

A Course in Mechanics by Dr. J. Tinsley Oden
Part II - Homework 4 - Questions

Exercise Set II.4:

1. Prove that the following correspondence principle holds for the principle of balance of angular momentum:

$$\frac{d \langle \mathbf{L} \rangle}{dt} = \langle \mathbf{q} \times \mathbf{F} \rangle, \quad \mathbf{F} = -\frac{dV}{d\mathbf{q}}.$$

2. Show that the eigenvalues of the spin operator S_1 for an electron are $\pm \hbar/2$.
3. Confirm that S_1 , S_2 , S_3 and S^2 (for electrons) represent observables but S_+ and S_- do not.
4. Ignoring normalization, determine which (if any) of the following wavefunctions are valid for the Helium atom.

(a) $\varphi_{1s}(1) \varphi_{2s}(2) \begin{vmatrix} \alpha_1 & \beta_1 \\ \alpha_2 & \beta_2 \end{vmatrix}$

(b) $\left(\varphi_{1s}(1) \varphi_{2s}(2) - \varphi_{2s}(1) \varphi_{1s}(2) \right) \begin{vmatrix} \alpha_1 & \beta_1 \\ \alpha_2 & \beta_2 \end{vmatrix}$