CHEMICAL EXCHANGE. G. M. Panchenkov, V. D. Moiseev, and A. V. Makarov. Doklady Akad. Nauk S.S.S.R. 112, 659-61 (1957). C.A. 51, 11880d.
Details are given of B isotope separation by chemical exchange based on the reaction of $B^{10}F_3 + A{\cdot}B^{11}F_3 \rightleftharpoons B^{11}F_3 + A{\cdot}B^{10}F_3$; where A is the anisole $C_6H_5OCH_3$ and $A{\cdot}BF_3$ is the liquid complex compound of anisole with boron fluoride. It has been shown that the isotope exchange reaction, as shown above, has the equilibrium constant $\alpha = 1.013 \pm 0.005$ and the isotope B^{10} concentrated in the anisole-fluorine boron complex, i.e. in the liquid phase. Results of the experiments are shown in tabular and graphical forms.

2305
CONCENTRATION OF THE ISOTOPE NITROGEN-15 BY A CHEMICAL EXCHANGE REACTION. Adolf Zeman and Vladimír Čermák. Chem. listy 51, 818-22 (1957). C.A. 51, 11880g.
A column (8.3 meters) for the concentration of the N^{15} isotope by the exchange reaction between gaseous $N^{15}H_3$ and NH_4NO_3 solution was filled with cylinders made of glass tissue. After 27 days of operation the concentration of N^{15} increased from 0.365 atom % to 11.4 atom %. The enrichment factor Z = 35.1, and the height of the equivalent theoretical plate is 5.3 cm.

2306
SECONDARY HYDROGEN ISOTOPE EFFECTS AS A CRITERION OF MECHANISM. E. A. Halevi. Tetrahedron 1, 174-5 (1957). C.A. 51, 12575g.
Secondary H-isotope effects are discussed.

2307
SEPARATION OF GASEOUS MIXTURES BY A NON-UNIFORM BARRIER. Stephen Prager. 1957, 14 pp. (K-1311). C.A. 51, 12584d.
A mathematical study of the effects of structural irregularities of an infinite porous plate on its performance as a gas mixture flows across and through its face.

2308
A SOLUTION OF THE DIFFUSION EQUATION FOR ISOTOPIC EXCHANGE BETWEEN A SEMI-INFINITE SOLID AND A WELL-STIRRED SOLUTION. I. R. Beattie and D. R. Davies. Phil. Mag. [8], 1, 874-9 (1956). C.A. 51, 12605h.
From Fick's Law a theoretical solution of the problem of diffusion of material from a semi-infinite solid of known surface area into a given volume of a well-stirred liquid is derived.

2309
TRANSFERENCE MEASUREMENTS FOR DETERMINING THE MOBILITIES OF LITHIUM-6, LITHIUM-7, AND LEAD IN MOLTEN MIXTURES OF LITHIUM CHLORIDE AND LEAD CHLORIDE. A. Klemm and E. U. Monse. Naturforsch. 12a, 319-34 (1957). C.A. 51, 12606h.
The measurement of ion mobilities in molten-salt mixtures is discussed from a general point of view, and a theory of

moving boundaries is given. The system $LiCl/PbCl_2$ was studied experimentally. An isotope analysis showed that the difference of the reduced relative mobilities of the Li isotopes (mass effect) has a constant value of -0.14 between 100 and 20 equivalent % of LiCl. The difference then increases and reaches a value of -0.27 at 5 equivalent % of LiCl.

2310
STUDY OF THE ISOTOPIC EXCHANGE BETWEEN TELLURIUM(IV) AND TELLURIUM(VI) IN ACID SOLUTION. M. W. Hanson and T. C. Hoering. J. Phys. Chem. 61, 699 (1957). C.A. 51, 12612b.

No detectable exchange over a period of 4 days was obtained between 0.05M solutions of TeO_2 and H_6TeO_6 in 6M $HClO_4$ at 30°. Heating an identical mixture at 95-100° for 24 hours also did not result in exchange. No exchange was observed in solutions containing 6M H^+, 3M Cl^-, 0.05M Te(IV) and 0.05M Te(VI) at 30° or 95-100°.

2311
ISOTOPIC EXCHANGE REACTION BETWEEN BENZOYL PEROXIDE AND POTASSIUM BENZOATE. Giovanni Giacometti and Antonio Iliceto. Ricerca sci. 27, 743-50 (1957). C.A. 51, 12612e.

The exchange reaction using KOBz tagged with C^{14} was studied in acetone -10% water solution with concentration of reactants up to 0.2M.

2312
KINETIC ISOTOPE EFFECT IN THE IODINATION OF 2,4,6-TRIDEUTERIOPHENOL. Erling Grovenstein, Jr., and Donald C. Kilbey. J. Am. Chem. Soc. 79, 2972-3 (1957). C.A. 51, 12612i.

2,4,6-trideuteriophenol undergoes iodination at 25° at a rate 1/4 that of ordinary PhOH (k_H/k_D 3.97) in acetate buffer. Similar effects were obtained in dilute $HClO_4$.

2313
PYROLYSIS OF LEAD OXALATE; ISOTOPE EFFECTS AND PRODUCT COMPOSITION. Peter E. Yankwich and James L. Copeland. J. Am. Chem. Soc. 79, 2081-6 (1957). C.A. 51, 12616i.

The composition and isotopic constitution of the gaseous products were studied for the pyrolysis of PbC_2O_4 at 350-625°. Variations with temperature of the CO_2:CO ratio and of C isotope distribution in the product gases are considered.

2314
REMOVAL OF IODINE-131 FROM DISSOLVER OFF-GAS STREAMS BY ISOTOPIC EXCHANGE. E. D. McClanahan, Jr. 1956, 19 pp. (HW-47676). C.A. 51, 12681b.

Laboratory experiments show that I^{131} removal from dissolver off-gas can be achieved by passing the gas through a bed of nonradioactive AgI operated at 250-300°. The exchange of I^{131} with I^{127} in the bed is fast enough to make it of practical use on gas streams with I concentrations as low as 10^{-7} g./cu. ft. Reduction in the I^{131} effluent concentration occurs when the holdup is sufficiently larger than the 8-day half-life.

2315
ENRICHMENT OF THE LIGHT URANIUM ISOTOPE BY THE GASEOUS-DIFFUSION PROCESS. E. W. Becker. Chem.-Ing.-Tech. 29, 365-71 (1957) C.A. 51, 12693c.

By analyzing the effects of operating variables a value function is developed for specific energy consumption of the process. Reasonable values for operating pressures, pumping factors, cell efficiency, etc., are then assumed, and by similarity consideration for the cascade element and total cascade Becker estimates the cost of U^{235} production at $560/kg. U^{235}/year, from published data of current consumption and price of U^{235}.

2316
SEPARATION AND CONCENTRATION OF ISOTOPES OF BORON AND OXYGEN. Ray H. Crist and Isidor Kirshenbaum. U. S. 2,796,330, June 18, 1957. C.A. 51, 12696d.

Isotopes are separated: (1) by forming a dissociable compound of the element which, when vaporized, dissociates appreciably by a reversible dissociation process but which has substantially the same chemical composition in the 2 phases; (2) heating the compound to convert a portion of it to the vapor phase; and (3) establishing a countercurrent flow of the liquid and vapor phases while maintaining the liquid and vapor in intimate contact with one another to cause the different isotopic species of the compound to concentrate in different phases. An effective separation of B^{10} and B^{11} is achieved by forming a complex of BF_3 and Me_2O. O^{16} and O^{18} can also be separated in a similar manner, the same reagents being used. Et_2O or Me borate can be used instead of Me_2O.

2317
CONCENTRATION OF ISOTOPES BY ELECTROMIGRATION IN AQUEOUS SOLUTION: INFLUENCE OF TEMPERATURE ON RELATIVE MOBILITIES OF Na^{22+} AND Na^{24+} IONS. Andre Bonnin. Compt. rend. 244, 2708-10 (1957).(In French). C.A. 51, 13512c.

The relative difference in mobility of Na^{22+} and Na^{24+} ions in aqueous solution was studied as a function of temperature by electromigration on filter paper. It increased with temperature, changing from 0.003 at 1°C to 0.008 at 49°C.

2318
THE ISOTOPIC EXCHANGE OF OXYGEN IN MINERAL OXIDES WITH CO_2 AND ITS USE FOR DETERMINING THE ACTIVE SURFACE VALUE. E. I. Dontsova. Doklady Akad. Nauk S.S.S.R. 110, 589-92 (1956). C.A. 51, 13513f.

Investigation of the O interchange between solid oxides and CO_2 containing O^{18} gave data from which the active surface of the oxide powder could be calculated. SiO_2, MnO_2, Fe_3O_4 and Al_2O_3 were studied at temperatures from 200-1380°.

2319
EFFECT OF PRESSURE ON THE ISOTOPE EFFECT IN A UNIMOLECULAR GASEOUS REACTION: TRITIUM AND CARBON-13 EFFECTS IN THE ISOMERIZATION OF CYCLOPROPANE. Ralph E. Weston, Jr. J. Chem. Phys. 26, 975-83 (1957). C.A. 51, 13531c.

As a new means of studying the effect of pressure on unimolecular gaseous reaction kinetics, the tritium isotope effect in the isomerization of cyclopropane to propylene has been measured. At a pressure of 200 mm, the ratio of rate constants for unlabeled and singly-labeled species is given by $k/k' = (0.86 \pm 0.06) \exp(385 \pm 95/RT)$. The temperature range

was 406 to 492°C. The carbon-13 isotope effect was measured at 1 atmosphere and 492°, and was found to be k/k' = 1.0072 ± 0.0006.

2320
CARBON ISOTOPE EFFECT DURING OXIDATION OF CARBON MONOXIDE WITH NITROGEN DIOXIDE. Harold S. Johnston, William A. Bonner, and David J. Wilson. J. Chem. Phys. 26, 1002-6 (1957). C.A. 51, 13531g.

By use of naturally occurring C^{12} and C^{13} isotopes in CO, the effect of carbon mass on the rate of the reaction $CO + NO_2 = CO_2 + NO$ has been studied in a 15-l Vycor flask, in the temperature range 540 to 727°K, and at pressures between 1 and 20 mm. The ratio of rate constants k_{12}/k_{13} was 1.022 at 540°K, 1.019 at 638°K, and 1.016 at 727°K.

2321
CALCULATION OF EXPERIMENTAL ISOTOPE EFFECT FOR PSEUDO FIRST-ORDER IRREVERSIBLE REACTIONS. James Ying-peh Tong and Peter E. Yankwich. J. Phys. Chem. 61, 540-3 (1957) C.A. 51, 13532c.

Four exact equations are derived for the calculation of experimental isotope effects of systems of pseudo first-order irreversible reactions.

2322
EXCHANGE AND ISOMERIZATION OF TRANS-ETHYLENE-d_2 ON NICKEL IN THE PRESENCE OF DEUTERIUM. Ted B. Flanagan and B. S. Rabinovitch. J. Phys. Chem. 61, 664-7 (1957). C.A. 51, 13540g.

The products of the exchange and isomerization reactions of trans-ethylene-d_2 and D_2 on Ni wire can be satisfactorily explained by assuming that the reactions proceed through a half-hydrogenated state.

2323
ISOTOPIC EFFECT IN THE LIQUID-VAPOR EQUILIBRIUM OF BINARY SYSTEMS CONTAINING DEUTERIUM COMPOUNDS. I. B. Rabinovich, P. N. Nikolaev, Z. E. Gochaliev, and N. N. Tretyakova. Doklady Akad. Nauk S.S.S.R. 110, 241-4 (1956). C.A. 51, 13543d.

The vapor pressure-composition diagrams of the systems $CHCl_3$-Et_2CO, $CDCl_3$-Et_2CO at 25, 35, and 50°, and of H_2O-C_5H_5N and D_2O-C_5H_5N at 70, 75, and 80° and the boiling point-composition diagrams of $(CH_3)_2$-$CHOH$-C_6H_6 and of $(CH_3)_2CHOD$-C_6H_6 at 760 mm. were investigated.

2324
CHEMICAL AND ISOTOPIC STUDIES OF THE NITROX SYSTEM FOR N^{15} ENRICHMENT. G. M. Begun, L. L. Brown, L. B. Yeatts, N. C. Bradley, and E. F. Joseph. June 25, 1957. 20 p. (ORNL-2291). C.A. 51, 13606h.

The Nitrox system for concentration of N_2 isotopes has been studied in detail; in this system use is made of the exchange reaction between HNO_3 and the oxides of nitrogen. The isotopic separation factor at room temperature for the system has been found to vary from 1.064 at 1 M HNO_3 to 1.020 at 15.5 M HNO_3. The conversion of HNO_3 to oxides of nitrogen with gaseous SO_2 in the product refluxer has been studied, and suitable refluxers have been designed. A small, two-column enriching cascade has been designed and operated which produced gram quantities of highly enriched N^{15}.

2325
INFLUENCE OF OXYGEN ON THE ELECTROLYTIC SEPARATION OF HYDROGEN ISOTOPES. J. Brun and K. Andreassen. Kgl. Norske Viderskab. Selskabs, Forh. BD 28, No. 1, 1-4 (1955). C.A. 51, 13616f.

In experiments where the cathode surface was exposed to O the electrodes were placed horizontally, parallel to one another, 1 mm. apart, with the cathode above the anode, to permit the anodically evolved O to come into close contact with the cathode. Control experiments were performed in which precautions were taken to prevent the catholyte from becoming contaminated with O. A few experiments were performed with electrolyte containing 2 g. $K_3Fe(CN)_6$/l. as cathode depolarizing agent. The results showed a favorable effect of O on the isotopic separation efficiency, which was attributed to poisoning of the catalytically active cathode surface by the O, thus suppressing the exchange reaction between H_2 and H_2O (liquid).

2326
ELECTROLYTIC CONCENTRATION OF HEAVY WATER. Yasujiro Okajima, Yozaburo Yoshikawa, and Doug Zing Han. Nippon Kagaku Zasshi 76, 1370-4 (1955). C.A. 51, 13622h.

A new apparatus for the electrolytic concentration of heavy water is described. The catalyst used for the combination of O and H was copper oxide. With electrodes of Ni and Cr, $\alpha = 4$, where α is found in the equation $[(1 - C_0)/(1 - C)](C/C_0)^{\alpha} = (V_0/V)^{\alpha-1}$. C and V are concentration and volume, respectively, and the subscript zero indicates initial values and no subscript indicates values after electrolysis.

2327
ISOTOPIC EXCHANGE AND STRUCTURE OF TRICALCIUM PHOSPHATE. III. APPLICATION OF THE LAW OF BOLTZMANN. A. Baudrenghien and J. Govaerts. Silicium, Schwefel, Phosphate, Colloq. Sek. Anorg. Chem. Intern. Union Reine u. Angew. Chem. Munster 1954, 212-16 (1955). C.A. 51, 13630h.

Inactive tricalcium phosphate was suspended in a solution of $Ca^{45}Cl_2$ or $Na_2HP^{32}O_4$ and the extent of exchange measured at various times.

2328
PRELIMINARY INVESTIGATIONS OF THE ISOTOPIC COMPOSITION OF SURFACE AND SUBTERRANEAN WATERS OF UZBEKISTAN. A. S. Uklonskiĭ. Zapiski Uzbek. Otdel. Vsesoyuz. Mineral Obshchestva 1953, No. 4, 47-62; Referat. Zhur., Geol., Geograf. 1954, No. 3011. C.A. 51, 14173e.

Waters and other natural materials were investigated for H and O isotopes. Ranges are relative to a standard, for total H and O heavy isotopes, + 14.4 for water from a chlorite shale to -6.2 for ice from Yakutia; for D + 4.6 in water from a Pirogov spring to -9.3 for ice from a puddle; for O + 13.6 for water from a chlorite shale to -9.0 for ice from Yakutia.

2329
ANOMALOUS ISOTOPE EFFECT IN METALLIC DIFFUSION. David Lazarus and Boudewijn Okkerse. Phys. Rev. 105, 1677-8 (1957). C.A. 51, 14337e.

The difference in Fe^{55} and Fe^{59} diffusion constants in monocrystalline Ag at 883° is 15%, or 4 times as large as rate theory predicts. Tunnel diffusion may cause deviation from the Arrhenius temperature relation.

2330
BIBLIOGRAPHY OF RESEARCH ON DEUTERIUM AND TRITIUM COMPOUNDS 1953 AND 1954. Virginia R. Johnson, Lawrence M. Brown, and Abraham S. Friedman. July 15, 1957, 34 p. [NBS-C-562 (Suppl. 1)]. C.A. 51, 14339b.
720 references.

2331
RELATIVE VOLATILITY OF H_2O^{16}/H_2O^{18} AND EQUILIBRATION TIME FOR FRACTIONAL DISTILLATION OF WATER. Sadahiro Sakata and Noriyoshi Morita. Bull. Chem. Soc. Japan 30, 254-9 (1957). C.A. 51, 14352a.
By determining density of water samples from both still and condenser (at equilibrium) the relative volatility, α, for H_2O^{16}/H_2O^{18} was determined as 1.0039 ± 0.0002, a slightly lower value than previously reported (C.A. 50, 11073f). Mathematical formulas for equilibrium time, and values of α by other authors are considered.

