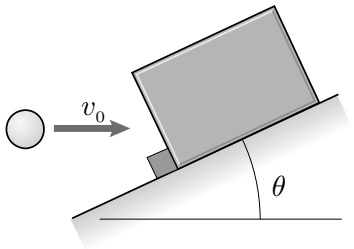
Name: _____ UT EID: _____

EM 311M - Dynamics
Practice Test

Write your work and solutions only on the **FRONT** side of the sheets provided, including white sheets.

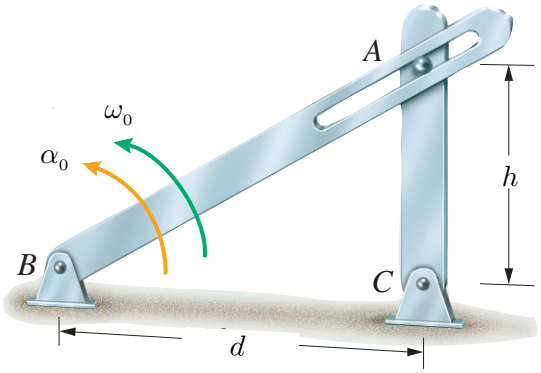
1. A ball of mass m_b moving horizontally with a velocity v_0 strikes a block of mass m_B. The coefficient of restitution of the impact is e and the coefficient of kinetic friction between the block and the inclined surface is μ_K.
(20 points) Find the expression for the distance that the block slides before stopping, as a function of the given data.
Note: Treat the ball as a point mass. The acceleration of gravity g is given.



2. The bar AB rotates with counterclockwise angular velocity ω_0. The height h and the distance d are given.

i. (10 points) Determine the expressions for the angular velocity of bar AC and the velocity at which sleeve A slides relative to B at the instant shown, as a function of the given data.

ii. (10 points) Assume now that $d = h$ and that A slides at a *constant* velocity relative to B. Find the expressions for the angular acceleration α_0 of bar AB and the angular acceleration of bar AC, as a function of the given data.



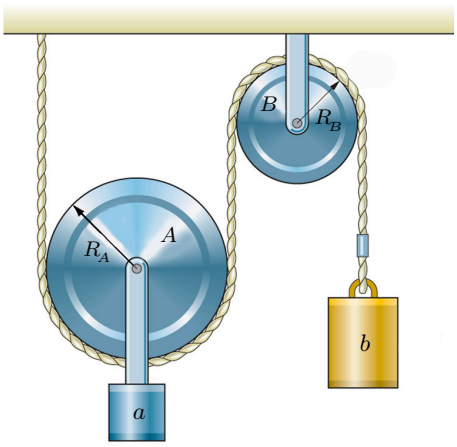
3. In the system shown below, the following information is provided:

- The weight W_A of the pulley A, its radius R_A and its moment of inertia I_A about its center.
- The moment of inertia I_B of pulley B about its center and its radius R_B.
- The weights of the loads a and b: w_a and w_b.

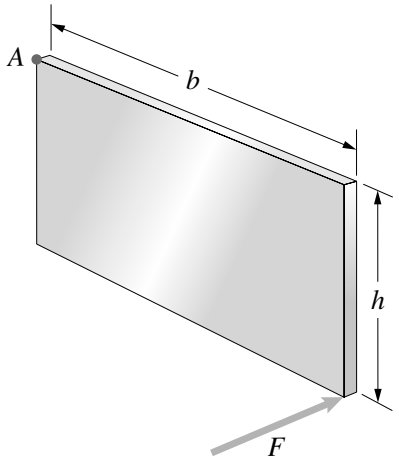
Assume the system is released from rest.

(a) (18 points) What is the expression for the acceleration of the load b as a function of the given data?

(b) (2 points) Take the result of (a) and assume you do not know the weight w_b. What is the condition on the magnitude of w_b so that the velocity of the load b is downward?



4. (20 points) The thin plate has mass m and dimensions h and b. The plate is stationary relative to an inertial reference frame when the force F is applied in the direction perpendicular to the plate. No other forces (including the weight) or couples act on the plate. At the instant F is applied, what is the magnitude of the acceleration of point A relative to the inertial reference frame?



5. The spring constant is $k = 800$ N/m, and the spring is unstretched when $x = 0$. The mass of each object is $m = 30$ kg. The surface is smooth and has an inclination of $\gamma = 20^o$. The radius of the pulley is $R = 120$ mm, its moment of inertia is $I = 0.03$ kg-m^2, and the damping constant is $c = 250$ N-s/m.

i. (10 points) Determine the period of vibration of the system relative to its equilibrium position.

ii. (10 points) At $t = 0\,\text{s}$, $x = 0\,\text{m}$ and $\dot{x} = 1\,\text{m/s}$. Find x as a function only of time t.

Note:: For (i) and (ii) you should use the numbers provided in the problem, and express the answer using appropriate units.