2332
MEASUREMENT OF VAPOR PRESSURE FOR He^3-He^4 MIXTURES CONTAINING LARGE CONCENTRATIONS OF He^3. V. P. Peshkov and V. N. Kachinskiĭ. Soviet Phys. JETP 4, 607-9 (1957). (English translation). C.A. 51, 14353d
See reference No. 2276.

2333
INTEGRATED RATE EQUATIONS FOR ISOTOPIC EXCHANGE IN SIMPLE REVERSIBLE REACTIONS. Robert A. Alberty and Wilmer G. Miller. J. Chem. Phys. 26, 1231-7 (1957). C.A. 51, 14385i.
The integrated rate equations are given for various mechanisms by which 3 substances can be interconverted by 1st-order reactions. These equations are of special interest in the interpretation of isotopic exchange in the presence of an over-all chemical reaction.

2334
THE CATALYTIC PROPERTIES OF SUPPORTED SODIUM AND LITHIUM CATALYSTS. Sterling E. Voltz. J. Phys. Chem. 61, 756-8 (1957). C.A. 51, 14394c.
Na dispersed on dried Al_2O_3 did not increase the activity of the Al_2O_3 for H_2-D_2 exchange. However, hydriding the Na-Al_2O_3 greatly increased the exchange activity, the hydrided catalyst being active even at -195°. Na-SiO_2 catalysts were much less active than the corresponding Na-Al_2O_3 catalysts. The supported alkali metal catalysts were much more active than the bulk hydrides of Na and Li for both of these reactions.

2335
THE CATALYSIS OF HYDROGEN-DEUTERIUM EXCHANGE BY OXIDES. D. A. Dowden, N. Mackenzie, and B. M. W. Trapnell. Proc. Roy. Soc. (London) 237A, 245-54 (1956). C.A. 51, 14394i.
H_2-D_2 exchange was investigated at the surfaces of 13 oxides of the 1st transition period, at temperatures between -195 and 20° and pressures between 1 and 5 cm. The condition for high activity is that the oxide should possess some, but not too many, unpaired d electrons. High activity occurs just after the beginning of the period (Cr_2O_3) and towards the end (Co_3O_4 and NiO).

2336
CARBON ISOTOPE PARTITION COEFFICIENT IN THE LIQUID-VAPOR EQUILIBRIUM OF ETHYLENE, ETHANE, AND METHANE. G. A. Yagodin, O. V. Uvarov, and N. M. Zhavoronkov. Doklady Akad. Nauk S.S.S.R. 111, 384-7 (1956). C.A. 51, 14439e.
The isotope partition coefficient between the liquid and the vapor phases of C_2H_4, C_2H_6, and CH_4 was determined with the use of the Rayleigh equation. The results show that the partition coefficients are strongly affected by temperature: ($\log P_{C_2^{12}H_4}/P_{C^{12}C^{13}H_4}$) = 0.00127-(0.0816/T); $\log P_{C_2^{12}H_6}/P_{C^{12}C^{13}H_6}$ = (0.03985/T) - 0.00213; and $\log P_{C^{12}H_4}/P_{C^{13}H_4}$ = (1.1968/T) -0.00782. The principal conclusion reached was that rectification is not a suitable method for the separation of the C isotopes of C_2H_4 and C_2H_6, while the isotope separation of CH_4 by rectification appears promising.

2337
SEPARATION OF HELIUM ISOTOPES BY RECTIFICATION AND THERMAL OSMOSIS. V. M. Kuznetsov. Zhur. Eksptl. i Teoret. Fiz. 32, 1001-11 (1957). C.A. 51, 15202d.
Rectification and thermal osmosis experiments are reported for the separation of He^3 from He^4.

2338
CATALYTIC ACTIVATION OF MOLECULAR HYDROGEN BY ALUMINUM CHLORIDE. L. W. Wright, S. W. Weller, and G. A. Mills. Ind. Eng. Chem. 49, 1054-5 (1957). C.A. 51, 15230d.
The H_2-D_2 exchange reaction is catalyzed by $AlCl_3$ at 10 atmospheres of H_2 pressure and 200°. No org. co-catalyst is necessary. A mechanism is suggested involving a heterolytic split of the H_2 molecule and exchange with a H donor in the catalyst.

2339
DEUTERIUM EXCHANGE OF POLY-DL-ALANINE IN AQUEOUS SOLUTION. Arieh Berger and K. Linderstrøm Lang. Arch. Biochem. Biophys. 69, 106-18 (1957). C.A. 51, 15230h.
The slow D exchange of poly-DL-alanine in aqueous solution was studied at different temperatures and pH values. The exchange reaction is catalyzed by both H and OH ions.

2340
EXCHANGE OF OXYGEN ATOMS BETWEEN GASEOUS OXYGEN AND CHROMIUM OXIDE CATALYST. Sadahiro Sakata and Noriyoshi Morita. Mem. Fac. Eng., Nagoya Univ. 8, 131-6 (1956). C.A. 51, 15235d.
Calculations based on mass-spectrometer measurements give the rate of exchange of O atoms between gaseous O_2 and catalyst as 6.6×10^{18} atoms/sec. or 9.2×10^{11} atoms/sec. sq. cm. of catalyst area. The O atoms of the catalyst do not seriously affect the results obtained in the exchange reactions between gaseous O_2 and H_2O vapor catalyzed by Cr oxide.

2341
VAPOR PRESSURE DIFFERENCES OF ISOTOPIC COMPOUNDS. INFRARED DISPERSION AS THE CAUSE OF HIGHER VOLATILITY OF THE HEAVIER SPECIES. P. Baertschi and W. Kuhn. Helv. Chim. Acta 40, 1084-1103 (1957). C.A. 51, 15245g.

Theoretical discussion concerning the relative volatility of isotopic species.

2342
PHOTOCHEMICAL EXCHANGE OF WATER BETWEEN $Cr(H_2O)_6^{3+}$ AND SOLVENT. Robert A. Plane and John P. Hunt. J. Am. Chem. Soc. 79, 3343-6 (1957). C.A. 51, 15279b.

Studies have been made on the rate of the exchange reaction $Cr(H_2O)_6^{3+} + 6H_2O^{18} \rightarrow Cr(H_2O^{18})_6^{3+} + 6H_2O$ in the presence of light of various wave lengths.

2343
RETENTION OF INERT GAS ISOTOPES. H. B. Greene. 1957, 19 pp. (ORNL-2275). C.A. 51, 15297h.

Inert gas ions produced in electromagnetic separators are adsorbed in mg. quantities on Ag, Ni, Al, Cu, W, Ta, Mg, graphite, and various alloys. Results with A are described.

2344
ON TWO MECHANISMS OF HYDROGENATION AND EXCHANGE BETWEEN ETHYLENE AND DEUTERIUM ON PALLADIUM. V. B. Kazanskiĭ and V. V. Voevodskiĭ. Doklady Akad. Nauk S.S.S.R. 111, 125-8 (1956). C.A. 51, 15393f.

Investigations of ethylene-deuterium interaction over palladium revealed that the reaction proceeds according to different mechanisms at high and low temperatures.

2345
CASCADE THEORY OF SEPARATION OF BINARY MIXTURES AND ISOTOPES. O. K. Davtyan. Zhur. Fiz. Khim. 31, 283-91 (1957). C.A. 51, 15815g.

The same principles of the ideal cascade separation of binary solution components underlie all the theories of the separation of binary mixtures by any physical means. A general equation for the ideal cascade which is applicable with any value of the partition coefficient and for any physical separation method, and which takes into consideration the diffusional effect, was derived. The equation derived by Cohen (C.A. 42, 7158h) is a special case of the derived equation. The theory is equally applicable to separation of binary mixtures and isotopes.

2346
ISOTOPIC COMPOSITION OF THE AMMONIA AND THE NITRATE ION IN RAIN. Thomas Hoering. Geochim. et Cosmochim. Acta 12, 97-102 (1957). C.A. 51, 16017d.

The NH_4^+ and NO_3^- were isolated by means of ion-exchange resins, and the isotope ratios of each were determined relative to atmospheric N_2. The N^{15} content of both ions varied from rain to rain, but the kinetic isotope effect between the NH_4^+ and NO_3^- remained constant at 1.004 ± 0.001. This agrees with the postulate that the NO_3^- arises from the oxidation of the NH_4^+.

2347
PROCESSES OF THE ISOTOPE EXCHANGE AND DIFFUSION IN CALCIUM SILICATES. B. V. Volkonskiĭ and L. G. Sudakas. Tsement 23, No. 3, 17-19 (1957). C.A. 51, 16062b.

The exchange reaction between CaO, indicated by Ca^{45}, with $3CaO \cdot SiO_2$ and $2CaO \cdot SiO_2$ (in their β- and γ-modifications) was studied in the sintered mixes.

2348
ISOTOPIC EXCHANGE REACTIONS OF NEPTUNIUM IONS IN SOLUTION. V. THE Np(V)-Np(VI) EXCHANGE IN D_2O. J. C. Sullivan, Donald Cohen, and J. C. Hindman. J. Am. Chem. Soc. 79, 3672-4 (1957). C.A. 51, 16062h.

Studies in mixed electrolyte systems show that ClO_4^- does not participate in the Np(V)-Np(VI) exchange reaction. There are 2 possible reaction paths, one acid-dependent and one acid-independent.

2349
THE EXCHANGE REACTION BETWEEN ETHANE AND DEUTERIUM ON EVAPORATED METAL FILMS. COMMENTS ON MIYAHARA'S THEORY. Charles Kemball. J. Research Inst. Catalysis, Hokkaido Univ. 4, 222-7 (1957). C.A. 51, 16064c.

The theories of Miyahara (C.A. 51, 3257b) and of Anderson and Kemball (cf. C.A. 48, 7965g) to account for the initial relative abundances of deuterioethanes in the catalytic exchange of C_2H_6 and D_2 are critically examined.

2350
EXCHANGE REACTION BETWEEN METHANE AND DEUTERIUM. Koshiro Miyahara. J. Research Inst. Catalysis, Hokkaido Univ. 4, 177-84 (1957). C.A. 51, 16064d.

Kemball's data (cf. C.A. 46, 331b) for the exchange between CH_4 and D_2 are subjected to a detailed theoretical analysis.

2351
EXCHANGE REACTION BETWEEN AMMONIA AND DEUTERIUM. Koshiro Miyahara. J. Research Inst. Catalysis, Hokkaido Univ. 4, 193-8 (1957). C.A. 51, 16064f.

The data of Kemball (cf. C.A. 46, 8489c) are analyzed in detail for the rate of exchange of D_2 with NH_3. The slow step in the exchange is a dissociation of an NH group on the surface of metals such as Fe or Ni to produce adsorbed N and adsorbed H atoms.

2352
SIMPLE LABORATORY METHOD FOR PRODUCING ENRICHED CARBON-13. Richard B. Bernstein. Science 126, 119-20 (1957). C.A. 51, 16130b.

CO_2 enriched in C^{13} by 33.2% can be obtained by the dehydration of HCOOH with H_2SO_4.

2353
ISOTOPE EXCHANGE PERMITS LARGE SILVER-111 β-RAY SOURCES. W. Wayne Meinke and D. N. Sunderman. Nucleonics 13, No. 12, 58-61 (1955). C.A. 51, 16132b.

Immersion of a AgI electrode in Ag^{111} solution causes isotopic exchange with 98% of the Ag^{111} deposited.

2354
THEORY OF SEPARATION OF STABLE ISOTOPES. V. K. Turkin. Trudy Moskov. Khim.-Tekhnol. Inst. im. D. I. Mendeleeva 1956, No. 22, 247-51. C.A. 51, 16135c.

For a given assembly of separating components in parallel, the concentration of isotopes and the coefficient of effective separation for each cascade have been derived by means of equations of finite differences.

2355
INFLUENCE OF THE CATHODE METAL ON THE SEPARATION OF HYDROGEN ISOTOPES. J. Brun, Th. Varberg, W. Gundersen, and R. Solli. Kgl. Norske Videnskab. Selskabs Forh. 29, 5-9 (1956). C.A. 51, 16135f.

Solutions of 5% KOH (previously electrolyzed to remove possible traces of metallic impurities) containing approximately 10% D_2O were electrolyzed 65 hours or more at 15° in diaphragmless cells (fitted with a return condenser to prevent spray or evaporation loss) at a c.d. of 0.05 amp./sq. cm., the evolved gas (a mixture of H, D, and O) being dried and then recombined by passing over CuO at 600°. The average separation factor for each cathode tested, calculated from (H)g/(D)g = s(H)liq./(D)liq. (a correction being made for water vapor loss during electrolysis) is given and many H overvoltages listed in C.A..

2356
THEORY OF THE SWING SEPARATOR. B. L. van der Waerden. Z. Naturforsch. 12a, 583-98 (1957). C.A. 51, 16135d. cf. Clusius and Huber, C.A. 50, 11060a.

Theoretical-mathematical. The systematic errors made if thermodiffusion constants are measured with the swing separator are theoretically calculated.

2357
ISOTOPE EFFECT INDUCED BY CURRENT IN MOLTEN LITHIUM METAL. A. Lundén, A. Lodding, and W. Fischer. Z. Naturforsch. 12a, 268-9 (1957). C.A. 51, 16137b.

Li metal was introduced into a steel capillary 0.7 mm. in diameter and 20 cm. long and at 300° about 37 amp. d.c. passed through for 159 hours. After the experiment the sample was cut up and the Li isotope distribution analyzed. From the data a mass effect μ of $(3.4 \pm 0.6) \times 10^{-5}$ is calculated.

2358
CONCENTRATION OF HEAVY WATER BY ELECTROLYSIS. Ko Kitagawa. Japan. 6268 ('55), Sept. 7. C.A. 51, 16138b.

The evolved H and O are pumped back to their respective electrode chambers to aid in evaporation in multiplestage electrolysis.

2359
ENRICHING WATER WITH DEUTERIUM. Centro Informazioni Studi Esper. and Cesare Marchetti. Italian patent 493,492, Apr. 26, 1954. C.A. 51, 16138c.

The equipment consists of 2 reactors which may be filled with Pd catalyst supported on silica gel and 2 exchangers in which H_2 containing D and water vapor containing D_2O may come into equilibrium with liquid water and D_2O.

2360
HEAVY WATER. Luca Barnocchi. Italian patent 518,551, March 7, 1955. C.A. 51, 17028d.

Water is allowed to freeze above a layer of CS_2, tetrachloroethane, or ethylene trichloride. The layer of ice formed containing some D_2O is collected. The operation is repeated with water obtained by melting this ice until a suitable concentration of D_2O results for electrolysis.

2361
DETERMINATION OF THE COEFFICIENT FOR THE DISTRIBUTION OF DEUTERIUM IN THE ISOTOPIC EXCHANGE OF HYDROGEN BETWEEN NAPHTHALENE AND DEUTERIUM BROMIDE. Ya. M. Varshavskiĭ, V. R. Kalinachenko, S. E. Vaĭsberg, and A. I. Shatenshtein. Zhur. Fiz. Khim. 30, 1647-51 (1956). C.A. 51, 17115h.

The distribution coefficient, α, for H exchange was determined for the system $DBr-C_{10}H_8$ for the temperature range 0-70°. The experimental values (3.1 at 0°, 3.0 at 20°, 2.8 at 25°, 2.6 at 50°, 2.4 at 70°) were compared with values calculated by means of an equation derived earlier (C.A. 50, 16301f) and found to agree well.

2362
VARIATIONS OF THE O^{18}/O^{16} RATIOS OF FRESH WATERS AND ICE. Samuel Epstein. Natl. Acad. Sci.-Natl. Research Council, Publ. No. 400, 20-8 (1956). C.A. 51, 17275h.

The O^{18} content of the water in rain or snow decreases with increasing elevation, but appears to be independent of kind of precipitation. Summer snow has a higher ratio than winter snow, and the isotope content of glaciers is not uniform.

2363
EQUATION OF STATE OF HYDROGEN AND ITS ISOTOPES BELOW 20°K. J. J. M. Beenakker and F. H. Varekamp. Bull. inst. intern. froid, Annexe 1956-2, 189-94. C.A. 51, 17296g.

A method was developed for determining the 2nd virial coefficient in the equation of state of H_2, HD, and D_2. The method is based on the difference in behavior of He gas, and the H isotope under consideration.

2364
CLUSIUS AND DICKEL COLUMN CONSTANTS FOR A GAS CONSISTING OF HARD SPHERICAL MOLECULES. R. C. Srivastava. Proc. Phys. Soc. (London) 70B, 93-7 (1957). C.A. 51, 17297d.

The theory is extended to include the temperature dependence of the gas coefficients. The theory agrees with earlier experimental data on He (McInteer, et al., C.A. 43, 489d).

2365
SEPARATION AND APPLICATION OF STABLE ISOTOPES. I. PREPARATION OF STABLE ISOTOPES AS A DISTILLATION PROBLEM. Erich Krell. Chem. Tech. (Berlin) 9, 333-40 (1957). C.A. 51, 17301g.

Distillation methods for the separation of stable isotopes of H, He, B, C, N, O, Ne, S, Cl, and A are reviewed critically. Pertinent properties of the isotopes are tabulated, enrichment factors are presented as a function of temperature, and formulas for the enrichment per stage are reviewed. Numerous diagrams of columns are presented and results obtainable in practical-scale separations are set forth. 34 references.

2366
THERMODYNAMIC PROPERTIES OF LIQUID HELIUM-3. VAPOR PRESSURES BELOW 1°K. Stephen G.

Sydoriak and Thomas R. Roberts. Phys. Rev. 106, 175-82 (1957). C.A. 51, 17302c.

Liquid He^3 vapor pressures were measured from 0.45 to 1.0°K.

2367

CALCULATION OF THERMODYNAMIC QUANTITIES OF HELIUM-3-HELIUM-4 MIXTURES FROM THE VAPOR PRESSURE AT TEMPERATURES BETWEEN 1.2 AND 1.9°K. D. H. N. Wansink. Physica 23, 140-53 (1957). C.A. 51, 17302g.

On the basis of vapor pressure of He^3-He^4 mixtures, the change in the Gibbs function of the mixture with concentrations was calculated at concentrations up to 7% He^3. Entropy, heat, and specific heat of mixing are given in comparison with experimental data. The phase separation at low temperatures and the mechanocaloric effect of the mixtures are calculated.

2368

MELTING CURVES OF HELIUM AND HYDROGEN ISOTOPES. C. Domb. Proc. Phys. Soc. (London) 70B, 150-2 (1957). C.A. 51, 17303g.

It is shown theoretically that one might expect that sufficiently far along the melting curve classical theory is valid and the curves for He^4 and He^3 then become identical. On the other hand for H_2, D_2, and T_2 this need not be true.

2369

DIFFUSION COEFFICIENTS OF SILVER AND IODINE IN THREE FORMS OF SILVER IODIDE BY THE HETEROGENEOUS ISOTOPIC EXCHANGE METHOD. P. Jordan and M. Pochon. Helv. Phys. Acta 30, 33-48 (1957). C.A. 51, 17305c.

The exchange, with Ag^{110} or I^{131} as a tracer, was studied between 20 and 200°, with AgI and its aqueous ions.

2370

EXCHANGE OF RADIOCHLORINE BETWEEN PYRIDINIUM CHLORIDE AND ACID CHLORIDES IN CHLOROFORM SOLUTION. M. J. Frazer. J. Chem. Soc. 1957, 3319. C.A. 51, 17359h.

An investigation of Cl^{36} exchange in $CHCl_3$ solution between pyridinium chloride and BCl_3, PCl_3, $SOCl_2$, SO_2Cl_2, and AcCl was successfully completed under anhydrous conditions at 20° within time of separation 3 minutes.

2371

HOMOGENEOUS EXCHANGE RATE BETWEEN HYDROGEN AND DEUTERIUM. G. Boato, G. Careri, A. Cimino, E. Molinari, and G. G. Volpi. Naturwissenschaften 42, 388 (1955). C.A. 51, 17363d.

Experimental results of Geib and Harteck (C.A. 26, 655) on rate of para-H_2 to ortho-H_2 conversion were confirmed.

2372

RELATIVE RATES OF REACTION OF THE ISOTOPIC SPECIES H_2-HD-D_2 WITH HYDROXYL RADICALS IN PERCHLORIC ACID SOLUTION. T. J. Hardwick. 1957, 16 pp. (CRC-713); (AECL-459). C.A. 51, 17363h.

Separate 0.1N $HClO_4$ solutions of Fe(II) perchlorate, and H_2O_2 were saturated with mixtures of H_2, HD, or D_2, respectively, and O_2 at the following temperatures: 0.1, 8.8, 20.2, and 29.8°. Reactant concentrations were of the order of micromoles per l. The respective solutions were then mixed and allowed to stand until the reactions were completed. From initial and final concentrations of Fe(II) and H_2O_2, rate-constant ratios were calculated, and an Arrhenius plot was drawn. On the basis of different (E_1 - E_2) values for H_2, HD, and D_2, and the thesis that a difference in activation energies between OH + H_2, and OH + D_2 is incompatible with an electron-transfer mechanism, it was concluded that the reaction OH + H_2 in aqueous solution proceeds by bond-rupture of the H_2, rather than by electron transfer.

2373

ISOTOPE EFFECTS ON THERMODYNAMIC FUNCTIONS OF HINDERED ROTATORS. W. H. Stockmayer. J. Chem. Phys. 27, 321-2 (1957). C.A. 51, 17385a.

Mathematical discussion.

2374

RADIATION-INDUCED EXCHANGE OF CHLORINE WITH CCl_4. John W. Schulte. J. Am. Chem. Soc. 79, 4643-8 (1957). C.A. 51, 17466d.

The chemical and virtual changes in CCl_4 containing Cl_2 under the influence of Co^{60} γ-rays was determined. Two reactions were observed: the exchange of Cl_2 with CCl_4, and the decomposition of CCl_4 to form C_2Cl_6 and Cl_2. The rates of both reactions were independent of the Cl_2 concentration and directly proportional to the dose rate.

2375

ISOTOPE REFERENCE SAMPLE PROGRAM AT THE NATIONAL BUREAU OF STANDARDS. Vernon H. Dibeler. Natl. Acad. Sci.-Natl. Research Council, Publ. No. 400, 55-61 (1956). C.A. 51, 17507e.

The available samples are H (as H_2O), D (as H_2, D_2, D_2O, D), He, Ne, A, Kr, Xe, Li (as spodumene), Li_2CO_3, K (as K_2CO_3), Rb (as Rb_2CO_3), Sr (as $SrCO_3$), Mg (as $Mg(OH)_2$), Cl (as NaCl, MeCl), Br (as NaBr, MeBr), S (as native S, SO_2), O (as air), N (as N_2), Pb (as galena, PbI_2, $Pb(CH_3)_4$), Ag (as $AgNO_3$), Cd (as CdI_2), Hg, B (as BF_3), Si (as SiF_4), Ca (as limestone), C (as limestone), O (as limestone). Gases and liquids are in break-seal tubes, solids in vacuum-sealed hard-glass tubes.

2376

VARIATIONS IN THE NITROGEN ISOTOPE ABUNDANCE. T. Hoering. Natl. Acad. Sci.-Natl. Research Council, Publ. No. 400, 39-44 (1956). C.A. 51, 17507f.

The N^{15}/N^{14} ratio was determined for a wide variety of natural substances. The highest negative per mil difference found was 13.0 in methane gas; highest positive, 12.1, stomach contents of the white rat. The variations are somewhat smaller than those reported for C^{13}/C^{12}, O^{18}/O^{16}, or $S^{34}/S32$. N of the atmosphere and rocks appears to have a constant isotopic composition.

2377

FRACTIONATION OF OXYGEN ISOTOPES IN THE FORMATION OF OXIDE FILMS ON COPPER. John B. Brown, Malcolm Dole, and G. A. Lane. J. Chem. Phys. 27, 251-8 (1957). C.A. 51, 17507g.

The fractionation was studied by measuring the O^{18}/O^{16} isotope ratio in the residual unreacted O_2 gas after a fraction of the O_2 reacted at 0, 25, and 100° on granular Cu and Cu foil. Two fractionation factors, one of unity or less for an initial rapid reaction and one

greater than unity for the slower and approximately steady-state reaction were required to explain the data. The fractionation factor for the steady-state reaction was calculated to be 1.045, 1.042, and 1.037 at 0, 25, and 100°, respectively.

2378
PROBLEM OF APPROXIMATING AN IDEAL ISOTOPE SEPARATION CASCADE BY A STEPWISE GRADED CASCADE WITH AND WITHOUT CONSIDERATION OF MATERIAL LOSSES. Heinz Barwich. Ann. Physik 20, 70-9 (1957). C.A. 51, 17508b.
Theoretical-mathematical communication.

2379
ISOTOPE SEPARATION BY GASEOUS DIFFUSION. II. CONTINUOUS CASCADE. E. Brutto, G. Perona, and R. Sesini. Energia nucleare (Milan) 4, 128-30 (1957); cf. ibid. 19-23. C.A. 51, 17508c.
A scheme of continuous cascade for isotope separation by diffusion in the gaseous phase is suggested. Overcoming the ideal cascade concept stated by Cohen (C. & Murphy, Theory of Isotope Separation 1951, C.A. 56, 1890h) the harmful minglings are removed, thus increasing the efficiency. A diagram of the apparatus used and a study of its efficiency are included.

2380
ISOTOPE SEPARATION BY DISTILLATION. G. Richter. Ann. Physik 20, 45-52 (1957). C.A. 51, 17508c.
Theoretical-mathematical communication. It is shown that an increased separation is obtained in distilling columns by a buffer action of their fluid contents.

2381
NATURAL VARIATIONS IN THE NITROGEN ISOTOPE ABUNDANCE RATIO IN IGNEOUS ROCKS. K. I. Mayne. Geochim. et Cosmochim. Acta 12, 185-9 (1957). C.A. 51, 17657i.
Preliminary data show substantial variation in the yield of N and in its isotopic composition. The N yield ranges from 0.0018 to 0.049 cc. at standard conditions/g. The isotopic composition varies regularly with the yield, within the range of a few %. The less N a rock contains, the more enriched this is in N^{15}. There is no clear correlation between age and isotopic composition or total yield of N, although the very old rocks contain only small amounts of N.

2382
MEASUREMENT AND INTERPRETATION OF THE RELATIVE VARIATIONS OF ABUNDANCE OF OXYGEN-18 AND CARBON-13 IN CARBONATE ROCKS AND MINERALS. Peter Baertschi. Schweiz. mineral petrog. Mitt. 37, 73-152 (1957). C.A. 51, 17658b.
The isotopic composition of O and C in about 250 specimens of carbonate rocks and minerals has been measured.

2383
SULFUR ISOTOPE ABUNDANCES IN SULFIDE MINERALS. J. L. Kulp, W. U. Ault, and H. W. Feely. Natl. Acad. Sci.-Natl. Research Council, Publ. No. 400, 45-54 (1956). C.A. 51, 17658e.
A great range in S^{32}/S^{34} ratios was found in natural materials: meteorites (cosmic ratio), 22.21; chalcopyrite from Ivigtut, Greenland, 21.55 (low), with great postulated age; pegmatitic pyrrhotite from Newry, Maine, 22.85 (high, with postulated organic origin). Primeval S is oxidized to sulfate with enriched S^{34} and depleted residual sulfide. Bacteria preferentially reduce the light isotope of the sulfate to H_2S.

2384
FRACTIONATION OF SULFUR ISOTOPES IN NATURE. Hitoshi Sakai. Geochim. et Cosmochim. Acta 12, 150-69 (1957). C.A. 51, 17658f.
The S compounds were converted to SO_2 and the S^{34} to S^{32} ratio was measured on a mass spectrometer.

2385
ISOTOPIC GEOCHEMISTRY OF THERMAL WATERS. Harmon Craig, Giovanni Boato, and Donald E. White. Natl. Acad. Sci.-Natl. Research Council, Publ. No. 400, 29-38 (1956). C.A. 51, 18398f.
Waters from a number of geographic world sources were analyzed for HDO and H_2O^{18}. Those of near normal chloride content or near neutral springs have about the same isotopic composition as associated surface waters. The acid hot springs range up to 5% higher in D and 1.6% higher in O^{18} than local meteoric waters, reflecting isotopic enrichment and suggesting a molecular type distillation.

2386
THE MECHANISM OF THE EXCHANGE REACTION BETWEEN CERIUM(III) AND CERIUM(IV) AT PLATINUM SURFACES. Sture Fronaeus and Carl Otto Ostman. Acta Chem. Scand. 10, No. 5, 769-78 (1956). NSA 11, 91.
The heterogeneous electron exchange reaction between Ce^{3+} and Ce^{4+} at Pt surfaces under equilibrium electrode potential is investigated in a perchlorate ionic medium by means of a radioactive tracer.

2387
PRELIMINARY REPORT ON HIGH CONCENTRATION OF DEUTERIUM BY CATALYTIC EXCHANGE REACTIONS. Harris Mayer and Robert Bonner. Feb. 4, 1943. Decl. Aug. 14, 1956. 21 p. (AECD-3754). NSA 11, 132.
The theoretical analysis of a plant to concentrate D_2 from 2 atom % to 90 atom % by the NH_3-H_2 exchange reaction is presented.

2388
RECENT EXPERIMENTS ON THE PRODUCTION OF HEAVY WATER BY ELECTROLYSIS AND ION EXCHANGE REACTIONS. S. Finzi, R. Renzoni, and M. Silvestri. Energia nucleare (milan) 3, 294-308 (1956). NSA 11, 197.
A series of experiments in connection with the production of heavy water by electrolysis and isotopic exchange reactions is described here.

2389
BIBLIOGRAPHY OF DEUTERIUM SEPARATION METHODS. William P. Drews. Dec. 4, 1953. Decl. Oct. 28, 1955. 65 p. (NYO-6084). NSA 11, 1487.
Bibliography listing both unclassified and classified references to methods of deuterium separation. References which provide useful information or possible processes were selected.

2390
THE OPERATION OF A DUAL-TEMPERATURE SINGI STAGE TOWER FOR DEUTERIUM CONCENTRATION. M. L. Eidinoff and C. F. Hiskey. May 28, 1943. Decl. Nov. 1, 1956. 16 p. (A-718)

NSA 11, 1788.

An all glass unit simulating the operation of a proposed S-Process plant has been constructed and operated. In this process water flows successively through a cold tower and through a hot tower, and then is eliminated as waste. Hydrogen sulfide gas is recycled in these two tower countercurrent to the water flow. The course of the gas is first through the hot tower, then through coolers, then into the cold tower, and finally to a blower which feeds it back into the hot tower. The process utilizes the fact that the equilibrium constant of the exchange reaction $HDS + H_2O \rightleftharpoons H_2S + HDO$ varies with temperature, being less at the higher temperatures. The rate of exchange between the H_2S gas and that of the water is extremely rapid, and thus in normal operation the enriched product concentrates between the hot and cold towers. From here it may be drawn off as product, or sent to a second stage where it may be concentrated to a greater degree.

2391

CHEMICAL EXCHANGE REACTIONS FOR THE PRODUCTION OF HEAVY WATER. Interim Progress Report. Jacob Bigeleisen, Norman Elliott, Lewis Friedman, A. P. Irsa, Arthur Kant, Morris L. Perlman, and Herbert C. Prosser. Apr. 15, 1951; Decl. Nov. 14, 1956. 13 p. (BNL-107). NSA 11, 3347.

An investigation is being made of the kinetics of the exchange of hydrogen between the elementary gas and liquid ammonia containing dissolved potassium amide. Under the conditions of the experiments the reaction is diffusion-controlled; thus the rate depends on the efficiency of phase contact. Appreciable exchange may be observed in a fraction of a second. The possible use of the hydrogen exchange reaction $HD + NH_3 \rightleftharpoons NH_2D + H_2$ for the industrial concentration of deuterium in a dual temperature plant is discussed in terms of rates and equilibria. Water may be used as a source material. It has been found that hydrogen exchanges rapidly at room temperature between the gas and uranium hydride. A preliminary measurement of the equilibrium shows that this reaction is not suited to the separation of the isotopes of hydrogen.

2392

FINAL REPORT TO U. S. ATOMIC ENERGY COMMISSION; LOW-TEMPERATURE HEAVY WATER PLANT. Mar. 15, 1951; declassified with deletions Jan. 21, 1956. 102 p. (NYO-889 (Del.)). NSA 11, 3717.

The design of a low-temperature plant for the production of heavy water by the distillation of ammonia synthesis gas is presented.

2393

A LINEAR PROGRAMMING MODEL OF THE GASEOUS DIFFUSION ISOTOPE-SEPARATION PROCESS. D. M. Fort. Oct. 1, 1956. 77 p. (RM-1801 (RAND)). NSA 11, 4558.

It is shown how the gaseous diffusion process, as applied to the separation of uranium isotopes, may be analyzed in terms of a linear programming model.

2394

PRELIMINARY ESTIMATE OF THE COST OF PRODUCTION OF 10% ISOTOPIC PURITY OXYGEN-17 BY CHEMICAL EXCHANGE. B. B. Klima. Feb. 1, 1957. 52 p. (CF-57-2-97). NSA 11, 4925.

An order of magnitude estimate was made to determine a minimum cost for 10% pure O^{17} when produced by a chemical exchange process. The calculations were based on separations factors of 1.03, 1.01, and 1.003. The cost of product was found to vary from $23 per gram for the larger factor to $165 per gram for the smaller.

2395

QUARTERLY REPORT FOR OCTOBER, NOVEMBER AND DECEMBER 1956. George T. Miller. Dec. 31, 1956. 14 p. (HEC-74). NSA 11, 5189.

The anisole--BF_3 system for isotope separation was shut down. The dimethyl ether-BF_3 system producing B^{11} on a pilot plant scale has been successfully operated. A study is being conducted on the corrosion of various metals by anisole--BF_3 complex at elevated temperatures.

2396

ARC INITIATED DISCHARGE IN MAGNETIC FIELD IN HIGH VACUUM. I. IONIC CENTRIFUGE TYPE OF DISCHARGE. Joseph Slepian. June 1956. 15 p. (NP-6214). NSA 11, 5421.

An ionic centrifuge type of discharge was investigated as a possible method of isotope separation. This type of discharge from a central electrode ran to an insulated cylindrical electrode which floated approximately at the Larmor potential and took half the yield of cations from the arc. The remaining cations went to end plates having potentials exceeding the Larmor potential. The discharge shows no space charge limitations, however, its use in isotope separation did not appear promising since its enrichment at the end plates was less than m/2m.

2397

ARC INITIATED DISCHARGE IN MAGNETIC FIELD IN HIGH VACUUM. II. MAGNETO-IONIC EXPANDER TYPE OF DISCHARGE. Joseph Slepian. Aug. 1956. 18 p. (NP-6215). NSA 11, 5422.

The theory of the magneto-ionic isotope separator is discussed, and the equations describing the magnetic and electrostatic forces at various locations in the separator are developed.

2398

A NOVEL MAGNETO-IONIC MEANS FOR SEPARATING ISOTOPES IN VERY LARGE QUANTITIES. Joseph Slepian. Nov. 1956. 17 p. (NP-6216). NSA 11, 5423.

Isotopes of ions of the same kinetic energy are sent by a magnetic field on slightly different paths, permitting their separation as in the mass spectrometer. The current, however, is limited to a very low value by their space charge. Their space charge can be eliminated by the presence of electrons substantially at rest, as in the Calutron, but oscillations inherently set themselves up at a new value of limiting current which is again too low for practical separation. A new Magneto-Ionic Expander Isotope Separator which has no space charge limit is described. This method of isotope separation is postulated to be more economical than any other known method.

2399
DETERMINATION OF THE SEPARATION COEFFICIENTS OF THE ISOTOPES OF BORON IN THE EQUILIBRIUM EVAPORATION OF BCl_3. N. N. Sevryugova, O. V. Uvarov, and N. M. Shavoronkov. Soviet J. Atomic Energy 4, 567-72 (1956). NSA 11, 5424.

The separation coefficients of the isotopes of boron are determined for equilibrium evaporation of boron chloride in the temperature interval 12.7 to 85°C. The methods are described, and the equation relating the dependence of the coefficient on the vaporization temperature is derived.

2400
LIGHT WATER SEPARATION WITH TRIETHYLAMINE. H. T. Hahn and E. B. Street. Feb. 22, 1957. 8 p. (HW-48735). NSA 11, 6293.

A proposed liquid-liquid extraction process using triethylamine for the separation of light water from heavy water is described. Results of experiments showed that no separation was observed in the system triethylamine-water in region of 2 to 3% light water.

2401
B-10 PLANT INVITES NON-AEC CUSTOMERS. Chem. Eng. 64, No. 5, 176, 178 (1957). NSA 11, 6449.

The applications, availability, and cost of boron with 61 to 95% B^{10} enrichment are discussed.

2402
PRODUCTION AND ANALYSIS OF ISOTOPES. W. Walcher. Naturwissenschaften 44, No. 6, 132-44 (1957). NSA 11, 6450.

A review.

2403
ELECTROMAGNETIC SEPARATION BY HERMES. Nuclear Power 2, 132-4 (1957). NSA 11, 6452.

The Heavy Element Radioactive Material Electromagnetic Separator is in principle a mass spectrograph. The apparatus is versatile and could be used for any element, but at the present it is being used to separate and collect in the milligram range, quantities of the four Pu isotopes, 239 to 242, in order to investigate their fission absorption cross sections.

2404
COMPLEX DISTILLATION SEPARATES ISOTOPES. Chem. Eng. 64, No. 5, 149-50 (1957). NSA 11, 6453.

A distillation process is described using 6 columns with a total height of 350 ft (360 transfer units) and producing boron with a 92 to 93% B^{10} enrichment. Dimethyl ether is complexed with BF_3 and fed into the distillation unit. The enriched complex is converted to KBF_4 and electrolyzed. Plant output is about 1000 lb. B^{10}/year.

2405
A STUDY OF THE DECOMPOSITION OF p-NITROPHENETHYLTRIMETHYLAMMONIUM IODIDE BY MEANS OF THE HYDROGEN ISOTOPE EFFECT. Ernest M. Hodnett and John J. Flynn, Jr. J. Am. Chem. Soc. 79, 2300-2 (1957). NSA 11, 6644.

The hydrogen isotope effect in the decomposition of p-nitrophenethyl-β-t-trimethylammonium iodide in water at 100° has been measured. A hydrogen atom on the carbon adjacent to the ring is removed from a labeled molecule 7.4 times as rapidly as a tritium atom in the same position. A hydrogen atom in this same position in an inactive molecule is removed 15% faster than a hydrogen atom in the corresponding position of the labeled molecule.

2406
CONSTRUCTION, OPERATION, AND MAINTENANCE OF A POLYMER FRACTIONATION UNIT. J. R. Eichna, K. G. Carpenter, C. J. McManus, R. Tuck, and C. Risher. July 23, 1946. Decl. Feb. 12, 1957. 105 p. (A-2370). NSA 11, 7463.

The vacuum unit was operated for the production of heavy water by water distillation for a period of over a year. Water is suitable as a cooling medium and steam as a heating medium provided that careful attention has been paid to the elimination of exchanger leaks. Steam ejectors are recommended for use in providing the vacuum for the unit, but it is highly advisable that spare vacuum facilities be installed to ensure continuity of operation, and that all vacuum leaks be eliminated.

2407
URANIUM ISOTOPE FRACTIONATION FACTOR IN BATCH EQUILIBRATION BETWEEN RESIN AND VERSENE SOLUTION. J. S. Drury and A. C. Rutenberg. Sept. 29, 1954. Decl. Feb. 14, 1957. 9p. (CF-54-9-171). NSA 11, 7498.

The isotope fractionation factor for the reaction of aqueous uranyl ion (in the presence of diammonium versenate ion) with the uranyl form of Dowex-50 resin was estimated from experimental data to be 1.00006 for the following reaction: $U^{238}O_2{}^{2+}$ (aqueous versenate) + $U^{235}O_2R_2 \rightleftharpoons U^{235}O_2{}^{2+}$ (aqueous versenate) + $U^{238}O_2R_2$, where R is the resin.

2408
THEORETICAL CONSIDERATIONS ON LIQUID THERMAL DIFFUSION EXPERIMENTS. Karl Cohen. Feb. 5, 1943. Decl. Feb. 12, 1957. 22 p. (A-531). NSA 11, 7701.

A mathematical treatment.

2409
FINAL REPORT ON WORK UNDER O. S. R. D. CONTRACT OEMsr-911. William W. Watson. Aug. 5, 1943. Decl. Feb. 12, 1957. 4 p. (A-779). NSA 11, 7702.

Experiments designed to indicate the feasibility of B^{10} concentration by thermal diffusion using BF_3 are discussed. B^{10} may be concentrated by this method, but with very low efficiency.

2410
PROGRESS REPORTS ON MOLECULAR DISTILLATION FROM FEBRUARY 10, 1943 TO MAY 25, 1943. A. Keith Brewer, Samuel L. Madorsky, and T. Ivan Taylor. Decl. Feb. 14, 1957. 39 p. (A-854). NSA 11, 7703.

Progress in the development of isotope separation by molecular distillation is reviewed. Distillation results using uranium pentaethoxide are reported. The separation coefficient measured was 40% of the theoretical value. Results with double salts of uranium were negative.

2411
FRACTIONATION OF URANIUM ISOTOPES BY ION EXCHANGE. J. S. Drury and A. C. Rutenberg. Nov. 23, 1954. Decl. Feb. 14, 1957. 6p. (CF-54-11-162). NSA 11, 7704.

An experiment was performed to determine the isotope fractionation obtained by passing a band of U through an ion exchange column. The conditions of the experiment were similar to those existing in the experiment described in ISC-475, except that an 11-inch band of U was passed through 64 inches of Cu resin. Very little enrichment resulted.

2412
ESTIMATE OF THE COST OF PRODUCING NITROGEN-15 BY CHEMICAL EXCHANGE: DETERMINATION OF MINIMUM COST NITROX SYSTEM. B. B. Klima. Apr. 25, 1956. 8 p. (CF-56-4-185). NSA 11, 8554.

An estimate was made of the cost of N^{15} based on the NO-HNO_3 acid system. Estimates were made of three systems using 7, 10, and 15 molar HNO_3 as the aqueous phase. One gram of N^{15} product produced at the rate of one pound N^{15} per day using 7 molar HNO_3 will cost $3.93 which is 10% less than the cost using 10 molar HNO_3 and much less than the costs using 15 molar acid.

2413
THE DESIGN OF THERMAL DIFFUSION CASCADES FROM EXPERIMENTAL DATA. Karl Cohen. Feb. 4, 1943. Decl. Feb. 12, 1957. 16 p. (A-530). NSA 11, 8555.

A mathematical treatment.

2414
AN INTERPRETATION OF THE ISOTOPIC SEPARATION IN THE DISTILLATION OF METHYL ETHER-BORON FLUORIDE COMPLEX. D. A. McCaulay. Oct. 3, 1945. Decl. Mar. 12, 1957. 28 p. (A-2357). NSA 11, 8556.

In order to calculate an isotopic separation factor for the equation, $B^{10}F_3(g) + Me_2O{\cdot}B^{11}F_3(l) \rightleftharpoons B^{11}F_3(g) + Me_2O{\cdot}B^{10}F_3(l)$, it was postulated that separation is due to a chemical exchange reaction and that the difference in vapor pressures between the isotopic compounds is negligible. Expressions were set up for the equilibrium constant K of the above reaction which, when combined with similar expressions for the one plate fractionation factor α, led to the expression,

$$K = 1 + \frac{\alpha - 1}{\text{Fraction Dissociated}},$$

from which K is calculated to be 1.027 when $\alpha = 1.016$. These assumptions were substantiated by laboratory experiments which showed an extremely small difference in boiling points between B^{10} complex and B^{11} complex, and which indicated a value of $K = 1.025 \pm .002$.

2415
CHEMICAL SEPARATION OF ISOTOPES SECTION SEMIANNUAL PROGRESS REPORT FOR PERIOD ENDING DECEMBER 31, 1954. May 20, 1955. Decl. Mar. 2, 1957. 32 p. (ORNL-1874). NSA 11, 8557.

New systems involving the exchange of B between boron trifluoride and boron trifluoride addition compounds have been explored. A precise determination of the separation factor for the anisole-boron trifluoride system gave the value $\alpha_{(90\%\ C.I.)} = 1.0291 \pm 0.0009$. B exchange was found to occur between BF_3 and BCl_3. A proposed system involving isotopic exchange between lithium dipivaloylmethane in diethyl ether and lithium hydroxide in aqueous solution was shown to give little or no Li isotope separation. Column studies of the NH_3-$(NH_4)_2CO_3$ system exchange reaction were concluded with a 40°C run. Slightly higher enrichment of N^{15} was obtained than at 30°C. The temperature dependence of α_{eff} in this system was measured between 15 and 45°C. The factor increases with temperature, showing a tendency toward a maximum near 45°C. Rapid isotopic exchange was found to occur between ammonia gas and aqueous carbamate ion. A proposed system for enriching K isotopes was found to have a single-stage separation factor of $\alpha_{(90\%\ C.I.)} = 1.006 \pm 0.002$. The single-stage fractionation factor between uranyl ion on Dowex 50 resin and on aqueous solution of uranyl ion in the presence of Versene was found to be approximately 1.00006. Very little enrichment resulted from passing a band of uranyl ion down an ion exchange column.

2416
MULTICOMPONENT GASEOUS DIFFUSION SEPARATION. R. H. Newell. Apr. 29, 1957. 6 p. (GAT-DR-226). NSA 11, 8865.

An algebraic method is presented for the solution of a 4-component gaseous diffusion cascade. At present the development is restricted to a single enricher, theoretical separation factor and the assumption of no losses. No insurmountable obstacles are foreseen in the extension of this work.

2417
EQUILIBRIUM TIME FOR A SQUARE PLANT. D. W. Burton. June 12, 1957. 429 p. (K-1330). (Addendum Nov. 4, 1957, 7 p.) NSA 11, 8986.

This report contains a table of equilibrium times for short square plants. This equilibrium time is defined by the relation, if is the equilibrium time, $[x(N,\tau) - x(0,\tau)]/[x(N,\infty) - x(0,\infty)] = 1 - \epsilon$ where ϵ has the values 0.02, 0.01, 0.005. The numerator is the difference between the top stage concentration and the bottom stage concentration at time . The denominator is the same difference at steady state. In the appendices the mathematical treatment is shown, and for the simple case of no top or bottom sampling drums, it is also shown that the equilibrium time derived by a linear problem differs slightly from the equilibrium time derived from a more exact equation. Thus the table can be used for the complete range of concentrations.

2418
U-235 BY CENTRIFUGING GETS NEW TRIAL. Chem. Eng. 64, No. 7, 144, 146 (1957). NSA 11, 8987.

The separation of U isotopes by centrifuging is being investigated in Germany. Eight centrifuges have been built for separating $U^{235}F_6$ from $U^{238}F_6$. These machines have a diameter of 7.2 in. and are 47 in. high. They will rotate at a peripheral speed of about 6000 ft/sec., equivalent to about 32,000 rpm. The centrifugal force is about 100,000 times that of gravity.

2419
CHEMICAL SEPARATION OF ISOTOPES SECTION SEMIANNUAL PROGRESS REPORT FOR PERIOD ENDING DECEMBER 31, 1953. June 24, 1954. Decl. Mar. 1, 1957. 18 p. (ORNL-1706). NSA 11, 9664.

No exchange of chlorine was found between chlorate and perchlorate ions in water solution after two years at room temperature. Hydrated lithium ions have been found to exchange all their molecules of solvation in a half-time of less than 0.8 min. Oxygen-18 was used as a stable isotopic tracer in this experiment. Methods of boron isotope separation have been examined. A gas-liquid type of system is proposed. Investigations are in progress on modifications of the ammonia (gas) vs. ammonium ion (aqueous) system for nitrogen isotope enrichment. The substitution of $Ca(OH)_2$ slurry for NaOH solution as a refluxing agent should cut the cost of reflux chemicals considerably. A proposed closed-cycle system which would eliminate or greatly reduce the cost of reflux chemicals is under investigation. This system uses ammonium carbonate in place of ammonium nitrate in the aqueous solution.

2420
A DYNAMIC PROGRAMMING SOLUTION TO A PROBLEM IN HEAVY WATER PRODUCTION. Richard Bellman. Nuclear Sci. and Eng. 2, 523-5 (1957). NSA 11, 10009.

A mathematical treatment of the optimum design of a plant to produce heavy water by water distillation.

2421
ESTIMATE OF THE COST OF PRODUCING NITROGEN-15 BY CHEMICAL EXCHANGE: AMMONIA-AMMONIUM CARBONATE SYSTEM USING CALCIUM HYDROXIDE REFLUX ASSUMING LOSSES OF 0.001 AT EACH REFLUX POINT. B. B. Klima and W. T. Ward. April 3, 1956. 45 p. (CF-56-4-12). NSA 11, 10905.

The cost of producing one pound per day of N^{15} (95% isotopic purity), assuming a loss of 0.001 fluxer, is estimated to be $5,912. For a plant producing fifty pounds per day this cost drops to $1,827 per pound. These costs are approximately 47% and 69% higher, respectively, than for plants of the same capacities designed on the basis of perfect (no loss) reflux. A breakdown of the investment costs, the fixed costs, and the variable costs are tabulated. A summary of annual operating costs including the cost per pound and per gram of N^{15} produced is given.

2422
ALL-UNION CONFERENCE ON THE APPLICATION OF RADIOACTIVE AND STABLE ISOTOPES IN THE NATIONAL ECONOMY AND SCIENCE. (ABSTRACTS OF PAPERS AND PLENARY SESSION PAPERS). Translated from a publication of the Academy of Sciences U.S.S.R., Moscow, 1957. 460 p. (AEC-tr-2925). NSA 11, 11016.

Abstracts are presented of papers presented at a conference on applications of stable and radioactive isotopes in the national economy and science in the U.S.S.R. Topics discussed include: isotope production and high-intensity γ systems; industrial and technical uses of isotopes; uses of isotopes in biology, medicine, and agriculture; and radiation chemistry.

2423
STEAM POWER PLANT WITH MEANS FOR HEAVY WATER CONCENTRATION. J. S. Foster, et al. U. S. Patent 2,798,359. July 9, 1957. NSA 11, 11547.

A method and apparatus for obtaining heavy water are described. Water enriched in deuterium is obtained by passing the main steam flow and returning condensate stream of condensing steam power cycle in opposite directions through a fractionating column located at a suitable place in the cycle.

2424
CONCERNING SOME ISOTOPIC EXCHANGE REACTIONS OF BORON COMPOUNDS. A. N. Webb and W. L. Rittschof. Oct. 30, 1945. Decl. Mar. 12, 1957. 19 p. (A-2364). NSA 11, 11561.

The isotopic exchange between boron atoms of the $(CH_3)_2O\text{-}BF_3$ complex and those of B-containing impurities was shown to be rapid and complete under the experimental conditions. It was also demonstrated that the exchange of B atoms within the $(CH_3O)_3B\text{-}BF_3$ molecule is rapid even at room temperature.

2425
THE ANCO SYSTEM FOR BORON ISOTOPE ENRICHMENT. PROGRESS REPORT FOR PERIOD ENDING SEPTEMBER 20, 1955. R. M. Healy, E. F. Joseph, and A. A. Palko. May 1, 1956. Decl. Mar. 2, 1957. 49 p. (ORNL-2069). NSA 11, 11577.

A new gas-liquid countercurrent system (the ANCO system from ANisole-COmplex) for the enrichment of boron isotopes was developed. The system utilizes the exchange reaction between BF_3 (gas) and BF_3 anisole (liquid) to concentrate B^{10} in the liquid phase. The single stage isotopic separation factor for this system was found to vary from 1.039 at 0°C to 1.029 at 30°C. The isotopic exchange reaction was shown to be rapid. Vapor pressures of the complex as a function of temperature were measured and the heat of formation of the complex determined. Laboratory experiments show that quantitative removal of the BF_3 from the complex can be accomplished by heating. Based upon the experience obtained with the laboratory ANCO unit a pilot plant large enough to utilize a 6-inch diameter exchange column was designed. The design calculations of the major pieces of equipment are presented.

2426
BORON AND ITS ISOTOPES. June 1957. 11 p. (AECU-3548). NSA 11, 11912.

Data are briefly presented on the physical, chemical, and nuclear properties of B, separation of the isotopes, uses of B^{10} and B^{11}, chemical properties of dimethyl ether boron trifluoride complex and potassium fluoborate, and toxicity and hazards. A graph of nuclear cross sections in the low-energy range is included.

2427
NEW RESEARCH DEVELOPMENTS FOR INDUSTRIAL SCALE ISOTOPE SEPARATION. S. Villani. Energia nucleare 4, 187-95 (1957). NSA 11, 12127.

Separation methods for U^{235}, H^2, N^{15}, and B^{10} are discussed.

2428
ISOTOPIC ENRICHMENT BY SLOW EVAPORATION OF WATER. L. Knop and F. Stern. "J. Stefan" Inst. Repts. (Ljubljana) 3, 149-56 (1956). NSA 11, 12128.

Experiments with slow evaporation of water indicate that a fixed H_2O-isotopic equilibrium exists as compared with atmospheric moisture. The equilibrium water contains more of the heavy isotope than normal water.

2429
ANCO PROGRESS REPORT FOR MONTH OF JANUARY 1956. J. S. Drury. Jan. 27, 1956. Decl. Mar. 13, 1957. 4 p. (CF-56-1-128). NSA 11, 12319.

Vapor pressure data for anisole-BF_3 mixtures were extended to include BF_3/anisole ratios of 0.55, 0.92, and 1.00. The temperature-pressure relationship of these and previously studied compositions is shown. An approximate melting point of 1 to 2°C was observed for the 1:1 complex, as compared with the literature value of -12 to -13°C. Progress is briefly reported on the laboratory-scale ANCO system and the reflux facility.

2430
SIMPLE PROCESS SEPARATION FACTORS FOR THE SEPARATION OF URANIUM ISOTOPES BY CHEMICAL EXCHANGE. G. H. Clewett and W. B. Schaap. Oct. 16, 1947. Decl. Mar. 6, 1957. 31 p. (Y-41). NSA 11, 12409.

Various chemical exchange systems for U isotope separation were investigated. Several are thought to have separation factors as high as 1.002.

2431
CHEMICAL SEPARATION OF ISOTOPES SECTION SEMIANNUAL PROGRESS REPORT FOR PERIOD ENDING DECEMBER 31, 1955. July 24, 1956. Decl. Mar. 19, 1957. 42 p. (ORNL-2097). NSA 11, 12513.

The anisole-complex system utilizes the exchange reaction between BF_3 gas and the liquid BF_3-anisole complex to concentrate B^{11} in the gas phase and B^{10} in the liquid phase. The properties of Pt metal catalysts for catalysis of the hydrogen-water exchange was studied and exchange rates determined. A simple method was developed for the determination of deuterium in H compounds. The equilibrium constant for the isotopic exchange of N between NO and NO_2 was determined by mass spectroscopic measurements. A 15-mm exchange column for the enrichment of N^{15} by the Nitrox Process was operated and an over-all enrichment greater than fiftyfold or 16% was realized. The single-stage separation factor between O^{16} and O^{18} in the methyl ether(g)-methyl ether·BF_3(l) system was found to be 1.017 ± 0.005 at room temperature. The heavy isotope concentrated in the liquid complex.

2432
LOSS IN PRODUCTION DUE TO PERIODIC FEED CONCENTRATION. D. W. Burton. Sept. 12, 1957. 61 p. (K-1341). NSA 11, 12799.

Losses in production result when the plant operating variables undergo transient or periodic changes in their values. The loss in production of the plant when the feed concentration to a simple series-type plant undergoes a periodic variation is calculated and compared to a more exact result for a square-type plant, but with a 100 stage stripper added. Numerical evaluation of the loss is carried through for a few cases.

2433
THE SEPARATION OF ISOTOPES OF MERCURY IN A TEN-CELL APPARATUS BY THE CASCADE EVAPORATION METHOD. Progress Report. A. K. Brewer and S. L. Madorsky. Nov. 25, 1940. Decl. with deletions Feb. 12, 1957. 14 p. (A-78 (Del.)). NSA 11, 13108.

Experiments were carried out in a 10-cell iron apparatus at an external pressure of ~ 10^{-6} mm Hg. Data indicate that the theoretical separation factor can be approached by the cascade evaporation method. The method is not necessarily limited to Hg. An modification in which the vapor is blown from cell to cell either by the vapor pressure of the liquid itself or by an inert gas is suggested to save power and extend the applicability of the method to a wide range of compounds.

2434
DESIGN OF CASCADES OF THERMAL DIFFUSION COLUMNS FROM EXPERIMENTAL DATA: A NOMOGRAPH OF RAPID CALCULATIONS. Karl Cohen. Aug. 13, 1943. Decl. Jan. 31, 1957. (4-R-95); Includes Attachments: MEMORANDUM ON THE THERMAL DIFFUSION METHOD AS CARRIED OUT BY THE NAVAL RESEARCH LABORATORY. Harold C. Urey. Feb. 19, 1943. (100M-79); [Letter to W. K. Lewis, Re: NAVAL RESEARCH LABORATORY METHOD.] Harold C. Urey. Sept. 4, 1943. (100U-L-260); [Letter to Lyman J. Briggs, Re: THERMAL DIFFUSION METHOD.] Harold C. Urey. Jan. 28, 1943. (100L-39); [Letter to James B. Conant, Re: LIQUID THERMAL DIFFUSION PROCESS.] Lyman J. Briggs, H[arold] C. Urey, E. V. Murphree, and W. K. Lewis. Sept. 8, 1943; and [Letter to James B. Conant, Re: LIQUID THERMAL DIFFUSION PROCESS AS AN ALTERNATE TO THE DIFFUSION SCREEN PROCESS.] Lyman J. Briggs. Jan. 30, 1943. 15 p. (A-781). NSA 11, 13843.

Some considerations preliminary to the design of cascades for thermal diffusion separation of U isotopes are given.

2435
ISOTOPE SEPARATION BY THE PHOTOEXCITATION OF SPECIFIC ISOTOPES; THE POSSIBILITY OF APPLYING THIS METHOD TO THE SEPARATION OF Li^6 AND Li^7. Leon M. Dorfman. Nov. 28, 1952. Decl. Mar. 22, 1957. 5 p. (KAPL-M-LMD-2). NSA 11, 13844.

Discussion of the possibility of separating Li isotopes by the photoexcitation method.

2436
SEPARATION OF THE BORON ISOTOPES BY ATMOSPHERIC DISTILLATION OF DIMETHYL ETHER-BORON TRIFLUORIDE COMPLEX. W. M. Keely and Kenton Atwood. June 3, 1953. Decl. Mar. 6, 1957. 25 p. (M-5507). NSA 11, 13845.

Results with an experimental setup are reported. Decomposition was too great with atmospheric pressure distillation unless methyl fluoride was recirculated to depress decomposition.

2437
ISOTOPIC EXCHANGE BETWEEN Pu(III) AND Pu(IV). Thomas K. Keenan. J. Phys. Chem. 61, 1117-20 (1957). C.A. 52, 55g.

The rate of exchange between Pu(III) and Pu(IV) in aqueous perchlorate media was investigated. Because of the rapidity of the exchange it was necessary to work in the concentration range of 10^{-6} to 10^{-5} Pu concentration.

2438
TRACER STUDIES ON ALCOHOLS. II. THE EXCHANGE OF OXYGEN-18 BETWEEN SEC-BUTYL ALCOHOL AND WATER. C. A. Bunton and D. R. Llewellyn. J. Chem. Soc. 1957, 3402-7. C.A. 52, 55h.

The kinetics of exchange between sec-BuOH and H_2O were determined at 99.8° in solutions containing 1.15-4.1M $HClO_4$ and 1.82 and 2.52M H_2SO_4.

2439
HYDROGEN-ISOTOPE EXCHANGE IN A LIQUID DEUTERIUM FLUORIDE MEDIUM. Ya. M. Varshavskiĭ and M. G. Lozhkina. Zhur. Fiz. Khim. 31, 911-14 (1957). C.A. 52, 57a.

An apparatus is described for the production of large amounts of HF enriched with DF, the isotope analysis in that mixture and directions are given for the preparation of solutions in liquid HF and for effecting isotope exchange reactions in a HF medium.

2440
NEW METHODS FOR OBTAINING FISSILE MATERIAL. K. Reger. Atom Wirtsch. 1, 61-3 (1956); Chim. et ind. 76, 1319 (1956). C.A. 52, 111c.

The most usual method of enriching U in U^{235} or the preparation of pure U^{235} uses gaseous thermodiffusion. But 2 recent processes appear advantageous; gaseous ultracentrifugation, which gives a very good separation coefficient but requires costly installations, and the separation nozzle which, because of its high rate of flow, gives a good hourly yield. Problems exist for both methods.

2441
ISOTOPIC EXCHANGE AND THE EVOLUTION OF METALLIC SURFACES IN ELECTROLYTIC SOLUTIONS. U. Camerini, J. Danon, and M. Malagolowkin. J. chim. phys. 54, 527-32 (1957). C.A. 52, 126b.

The number of atomic layers exchanged can be estimated from a measurement of the distribution of the ranges of particles emitted in a nuclear photographic emulsion. The method was applied to Bi, Zn, Pb, Cd, Cu, Ni, and Mn. The penetration of the tracer into the metal was shown not to be due to diffusion or to surface heterogeneity.

2442
EXCHANGE REACTION BETWEEN CHROMIUM(III) THIOCYANATE COMPLEX AND THIOCYANATE ION. Kunihiko Kigoshi and Hisako Murata. Nippon Kagaku Zasshi 78, 526-32 (1957). C.A. 52, 148b.

The exchange reaction between chromium(III) thiocyanate complex and free thiocyanate ion in aqueous solution was studied at 30-60° by using S^{35}.

2443
THERMAL DIFFUSION PLANT FOR THE ENRICHMENT OF HELIUM-3 FROM ATMOSPHERIC HELIUM. I. EXPERIMENTS TO DETERMINE THE CHARACTERISTICS OF THE INDIVIDUAL COLUMNS. R. W. Bowring. Atomic Energy Research Estab. GP/R-2058, 58 pp. (1957). C.A. 52, 809c.

A thermal diffusion plant producing 2 cc. He^3 at standard conditions per week from atmospheric helium at concentrations up to 10% He^3/He has been in satisfactory operation for some years. It has 3 columns: 2 are identical columns of the coaxial tube type and the 3rd is a hot-wire type.

2444
KINETICS OF COMPLEX ISOTOPIC EXCHANGE REACTIONS. D. F. Abell, N. A. Bonner, and W. Goishi. J. Chem. Phys. 27, 658-60 (1957). C.A. 52, 846a.

A general equation was developed for the kinetics of complex isotopic-exchange reactions in which each of 3 nonequivalent species is exchanging with the other 2.

2445
ISOTOPIC EXCHANGE REACTIONS. THE HALOGEN EXCHANGE BETWEEN SILICON TETRACHLORIDE AND HYDROCHLORIC ACID. Rolfe H. Herber. J. Chem. Phys. 27, 653-5 (1957). C.A. 52, 846b.

The exchange reaction was followed, Cl^{36} being used as tracer. The reaction was 1st-order in HCl and 2nd-order in $SiCl_4$. E' and S' were 22.4 kcal./mole and -17.6 cal./degree-mole, respectively.

2446
ISOTOPIC EXCHANGE REACTIONS BETWEEN PHOSPHORUS TRICHLORIDE AND PHOSPHORUS PENTACHLORIDE. Warren E. Becker and Rowland E. Johnson. J. Am. Chem. Soc. 79, 5157-9 (1957). C.A. 52, 846c.

PCl_3 was labeled with P^{32} or Cl^{36} and its exchange with PCl_5 in CCl_4 solution was measured at 0.1-50.0°. The exchange rates were the same for P and Cl, and the reaction was 1st-order in PCl_5 and zero-order in PCl_3. HCl accelerated the exchange, but the effect was less than that on the Cl-PCl_5 exchange.

2447
THE SULFATE-ION EXCHANGE IN AQUEOUS SOLUTIONS OF TRIVALENT COBALT ACIDOAMMINES. Ya. A. Fialkov and V. D. Panasyuk. Doklady Akad. Nauk S.S.S.R. 114, 124-7 (1957). C.A. 52, 847e.

The SO_4^{--} exchange in the inner sphere of $[Co(NH_3)_5SO_4]\cdot HSO_4\cdot 2H_2O$ and $[Co(NH_3)_4\text{-}H_2OSO_4]HSO_4\cdot 1.5H_2O$ was investigated to learn about the mobility of the SO_4^{--} in the inner sphere, and the effects of the intrasphere NH_3 and H_2O mols. on the rate of the SO_4^{--} isotope exchange in the aqueous solutions of the complexes. The reactions were studied at 30-70° and with varying concentrations of the complexes and of the SO_4 ions in the outer spheres using Na_2SO_4 containing S^{35}.

2448
ION EXCHANGE BETWEEN THE POTASSIUM NIOBATES AND SODIUM TANTALATES. A. V. Lapitskiĭ, D. Nishanov, V. M. Dmitriev, and A. Z. Kozorezov. Zhur. Neorg. Khim. 2, 952-8 (1957). C.A. 52, 950d.

The isotopic exchange between potassium metaniobate ($KNbO_3\cdot 2H_2O$), $KNbO_3$, sodium hexatantalate, and anhydrous potassium metatantalate was studied at 20°, 35°, and 50°. The exchange between the anhydrous salts and their saturated solution is only slight and completely independent of temperature. The degree of exchange between $KNb^*O_3\cdot H_2O$ and $Na_8Ta_6O_{19}\cdot 24H_2O$ and its

saturated solution is directly proportional to soly. and temperature.

2449
OXYGEN ISOTOPE VARIATIONS IN SOME URANIUM MINERALS. H. R. Hoekstra. Natl. Acad. Sci.-Natl. Research Council, Publ. No. 400, Nuclear Sci. Ser. Rept. No. 19, 160-5 (1956). C.A. 52, 998b.

Pitchblende and uranite ores were treated with BrF_3, and the evolved O_2 isotope ratios were determined by the mass spectrometer. Results for 25 ores are tabulated.

2450
ISOTOPE EFFECTS IN GAS-LIQUID CHROMATOGRAPHY. Kenneth E. Wilzbach and Peter Riesz. Science 126, 748-9 (1957). C.A. 52, 1725h.

Considerable changes in retention volume result from extensive substitution of D or T in organic compounds and provide a measure of the relative vapor pressures of the isotopic compounds, which may be used to estimate the number of D or T atoms/mole of a substance present in trace amounts.

2451
EQUILIBRIUM CONSTANTS FOR THE SULFUR ISOTOPE EXCHANGE BETWEEN SULFUR DIOXIDE AND SULFURIC ACID. H. B. Dunford, A. G. Harrison, and H. G. Thode. Can. J. Chem. 35, 817-20 (1957). C.A. 52, 1737h.

The S^{32}-S^{34} isotope exchange between SO_2 and 100% H_2SO_4 was studied over the range 200-400°. Equilibrium constants of 1.014, 1.011, and 1.008 were determined at 205, 300, and 400°, favoring S^{34} in the H_2SO_4. The data agree with computed constants for the exchange between SO_2 and SO_4^{--}.

2452
CHEMICAL EXCHANGE EFFECTS ON ISOTOPE SEPARATIONS IN THERMAL DIFFUSION COLUMNS. Ivan G. Chasalow. Univ. Microfilms (Ann Arbor, Mich.), Publ. No. 23070, 80 pp.; Dissertation Abstr. 17, 2165 (1957). C.A. 52, 1787c. cf. C.A. 51, 11830d.

2453
CATALYTIC EXCHANGE BETWEEN DEUTERIUM AND SATURATED HYDRIDES. J. R. Anderson. Revs. Pure and Appl. Chem. (Australia) 7, 165-94 (1957). C.A. 52, 2515c.

A review with 93 references.

2454
SEPARATION BY CHEMICAL EXCHANGE REACTIONS OF THE STABLE ISOTOPES OF NITROGEN. I. G. M. Panchenkov, I. A. Semiokhin, A. A. Renzaeva, V. V. Molchanov, and O. P. Kalashnikov. Zhur. Fiz. Khim. 31, 1352-8 (1957). C.A. 52, 3485f.

The effect of the nature and the size of the packing in the reaction column on the separation of N isotopes, and the effect of NH_3 partial pressure during the reaction of $N^{15}H_3$(gas) + $N^{14}H_4NO_3$(soln.) ⇌ $N^{14}H_3$(gas) + $N^{15}H_4NO_3$(soln.) was investigated.

2455
THE EXCHANGE OF DEUTERIUM BETWEEN HYDROGEN CHLORIDE AND WATER. O. Pugh and V. Y. Labaton. U. K. Atomic Energy. 1957, 9 pp. (IGR-TN/CA-652). C.A. 52, 3485i.

The exchange of D between HCl and H_2O was studied in a fractionating column with the constant boiling point 20 wt. % HCl mixture as the means of turn-around for refluxing. A theoretical study had shown that a separation factor of α = 1.05 would be obtained. The experiments were made in a column packed with multi-turn Fenske helixes. Samples were analyzed for D with an Abbé refractometer and by use of a nuclear-magnetic-resonance spectrometer. An isotope separation factor α = 1.03 was obtained. This method of separating D from H has no advantage over the method of distilling water.

2456
WALL EFFECTS IN THE EXCHANGE REACTION BETWEEN HYDROGEN AND DEUTERIUM. Alessandro Cimino, Ettore Molinari, and Gian Gualberto Volpi. Gazz. chim. ital 86, 609-23 (1956). C.A. 52, 3492c.

The walls of the vessel in which the reaction between H and D takes place exercise a double effect: (a) Above 640° they favor the formation of a stationary concentration in gas phase of H and D atoms following a heterogeneous dissociation of molecules in atoms at the surface, thus allowing a homogeneous exchange reaction. (b) Below 640° they catalyze a heterogeneous exchange reaction depending on the surface/volume ratio.

2457
ISOTOPIC TRACER INVESTIGATIONS OF MECHANISM AND STRUCTURE IN INORGANIC CHEMISTRY. D. R. Stranks and R. G. Wilkins. Chem. Revs. 57, 743-866 (1957). C.A. 52, 3577c.

Review, 503 references.

2458
THE SEPARATION NOZZLE. II. THE PHYSICAL BASIS OF THE SEPARATION EFFECT AND SPECIFIC OPERATIONAL CONSTANTS OF THE METHOD. E. W. Becker, W. Beyrich, K. Bier, H. Burghoff, and F. Zigan. Z. Naturforsch. 12a, 609-21 (1957). C.A. 52, 4253c. cf. C.A. 51, 3196b.

By using a natural A^{36}-A^{40} mixture, the influence of the nozzle form and the pressure dependence of the isotope separation is investigated in a supersonic expansion. The separation can be explained as a combination pressure diffusion and ordinary diffusion. Operational characteristics are determined for operation of a separation cascade, with a set of nozzles connected in series. From these characteristics it is shown that it is economically feasible to separate U in the form of its hexafluoride.

2459
PROBLEMS CONNECTED WITH THE PRODUCTION OF HEAVY WATER IN FRANCE. Étienne Roth. Comm. énergie atomique (France), Rappt. No. 657, 339-52 (1957). C.A. 52, 4277c.

A review of work on the production of heavy water by water and liquid H distillation. In searching for a source of H showing natural D enrichment it was found that H_2S in natural gas from Lacq in south west France is depleted in D apparently by the $H_2O(l)$ + HDS(g) = HDO(l) + H_2S(g) reaction.

2460
ISOTOPIC EXCHANGE BETWEEN NITROGEN-14 AND NITROGEN-15 ON VARIOUS CATALYSTS: UNPROMOTED IRON, IRON WITH K_2O, IRON WITH K_2O-

Al_2O_3, AND IRON WITH K_2O-Al_2O_3-CaO. A. Krylova and S. Roginskiĭ. Izvest. Akad. Nauk S.S.S.R., Otdel. Khim. Nauk 1957, 1271. C.A. 52, 4300a.

The highest rate of exchange occurred on the unpromoted Fe, which is but feebly active for synthesis of NH_3; the K_2O-promoted Fe, which is very active for NH_3 synthesis, displayed no isotope exchange. Catalytic decomposition of NH_3 is such on Fe-K_2O-Al_2O_3 catalyst that it begins 100-200° lower than the temperature of beginning of isotope exchange. The results indicate chemisorption of N_2 in the catalytic process of formation of NH_3 with N_2 not being dissociated into atoms.

2461

THE SEPARATION TUBE. XX. COMPARISON OF THE THERMODIFFUSION CONSTANT OF $N^{14}N^{15}/N_2{}^{14}$ AND $N^{15}O/N^{14}O$. PARADOX OF THE TEMPERATURE INFLUENCE IN THE SEPARATION TUBE. K. Clusius and P. Franzosini. Z. Naturforsch. 12a, 621-9 (1957). C.A. 52, 4351d.

By using a wire-heated glass separation tube the separation factors of the systems $N^{14}N^{15}/N_2{}^{14}$ and $N^{15}O/N^{14}O$ are compared in a temperature range up to 500°K. and up to pressures of 2 atmospheres. For the separation of N isotopes the use of NO would be more favorable. However, the thermodiffusion factor of $N^{15}O/N^{14}O$ is only 80% that of $N^{14}N^{15}/N_2{}^{14}$ at 350°K. Therefore, the use of NO would require 1.5 times as much power input to produce a similar amount of N^{15}. Increasing the temperature makes the use of NO more favorable, but then the decomposition of NO limits this possibility. The paradox is that at lower pressures when the temperature of the hot wire is increased the separation factor diminishes.

2462

TRITIUM SEPARATION FACTOR IN THE CALCIUM-WATER REACTION. D. A. Brown. 1957, 8 pp. (DP-217). C.A. 52, 4351f.

The separation factor, $\alpha_{H/T}$, was found to be 1.8 for the reaction between tritiated water and Ca metal at 85-95°, at low concentration of T_2O. It was not a sensitive function of the extent of the reaction.

2463

HIGH ENRICHMENT OF URANIUM-235. B. Harmatz, H. C. McCurdy, F. N. Case, and R. S. Livingston. 1957, 22 pp. (ORNL-2381). C.A. 52, 4351g.

Small amounts of very high purity U^{235} were obtained by electromagnetic separations. Products and enrichments obtained are (1) 80 g. 99.9% U^{235}, (2) 1100 g. 99.7% U^{235}, and (3) 8 g. 99.994% U^{235}.

2464

ISOTOPE SEPARATION IN SUPERSONIC JETS. E. W. Becker. Brit. Chem. Eng. 3, 37 (1958). C.A. 52, 4351h.

A new separation process suitable for U isotopes depends on the partial spatial demixing of the different heavy gases in a freely expanding supersonic stream. The specific energy used is estimated to be roughly the same as that of the diffusion process. By avoiding fine-pored membranes a series of technical advantages may be possibly achieved. A disadvantage is a comparatively low absolute pressure, implying relatively high costs for the blowers to recompress the UF_6.

2465

VAPOR-PRESSURE DIFFERENCES BETWEEN SOME OF THE ISOTOPIC SPECIES OF CARBON MONOXIDE, METHANE, AND OXYGEN. I. EXPERIMENTAL. T. F. Johns. Atomic Energy Research Estab. 1957, 53 pp. (GP/R-2166). C.A. 52, 5914b.

The differences between the vapor pressures were determined directly for a number of samples of CO containing different proportions of $C^{12}O^{16}$, $C^{13}O^{18}$, and $C^{12}O^{18}$. From these the vapor-pressure ratios of the 3 species were calculated. The vapor-pressure difference between $C^{12}O^{16}$ and $C^{13}O^{16}$ is about 1.3 times as large as the difference between $C^{12}O^{16}$ and $C^{12}O^{18}$ both for the liquid between 68.1 and 81°K. and for the solid between 57° and 68.1°K. The vapor-pressure ratio of liquid $C^{12}O^{16}$ and $C^{13}O^{16}$ varies from 1.011 at the m.p. to 1.0073 at 80°K. Similar measurements were made for methane and for O_2. The vapor-pressure ratio of liquid $C^{12}H_4$ and $C^{13}H_4$ varies from 1.0055 at the m.p. to 1.0041 at 100°K., whereas that of $O^{16}O^{16}$ and $O^{18}O^{18}$ varies from 1.010 at 70°K. to 1.0055 at 90°K. The differences between the melting and transition points of the various isotopic species also were measured.

2466

THE SEPARATION TUBE. XIX. THE ENRICHMENT OF THE ISOTOPES BROMINE-79 AND BROMINE-81. Klaus Clusius and Hans Ulrich Hostettler. Z. Naturforsch. 12a, 974-82 (1957). C.A. 52, 6008g.

The separation of the Br isotopes Br^{79} and Br^{81} was studied by thermodiffusion of HBr. The thermal dissociation of the HBr at the hot wire can be sufficiently suppressed by adding 3% H_2 to the HBr. By this method the Br formed at the wire diffuses to the colder wall of the tube and recombines on its way in an homogeneous chain reaction with H. In tubes of 10 and 13 m. length, the maximum enrichment for Br^{79} was 84.5% and for Br^{81} 63.8%. The suitability of HBr as an auxiliary gas for the separation of the 2 lightest and rarest Kr isotopes was also investigated. Kr^{78} could be enriched to 60.5% and Kr^{80} to 29.1%, although their concentrations in the starting mixture were only 0.37 and 2.6%, respectively.

2467

CHEMICAL METHOD FOR THE SEPARATION OF BORON ISOTOPES. G. M. Panchenko, V. D. Moiseev, and A. V. Makarov. Zhur. Fiz. Khim. 31, 1851-59 (1957). C.A. 52, 6008i.

B isotopes were separated by an interaction of BF_3 with its anisole (A) complex, $BF_3 \cdot A$,

$$A \cdot BF_3 \underset{20^\circ}{\overset{100-50^\circ}{\rightleftharpoons}} A + BF_3.$$

The BF_3 formed by the decomposition of the complex was either made to pass successively through fresh portions of A, or continuously countercurrently through it. The apparatus used is shown and described in detail. The separation of

B^{10} and B^{11} isotopes resulted from the reaction $B^{10}F_3 + A \cdot B^{11}F_3 \rightleftharpoons B^{11}F_3 + A \cdot B^{10}F_3$ and the B^{10} isotope was concentrated in the liquid phase, as proven mass spectroscopically, from about 19% to 22.5% after 22-7 hours of operation. The isotope separation coefficient in the $BF_3 + A \cdot BF_3$ reaction was 1.013.

2468

SEPARATION OF BORON ISOTOPES. I. BORON TRIHALIDE ADDITION COMPOUNDS. R. M. Healy and A. A. Palko. J. Chem. Phys. 28, 211-13 (1958). C.A. 52-8648f.

The following separation factors, (B^{10}/B^{11})liq./(B^{10}/B^{11})gas, were determined at 25°: BF_3(g) vs. anisole-BF_3(l.), 1.032; BF_3(g) vs. Bu_2S-BF_3(l.), 1.033; BF_3(g) vs. phenol-BF_3(l.), 1.027; BCl_3(g) vs. BCl_3-AcCl(l.), 0.996; BCl_3(g) vs. BCl_3-Ph_2O(l.), 1.001. The acceptor properties of the B halides are in the order of $BI_3 > BBr_3 > BCl_3 > BF_3$.

2469

SEPARATION OF BORON ISOTOPES. II. THE BF_3 ANISOLE SYSTEM. A. A. Palko, R. M. Healy, and L. Landau. J. Chem. Phys. 28, 214-17 (1958). C.A. 52, 8648g.

A new gas-liquid countercurrent system has been developed for the separation of boron isotopes. This system utilizes the exchange reaction between BF_3 gas and the BF_3·methyl phenyl ether (anisole) complex. Quantitative dissociation of the complex is attained by heating, and recombination by cooling. Half-time for the isotopic exchange has been shown to be less than three seconds. The single-stage separation factor [$B^{10}F_3$·anisole(liq.)/$B^{11}F_3$·anisole(liq.)/$B^{10}F_3$(gas)/$B^{11}F_3$(gas)] varies from 1.039 at 0°C to 1.028 at 30°C. Physical properties of the complex have been determined and solvent decomposition has been studied.

2470

See Reference Number 2465.

2471

A NOTE ON EXACT AND APPROXIMATE EQUILIBRIUM TIME FOR A SQUARE PLANT. Addendum. D. W. Burton. Nov. 4, 1957. 7 p. (K-1330(Add.)) NSA 12, 386.

See reference No. 2417.

2472

INTERIM REPORT ON THE SEPARATION OF ISOTOPES BY LIQUID THERMAL DIFFUSION. H. T. Hahn. Oct. 21, 1955. Decl. Feb. 26, 1957. 18 p. (HW-39477). NSA 12, 956.

Experiments in the separation of U isotopes by liquid thermal diffusion in $UO_2(NO_3)_2$-TBP complex and in aqueous and molten $UO_2(NO_3)_2$ are described.

2473

AEC RESEARCH AND DEVELOPMENT QUARTERLY REPORT FOR APRIL, MAY, AND JUNE 1957. G. T. Miller. Aug. 22, 1957. 22 p. (HEC-79). NSA 12, 1288.

Phase I is concerned with the separation of boron isotopes 10 and 11. The presently used method of separation of boron isotopes is distillation of the dimethyl ether-boron trifluoride complex. The distillation is carried out in extremely effective continuous fractionation columns, the B^{10} enriched complex being recovered from the bottoms. A second method for the separation of boron isotopes is in the development stage. The method is dependent on an exchange between BF_3 gas and anisole-boron trifluoride liquid complex. The desired boron-10 isotope is concentrated in the liquid phase. The boron isotope separation factor is greater for the anisole-BF_3 complex system than for the dimethyl ether-BF_3 system. Phase II is concerned with the reduction of boron compounds (product of Phase I) to the elemental form. Although hydrogen reduction of boron trichloride using a hot wire was used in plant operations, fused salt electrolysis is used at present. The process involves the electrolysis of potassium fluoroborate in a potassium chloride melt.

2474

BORON ISOTOPE SEPARATION WITH ANISOLE-BORON TRIFLUORIDE COMPLEX. Kenneth O. Hambrock. Aug. 26, 1957. 38 p. (HEC-80). NSA 12, 1289.

Three aspects of the anisole-BF_3 system for B isotope separation were investigated: metal corrosion in anisole at reflux temperatures in the presence of BF_3, both with and without water, anisole decomposition in the presence of varying water content, and anisole purification methods. Recommended materials of construction, anisole purity, and decomposition product tolerances are given for design purposes.

2475

GAS CHROMATOGRAPHIC SEPARATION OF HYDROGEN ISOTOPES. E. Glueckauf and G. P. Kitt. Feb. 9, 1956. 10 p. (AERE-C/R-1847). NSA 12, 1482.

Complete purification of deuterium from deuterium-hydrogen mixtures has been achieved by passage of a 1:1 mixture through a column containing Pd black on asbestos, at room temperature. A column containing 20 g of Pd can deal with approximately 1 liter N.T.P. of mixture. The separation factor of T_2-H_2 is about 40% larger than that of D_2-H_2. This means that the separation is better, permitting a higher loading of the columns.

2476

A STUDY OF THE DECOMPOSITION RATE OF POLYMER DURING FRACTIONATION UNDER DIMINISHED PRESSURE. J. L. Hanner. June 1, 1954. Decl. Mar. 12, 1957. 18 p. (NYO-1239). NSA 12, 1835.

A study of the decomposition rate of polymer, $(CH_3)_2O \cdot BF_3$, refluxing through a 1 in. x 48 in. laboratory column packed with 1/8 in. glass helices under diminished pressures was made. It was found that decomposition increased with temperature. At a temperature level approximately equivalent to that expected in plant operation it was found that the decomposition rate amounted to about 2% a day. The same rate was obtained on a pilot plant scale using the 6 in. x 16 in. monel column packed with 0.24 in. x 0.24 in. monel protruded packing.

2477

PRODUCTION OF DEUTERIUM BY THE DISTILLATION OF LIQUID HYDROGEN. J. O. Maloney, H. E. Hughes, and N. G. Addington.

July 1, 1950. Decl. Feb. 16, 1957. 25 p. (COO-19). NSA 12, 2033.

A survey was made of existing facilities for liquid hydrogen production. The purification of hydrogen streams and the feasibility of deuterium separation from hydrogen by low-temperature distillation are discussed briefly. Recommendations are made concerning engineering problems which require additional study.

2478
PRELIMINARY COST ESTIMATE FOR QUANTITY PREPARATION OF BORON-10. Oct. 14, 1949. Decl. Feb. 19, 1957. 9 p. (HKF-AED-100). NSA 12, 2034.

Of the three items in producing B^{10} (feed cost, separation plant cost, and product finishing) it was found that, per pound of B^{10} produced, the feed and raw materials will cost about $15 (assuming return of waste BF_3 to manufacturer), the isotope separation will cost about $32, and the production of amorphous B from BF_3 will cost about $10. Of these items the last is the most uncertain. The over-all price per pound of B^{10} is about $57.

2479
CHEMICAL SEPARATION OF THE ISOTOPES OF URANIUM. R. W. Woodard, L. P. Twichell, D. A. Lee, P. B. Petretzky, J. S. Drury, R. D. Williams, F. V. Tilson, F. B. Waldrop, and G. H. Clewett. Aug. 1948. Decl. with deletions Mar. 6, 1957. 111 p. (Y-185(Del.)). NSA 12, 2035.

Two reactions have been utilized: the first involves a two phase liquid-liquid system in which a chloroform solution of an organic (cupferron) complex of uranium is contacted with an aqueous solution of tetravalent uranium ions. After the system has reached isotopic equilibrium, the phases are separated and the uranium recovered: the second is a single phase system, in water, wherein the separation of uranium is accomplished by an exchange reaction involving the exchange of uranium between U^{+4} and UO_2^{+2} ionic species. The separation effects obtained from these two reactions (each has a factor of about 1.001) are disappointingly low when considered from the possibility of adaptation to large scale processing, but the most significant feature of the work presented is the fact that measurable separation of the isotopes has been attained. Extensive efforts to utilize the liquid-liquid system in continuous column operation were unsuccessful. Considerable effort was made to find a more stable organic compound which would be suitable for complexing the uranium without success.

2480
HEAVY WATER. Bibliography of British, Canadian and American Reports, etc., and Selected References to the Published Literature. R. Clarke. June 1957. 32 p. (AERE-Inf/Bib-87 (Suppl. 5)). NSA 12, 2777.

The opportunity has been taken in this Supplement to include a list of the more important published papers on the production, purification, properties, and analysis of heavy water and deuterium (taken from Nuclear Science Abstracts 1948 to May 1957). The report references include some early reports which have only recently become available.

2481
HEAVY WATER IN GERMANY. Atomics 8, 428-30 (1957). NSA 12, 2778.

The three practicable methods of concentration of deuterium are considered: distillation, electrolysis of water, and chemical exchange reactions. The status of German research is summarized.

2482
CHEMICAL SEPARATION OF ISOTOPES SECTION SEMIANNUAL PROGRESS REPORT FOR PERIOD ENDING JUNE 30, 1955. Feb. 23, 1956. Decl. with deletions Mar. 4, 1957. 34 p. (ORNL-2005 (Del.)). NSA 12, 3603.

The countercurrent gas-liquid system BF_3(g)-anisole·BF_3(l.) for the concentration of boron isotopes has been studied. The single-stage separation factor varies from 1.039 at 0°C to 1.029 at 30°C. Rate of exchange is rapid. From vapor-pressure measurements, an approximate upper limit of $\Delta H = -12$ kcal per mole of complex was calculated for the reaction BF_3(g) + Anisole(l.) $\rightleftharpoons$ Anisole·BF_3 (l.). Qualitative tests indicate good resistance of anisole to decomposition by BF_3 under plant conditions. The single-stage, equilibrium separation factor for the NO-HNO_3 system varied with acid concentration from 1.064 with 1M acid to 1.020 with 15M acid. The nitrogen-isotope separation factor for the system NO(g) vs $FeNO^{++}$(aq.) was found to be 1.009 at 16.5°C. The N^{15} concentrated in the liquid phase. A number of experiments have been performed to evaluate the ammonium resin-ammonium hydroxide moving-band ion-exchange system for enriching the isotopes of nitrogen. A separating factor of 1.027 (24°C) was measured, and the total separation was shown to decrease upon increasing the rate of band travel. The equilibrium distillation of N_2O_4 has been found to enrich N^{15} in the liquid phase with an estimated single-stage separation factor of approximately 1.004. It has been found that the $B^{10}F_3$·dimethyl ether complex produced by the multistage distillation of BF_3·dimethyl ether complex is more than threefold enriched in O^{18}. The effective single-stage separation factor for oxygen separation by this system is estimated to be greater than 1.01. The equilibrium constant for the reaction NaK^{41} + $K^{39}I$ (DMC) = NaK^{39} + $K^{41}I$ (DMC) was found to be approximately 1.015 at 23°C.

2483
THE CONCENTRATION OF U^{235} BY CHEMICAL EXCHANGE IN COMBINATION WITH COUNTERCURRENT ELECTROMIGRATION. L. P. Twichell, R. D. Williams, and A. Clark. Aug. 22, 1949. Decl. Sept. 4, 1957. 44 p. (Y-488 (Rev.)). NSA 12, 3608.

It has been previously shown that U^{235} concentrates to a slight extent as UO_2^{2+} in the U^{4+}-UO_2^{2+} aqueous system. In this report a method is described for a continuous chemical process in which the U^{235} isotope has been successfully concentrated by a chemical exchange reaction. In this

method U^{4+} and UO_2^{2+} move countercurrently to each other by the countercurrent electromigration principle which was developed to concentrate certain isotopes of potassium, chlorine, and copper. When this method is applied to the U^{4+}-UO_2^{2+} system, the U^{4+} moves countercurrently to UO_2^{2+}, and the concentration of U^{235} should increase in the UO_2^{2+}; correspondingly, the concentration of U^{235} should increase in the U^{4+}. It was found that UO_2^{2+} could be washed from cathode to anode by a stream of electrolyte which flowed countercurrently to the U^{4+} migrating to the cathode. One cell was operated for 1400 hours to increase the concentration of U^{235} from 0.7111 to 0.7171%. Details of the method and the difficulties encountered in its operation are described.

2484
APPLICATION OF LIQUID-LIQUID SYSTEMS TO THE SEPARATION OF LITHIUM ISOTOPES. J. S. Drury. June 28, 1951. Decl. Mar. 6, 1957. 22 p. (Y-785). NSA 12, 3609.
A systematic effort to develop a liquid-liquid system suitable for the separation of lithium isotopes is described. The study included a search for immiscible solvent pairs; preparation of a number of lithium compounds, solubility studies of lithium compounds in individual solvents, distribution studies of lithium compounds in two phase liquid-liquid systems; and determination of isotopic shift in certain selected systems. No measurable isotopic enhancement was found in any of the systems studied.

2485
THE SEPARATION OF THE BORON ISOTOPES. Isidor Kirshenbaum, Nestor Sabi, and Philip W. Schutz. Sept. 30, 1944. Decl. Feb. 13, 1957. 191 p. (A-2120). NSA 12, 3784.
This method of separating the boron isotopes consists essentially in distilling a dissociable complex in a countercurrent system. A one-step fractionation factor of 1.016 ± 0.002 is obtained using the methyl ether and ethyl ether BF_3 complexes. The physical and chemical properties and thermal stability of these complexes and other related compounds are discussed in detail. Corrosion data are also included. A method for recovering the boron trifluoride from the ether complexes is given. This method involves the liberation of the ether by formation of the CaF_2-BF_3 complex and the subsequent decomposition of this salt complex at an elevated temperature. The various new tests, techniques, and pieces of apparatus devised are described. Other methods of separating the boron isotopes are given and evaluated quantitatively.

2486
See Reference Number 2462.

2487
PROPOSAL OF A NEW METHOD FOR THE SEPARATION OF HYDROGEN AND DEUTERIUM BY CHEMICAL EXCHANGE BETWEEN SIMPLE HYDROGEN COMPOUNDS AND PALLADIUM HYDRIDE AND PALLADIUM DEUTERIDE. Oliver N. Salmon. Feb. 9, 1953. Decl. with deletions Feb. 25, 1957. 8 p. (KAPL-M-ONS-2 (Del.)). NSA 12, 4755.
The application of H isotope exchange between Pd hydride and deuteride solid solution and water to a dual temperature process for the production of D_2O is discussed. Theoretical separation factors were estimated for the H_2O-Pd_2D exchange and NH_3-Pd_2D exchange and compared with those of some of the previously studied exchange reactions which have been considered favorable for dual temperature processes. An equation for calculating the separation factor as a function of composition for the H_2O-Pd hydride and deuteride are derived here to illustrate the theory involved.

2488
THE EFFECT OF TEMPERATURE AND PRESSURE ON THE MURPHREE PLATE EFFICIENCY FOR THE DEUTERIUM EXCHANGE BETWEEN WATER AND HYDROGEN SULFIDE. Jerome S. Spevack and Edward J. Grabowski. Apr. 17, 1943. Decl. Mar. 14, 1957. 15 p. (A-597). NSA 12, 5255.
An investigation of the Murphree plate efficiency applied to a single slotted bubble cap was made for the deuterium exchange between hydrogen sulfide and water. Efficiencies varied from approximately 50% to 70% at 20°C and from 66% to 82% at 100°C over a range of gas velocities from 71.06 to 35.53 cubic feet (S.T.P.)/square foot of slot area.

2489
UTILIZATION OF HEAVY WATER. Isidor Kirshenbaum, George M. Murphy and Harold C. Urey, eds. 1951. Decl. Feb. 27, 1957. 212 p. (NNES-III-4B); (TID-5226). NSA 12, 5257.
Discussions are included on the general theory of pile operation, physical and thermodynamic properties of the uranium oxides, physical properties of uranium oxide-water slurries, reactions of the uranium oxides, and stability of construction materials.

2490
ISOTOPE SEPARATION BY MULTISTAGE METHODS. T. F. Johns. Progr. Nuclear Phys. 6, 1-25 (1957). NSA 12, 5296.
A general account of some of the more important multistage separation methods is given. Some of the more important and representative references are listed.

2491
TRANSFER MEASUREMENTS FOR DETERMINATION OF THE MOBILITY OF Li^6, Li^7, AND Pb IN MOLTEN LiCl-$PbCl_2$ MIXTURES. A. Klemm and E. U. Monse. Z. Naturforsch. 12a, 321-34 (1957). NSA 12, 5483.
From isotope analysis it was found that the relatively reduced mobility difference of the Li isotopes (mass effect) remained almost constant a -0.14 for LiCl concentrations between 100 and 20%, but then it increased and at 5% LiCl the value -0.27 was reached. The measurement of mobility in molten mixtures was treated generally, a theory of moving boundaries given, and the experimental results from the LiCl-$PbCl_2$ system discussed.

2492
THE SEPARATION OF URANIUM-235. P. Caldirola. Translated by E. G. Peters from Energia nucleare (Milan) 3, Suppl. 74-81 (1956). 10 p. (IGRL-T/CA-59). NSA 12, 5485.
A brief description is presented of the principles on which the centrifugal

separation and the "Trennduse" processes for U^{235} separation are based. A more detailed description of the gaseous diffusion process for U^{235} separation is included.

2493

ELECTROMAGNETIC ENRICHMENT OF STABLE ISOTOPES. M. L. Smith. Progr. Nuclear Phys. 6, 162-91 (1957). NSA 12, 5489.

An account of the limitations and advantages of the electromagnetic process is given. Discussions are included on the development of the large 180° separator, a general description of the present production machine, a detailed account of the separation process, chemical problems involved in processing isotopic concentrates, applications of electromagnetically enriched stable isotopes, and application of small laboratory electromagnetic separators to stable- and active-isotope enrichment, and the future of electromagnetic separation.

2494

PROCEEDINGS OF THE INTERNATIONAL SYMPOSIUM ON ISOTOPE SEPARATION: Amsterdam, April 23-27 (1957). J. Kistemaker, J. Bigeleisen, and A. O. C. Nier, Editors. North Holland Publishing Co., Amsterdam; Interscience Publishers, Inc., New York (1958).

APPLICATIONS OF ISOTOPE THEORY TO EXPERIMENT. K. P. Cohen. p. 3-16. 9 references. EVALUATION OF ISOTOPE SEPARATION PROCESSES. G. A. Garrett and J. Shacter. p. 17-32. 12 references. USE OF A DIGITAL COMPUTER FOR SOLUTION OF AN ISOTOPE PLANT PROBLEM. H. Ashcroft. p. 33-43. MASS AND HEAT TRANSFER IN CONCURRENT LIQUID-GAS FLOW--APPLICATION TO SOME SEPARATING PROCESSES AND TO SEPARATING UNITS. S. Finzi, R. Renzoni, M. Silvestri, and S. Villani. p. 44-61. See C.A. 52, 68f. 7 references. DIFFERENCES IN VAPOR PRESSURE OF ISOTOPIC SUBSTANCES, DUE TO INFRARED ABSORPTION BANDS. P. Baertschi and W. Kuhn. p. 65-73. See C.A. 51, 15245g. 8 references. VAPOR PRESSURE OF ISOTOPIC SUBSTANCES. T. F. Johns. p. 74-102; cf. C.A. 52, 5914b. 15 references. ISOTOPE MIXTURES. I. Prigogine and A. Bellemans. p. 103-6. 8 references. ISOTOPE EFFECTS ON THE PARTITION FUNCTION, EQUATION OF STATE, AND THERMODYNAMIC FUNCTIONS OF COMPOUNDS OF HYDROGEN. A. S. Friedman. p. 107-17. 21 references. SIGNIFICANCE OF THE PRODUCT AND SUM RULES TO ISOTOPE FRACTIONATION PROCESSES. Jacob Bigeleisen. p. 121-57. 46 references. PREPARATION OF HIGHLY ENRICHED NITROGEN-15 BY CHEMICAL EXCHANGE OF NITRIC OXIDE WITH NITRIC ACID. T. I. Taylor and W. Spindel. p. 158-77. 17 references. PILOT PLANT FOR PRODUCTION OF HIGHLY ENRICHED BORON ISOTOPES. R. W. McIlroy and F. C. W. Pummery. p. 178-98. 10 references. CHEMICAL SEPARATION OF STABLE ISOTOPES. R. M. Healy, A. A. Palko, E. F. Joseph, and J. S. Drury. p. 199-200. EXCHANGE DISTILLATION FOR SEPARATION OF ISOTOPES, PARTICULARLY PRODUCTION OF BORON-10. K. E. Holmberg. p. 201-3. CHEMICAL EXCHANGE REACTIONS WITH BORON AND LABORATORY EXCHANGE COLUMN FOR BORON-10 ENRICHMENT. S. V. Ribnikar. p. 204-9. 2 references. GAS CHROMATOGRAPHIC SEPARATION OF HYDROGEN ISOTOPES. E. Glueckauf and G. P. Kitt. p. 210-26. 7 references. SEPARATION OF ISOTOPES OF LITHIUM ON ION EXCHANGERS. F. Ménès, E. Saïto, and E. Roth. p. 227-42. 11 references. ENRICHMENT OF HEAVY SULFUR ISOTOPES WITH AN ANION EXCHANGER. S. Forberg, W. Barnevik, I. Fogelström-Fineman, T. Westermark and H. v. Ubisch. p. 243-6. 7 references. ISOTOPIC EXCHANGE BETWEEN HYDROGEN AND WATER ON CATALYSTS IN LIQUID PHASE. R. Montarnal, J. C. Balaceanu, and G. Dirian. p. 247-71. 16 references. ION MOBILITY IN MOLTEN SALTS--TEMPERATURE AND CONCENTRATION EFFECT. A. Klemm. p. 275-82. 4 references. COUNTERCURRENT ELECTROMIGRATION IN MOLTEN SALTS. A. Lundén. p. 283-4. Reference. ENRICHMENT OF MAGNESIUM-26 THROUGH COUNTERCURRENT ELECTROLYSIS. H. Martin. p. 285-7. 6 references. CONCENTRATION OF ISOTOPES BY ELECTROMIGRATION IN DIFFERENT MEDIUMS. M. Chemla. 288-307. 14 references. HAEFFNER EFFECTS. A. R. E. Lodding. p. 308-12; cf. C.A. 51, 16135i. 3 references. ENRICHMENT OF ISOTOPES BY DIFFERENCE IN RATES OF ISOTOPIC REACTIONS. R. B. Bernstein. p. 313-15. ISOTOPE SEPARATION BY FRACTIONAL DISTILLATION. H. London. 319-35. 4 references. SEPARATION OF THE HEAVY ISOTOPES OF OXYGEN BY DISTILLATION. I. Dostrovsky and A. Raviv. p. 336-49. 47 references. EXPERIMENTS ON SEPARATION OF LITHIUM ISOTOPES BY MOLECULAR DISTILLATION. D. B. Trauger, J. J. Keyes, Jr., G. A. Kuipers, and D. M. Lang. p. 350-67. 2 references. DESIGN CRITERION FOR WATER DISTILLATION PLANT FOR HEAVY-WATER PRODUCTION. R. Casini. p. 368-82. 2 references. PRODUCTION OF DEUTERIUM BY DISTILLATION OF HYDROGEN. W. H. Denton. p. 383-4. PRODUCTION OF BORON-10 BY LOW-TEMPERATURE DISTILLATION OF BORON TRIFLUORIDE. P. T. Nettley, D. K. Cartwright, and H. Kronberger. p. 385-407. 12 references. ENRICHMENT OF ISOTOPES OF BORON-10 BY FRACTIONAL DISTILLATION OF BORON TRIFLUORIDE. J. Mühlenpfordt, T. Gagua, G. Siewert, and H. Zühlke. p. 408-15. 3 references. SEPARATION TUBE SEPARATION OF BROMINE-79 AND BROMINE-81 ISOTOPES. H. U. Hostettler and Kl. Clusius. p. 419-32. 18 references. QUANTITATIVE ENRICHMENT IN SEPARATION TUBE. G. Dickel. p. 433-45. 9 references. PERFORMANCE OF THERMAL DIFFUSION COLUMNS. W. W. Watson. p. 446-61. 20 references. PARAMETERS OF THERMAL DIFFUSION COLUMNS. G. R. Grove, K. W. Foster, and R. E. Vallee. p. 462-70. 7 references. SEPARATION OF HYDROGEN AND TRITIUM BY THERMAL DIFFUSION. C. Boorman and H. Kronberger. p. 471-82. 3 references. SEPARATION OF URANIUM ISOTOPES BY LIQUID THERMAL DIFFUSION. Ph. H. Abelson and J. I. Hoover. p. 483-508. 13 references. DESIGN THEORY FOR DIFFUSION PLANT STAGES. H. Kronberger and G. R. H. Geoghegan. p. 513-17. Reference. THEORY OF SERIES AND PARALLEL DIFFUSION PLANT STAGE CONNECTIONS. G. R. H. Geoghegan. p. 518-23. THEORY OF SEPARATION OF CONSTITUENTS OF A GASEOUS ISOTOPIC MIXTURE BY DIFFUSION THROUGH A POROUS BARRIER. D. Massignon. p. 524-35. 16 references. EXPERIENCE IN GAS DIFFUSION SEPARATION. G. Perona, E. Brutto, and R. Sesini. p. 536-7. COUNTERCURRENT

GASEOUS DIFFUSION; THEORY OF EQUILIBRIUM TAKING INTO CONSIDERATION PARTIALLY NON-SEPARATIVE MOLECULAR FLOW. J. A. McMillan. p. 538-40. 2 references. ISOTOPIC EFFECTS IN ADSORPTION AND SURFACE MIGRATION. P. Caldirola and G. Rossi. p. 541-4. SEPARATION OF ISOTOPES BY CONVECTION-DIFFUSION. D. Heymann and J. Kistemaker. p. 545-50. 2 references. DEVELOPMENTS IN HERTZIAN COUNTERCURRENT DIFFUSION APPARATUS. H. Barwich and R. Kutscherow. p. 551-9. 7 references. JET SEPARATION METHOD. E. W. Becker. p. 560-78. 4 references. OPERATIONAL EXPERIENCE WITH HERMES-HARWELL ACTIVE ELECTROMAGNETIC SEPARATOR. M. L. Smith. p. 581-91. SERVICES AND CONTROLS FOR HERMES. K. J. Hill. p. 592-6. 5 references. ELECTROMAGNETIC SEPARATION OF ISOTOPES OF THE HEAVY ELEMENTS. R. S. Livingston and J. A. Martin. p. 597-609. References. SPECIAL ISOTOPE SEPARATOR FOR IDENTIFICATION OR PURIFICATION OF RADIOACTIVE SPECIES. R. S. Livingston and J. A. Martin. p. 610-14. ELECTROMAGNETIC SEPARATION OF STABLE ISOTOPES AT OAK RIDGE NATIONAL LABORATORY. L. O. Love, W. A. Bell, Jr., W. K. Prater, G. M. Banic, and A. E. Cameron. p. 615-21. Reference. ELECTROMAGNETIC COLLECTIONS OF INERT GAS ISOTOPES. H. B. Greene and C. P. Keim. p. 622. AVAILABILITY OF PROCUREMENT OF ENRICHED STABLE ISOTOPES IN THE UNITED STATES. C. P. Keim. p. 623. ELECTROMAGNETIC SEPARATOR OF THE GERMAN ACADEMY OF SCIENCE OF BERLIN. F. Bernhard, S. Göring, G. Huhn, and E. Wilde. p. 624-30. 2 references. ELECTROMAGNETIC PRODUCTION OF VERY PURE ISOTOPES. Ch. Cassignol. p. 631-9. Reference. ELECTRIC MASS SPECTROMETER FOR ISOTOPE SEPARATION. W. Paul and H. P. Reinhard. p. 640-52. 3 references. TWO-DIRECTIONAL MECHANICAL BEAM SCANNING. K. O. Nielsen. p. 653-4. Reference. THRESHOLD PRESSURE IN A PLASMA ION SOURCE. K. O. Nielsen and O. Almen. p. 655-6. 2 references. SPUTTERING OF COPPER BY ION-BOMBARDMENT IN THE ENERGY RANGE OF 5-25 E. KV. P. K. Rol, J. M. Fluit, and J. Kistemaker. p. 657-62. 7 references. MAGNETOIONIC MEANS FOR SEPARATING ISOTOPES IN VERY LARGE QUANTITIES. Joseph Slepian. p. 663. ENRICHMENT OF URANIUM ISOTOPES BY THE GAS CENTRIFUGE PROCESS. K. Beyerle and W. Groth. p. 667-94. 17 references. INFLUENCE OF TEMPERATURE DISTRIBUTION INSIDE A GAS CENTRIFUGE. J. Los and J. Kistemaker. p. 695-700. 3 references.

2495

SEPARATION OF THE BORON ISOTOPES. George M. Murphy, ed. 1952. Declassified Feb. 27, 1957, 485 p. (TID-5227); (NNES-III-5).

Discussions and data are included of the wartime work at Columbia University SAM Laboratories on methods of Boron isotope separation. Data are included on distillation of various volatile boron compounds, isotopic analyses, chemical analyses and physical and chemical properties of boron compounds. The distillation of $(CH_3)_2O \cdot BF_3$ complex at reduced pressure was selected as the best method of B^{10} concentration and chemical, isotopic, and pilot plant data were determined for this system. Isotopic fractionation was determined to be due to isotopic exchange between BF_3 (gas) and $(CH_3)_2O \cdot BF_3$ (liquid). At 100 °C the effective separation factor was found to be 1.016 and the equilibrium constant for the isotopic exchange 1.027. Incomplete dissociation in the gas phase accounts for the difference. B^{10} concentrates in the liquid $[(CH_3)_2O \cdot BF_3]$ phase.

2496

CHEMICAL SEPARATION OF THE URANIUM ISOTOPES. Clyde A. Hutchison, Jr. George M. Murphy, Ed. 1952, declassified Feb. 27, 1957, 193 p. (TID-5224); (NNES-III-3).

Discussion of the theory of chemical separation of isotopes applied to U. Search was made for a two-phase system capable of application to countercurrent chemical exchange separation. Experimental results on various gas-liquid, liquid-liquid, and gas-solid systems examined are given. No system that possessed sufficient chemical stability, a sufficiently rapid exchange of uranium, and an appreciable separative effect was found.

2497

LABORATORY STUDIES FOR SEPARATION PROCESSES. M. L. Eidinoff, G. G. Joris, E. H. Taylor, H. S. Taylor, H. C. Urey: Edited by G. M. Murphy, H. C. Urey and I. Kirshenbaum. 1951; declassified 1957 (NNES-III-4D).

Experimental data are given on separation factors, pilot scale experiments and catalyst development for the following methods of deuterium enrichment: distillation of H_2O; H_2-H_2O exchange system; H_2S-H_2O dual temperature exchange system; mercaptan-H_2O dual temperature exchange system; NH_3-H_2O-H_2 dual temperature exchange system; cyclohexane-benzene-H_2 dual temperature exchange system.

AUTHOR INDEX

This index to the authors of papers listed in this bibliography is arranged alphabetically by the anglicized form of the name; consequently, the prefixed names such as, de Groot, S. R., and Van der Grinten, W., are alphabetized from the first letter of the prefix. Accent marks, including the umlaut, have been ignored in the arrangement.

Since original research is almost always published under personal credit lines, no impersonal authors such as corporate, patents or administrative subdivisions of organizations are listed. No research was attempted to determine the authors of those reports for which the name of the author was not readily available.

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SUBJECT INDEX

The subject index is fairly detailed, with emphasis placed on separation methods, exchange reactions, isotopic properties, and isotopic kinetic effects. Specific isotopes are not mentioned and indexing is given only to the element whose isotopes are under study. For example, Hydrogen exchange, H_2 and HCl, covers exchange between all the various hydrogen, deuterium, and tritium substituted species of the two molecules. Alphabetical order by name of the compound or species involved has been followed.

The words "isotope", "isotopic", and "reaction" have been omitted from almost every index heading listed. These words should be "read-into" their proper places. Such as, in Hydrogen "isotopic" properties; Lithium exchange "reaction"; Carbon "isotopic" kinetic effect; Neon "isotope" separation; and Oxygen "isotopic" abundance.

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1022	1261	J. Am. Chem. Soc. 74, 1592-3 (1952)(cond)
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1632	1572	
1793	1574	Dep. (mc)
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39477	2472	Dep. (mc); $3.30 (ph OTS); $2.40 (mf OTS)
47676	2314	Dep.; $0.20 (OTS)
48735	2400	Dep. (mc); $1.80 (ph OTS); $1.80 (mf OTS)

Report	Reference	Availability
IGR-TN/CA-652	2455	
IGRL-T/CA-59	2492	
ISC		
566	1800	Dep.; $5.25 (ph OTS); $2.50 (mf OTS)
671	2195	Dep.; $0.30 (OTS)
K		
843	2106	Dep. (mc); $3.30 (ph OTS); $2.40 (mf OTS)
925	1271	Dep.; $21.30 (ph OTS); $6.90 (mf OTS)
943	1427	Dep.; $3.30 (ph OTS); $2.40 (mf OTS)
979	2117	Dep.; $0.15 (OTS)
1044	1415	Dep.
1190	1838	Dep.; $9.00 (ph OTS); $3.25 (mf OTS)
1232	1925	Dep.; $0.35 (OTS)
1311	2307	
1312	2206	Dep.; $6.30 (ph OTS); $3.00 (mf OTS)
1330	2417	Dep.; $1.75 (OTS)
1330 (Add.)	2471	Dep.; $0.50 (OTS)
1341	2432	Dep.; $1.75 (OTS)
KAPL		
1036	1622	Dep.; $4.00 (ph OTS); $2.25 (mf OTS)
1272	2050	Dep.; $0.35 (OTS)
1667	2267	Dep.; $0.40 (OTS)
M-LMD-2	2435	Dep. (mc); $1.80 (ph OTS); $1.80 (mf OTS)
M-ONS-2 (Del.)	2487	Dep. (mc); $1.80 (ph OTS); $1.80 (mf OTS)
KLI-1098	1959	Dep.; $1.80 (ph OTS); $1.80 (mf OTS)
LA		
1873 UNM	1824	Dep.
1926 UNM	1828	Dep.
1972 UNM	2109	Dep.; $0.10 (OTS)
2048 UNM	2163	Dep.; $0.15 (OTS)
M		
3132	2111	Dep. (mc); $16.80 (ph OTS); $5.70 (mf OTS)
5507	2436	Dep. (mc); $7.80 (ph OTS); $3.30 (mf OTS)
MC		
36	714	
45	715	
MCC-1023-TR-207	2127	
MDDC		
891	805	Dep.
1496	806	Dep.
NBS		
1527	1268	In N.B.S. circ. 562, 85 p. $0.50 (GPO)
1631	1269	In N.B.S. circ. 562, 85 p. $0.50 (GPO)
1685	1270	In N.B.S. circ. 562, 85 p. $0.50 (GPO)
1721	1272	In N.B.S. circ. 562, 85 p. $0.50 (GPO)
1777	1273	In N.B.S. circ. 562, 85 p. $0.50 (GPO)
2266	1410	Dep.
2306	1413	Dep. (mc)
2492	1570	Dep. (mc)
2529	1419	In N.B.S. circ. 562, 85 p. $0.50 (GPO)
2626	1422	Dep. (mc)
3091	1575	Dep. (mc)
3144	1420	In N.B.S. circ. 562, 85 p. $0.50 (GPO)
3329	2094	Dep.; $3.30 (ph OTS); $2.40 (mf OTS)
3519	2123	Dep. (mc)
3676	1826	Dep. (mc)
3756	1985	Dep.
3872	1825	Dep. (mc)
3985	1830	Dep.
3992	1822	Dep. (mc)
4005	1823	Dep. (mc)
4059	1827	Dep. (mc)
4611	2028	Dep.; $0.50 (OTS)
4674	2170	Dep.; $0.25 (OTS)

Report	Reference	Availability
4712	2158	Dep.; $0.20 (OTS)
4877	2248	Dep.; $0.25 (OTS)
C-562(Suppl. 1)	2330	Dep. (mc); $0.25 (GPO)
NNES		
III-3	2496	See TID 5224
III-5	2495	See TID 5227
III-4B	2489	See TID 5226
III-4D	2497	
III-4F	1882, etc.	McGraw Hill Book Co.
NP		
1872	605	
3486	1262	
3662	1265	Phys. Rev. 71, 887-890 (1947)
4834	1423	
5992	2114	Lund, Hakan Ohlssons Boktoycheri, 1956, 114 p.
6214	2396	
6215	2397	
6216	2398	
NRL-3897	1263	
NYO		
503	1132	Dep. (mc)
623	1134	Dep. (mc)
624	1267	Dep. (mc)
625	1409	Dep. (mc)
889 (Del.)	2392	Dep. (mc); $18.30 (ph OTS); $6.00 (mf OTS)
1239	2476	Dep. (mc); $3.30 (ph OTS); $2.40 (mf OTS)
3922	1417	See AECD-3556
6084	2389	Dep. (mc); $10.80 (ph OTS); $3.90 (mf OTS)
6239	1576	Dep.
6242	2290, etc.	Dep.; $0.65 (OTS)
6635	1582	Dep. (mc)
7522	2112	Dep. (mc); $4.80 (ph OTS); $2.70 (mf OTS)
ORNL		
1422	1994	Dep.; $30.30 (ph OTS); $8.70 (mf OTS)
1706	2419	Dep. (mc); $3.30 (ph OTS); $2.40 (mf OTS)
1767	1681	Dep.; $4.00 (ph OTS); $2.25 (mf OTS)
1874	2415	Dep. (mc); $4.80 (ph OTS); $2.70 (mf OTS)
1900	1885	Dep.; $1.50 (ph OTS); $1.50 (mf OTS)
2005 (Del.)	2482	Dep.; $6.30 (ph OTS); $3.00 (mf OTS)
2069	2425	Dep.; $1.25 (OTS)
2097	2431	Dep. (mc); $1.00 (OTS)
2138	2189	Dep.; $0.25 (OTS)
2275	2343	Dep.; $0.25 (OTS)
2291	2324	Dep.; $0.25 (OTS)
2381	2463	
ORO-61	1266	Dep. (mc)
RM-1801 (RAND)	2393	
SO		
3252	1411	Dep.; $6.30 (ph OTS); $3.00 (mf OTS)
3253	1414	Dep.; $9.00 (ph OTS); $3.25 (mf OTS)
3256	1580	Dep.
TID		
5031	1264	Dep.; $1.75 (OTS)
5217	2096, etc.	Dep.;$2.65 (OTS)
5224	2496	Dep.;$3.00 (OTS)
5226	2489	Dep.;$5.50 (OTS)
5227	2495	Dep.; $7.00 (OTS)
U-8049	1581	See ATI-206230
UCRL-1723	2131	Dep. (mc); $4.80 (ph OTS); $2.70 (mf OTS)

Report	Reference	Availability
Y		
41	2430	Dep. (mc); $6.30 (ph OTS); $3.00 (mf OTS)
184	2107	Dep. (mc); $4.80 (ph OTS); $2.70 (mf OTS)
185 (Del.)	2479	Dep. (mc); $13.80 (ph OTS); $4.80 (mf OTS)
328	2101	Dep. (mc); $6.30 (ph OTS); $3.00 (mf OTS)
478	2108	Dep. (mc); $3.30 (ph OTS); $2.40 (mf OTS)
488 (Rev.)	2483	Dep.; $0.45 (OTS)
577	1692	Dep.; $5.25 (ph OTS); $2.50 (mf OTS)
623	1694	Dep.; $4.00 (ph OTS); $2.25 (mf OTS)
628	1696	Dep.; $4.00 (ph OTS); $2.25 (mf OTS)
669	1698	Dep.; $4.00 (ph OTS); $2.25 (mf OTS)
671	1695	Dep.; $2.75 (ph OTS); $2.00 (mf OTS)
683	1135	Dep.; $0.20 (OTS)
692	1697	Dep.; $2.75 (ph OTS); $2.00 (mf OTS)
693	1627	Dep.; $2.75 (ph OTS); $2.00 (mf OTS)
777	2116	Dep. (mc); $3.30 (ph OTS); $2.40 (mf OTS)
779	1653	Dep.; $2.75 (ph OTS); $2.00 (mf OTS)
785	2484	Dep.; $4.80 (ph OTS); $2.70 (mf OTS)
813	1693	Dep.; $2.75 (ph OTS); $2.00 (mf OTS)

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