

# **Ph.D. Qualifying Examination**

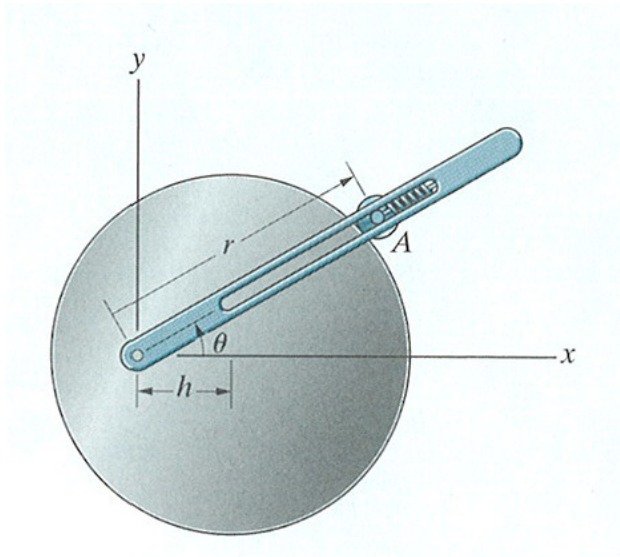
## ***Dynamics***

**Fall 2010**

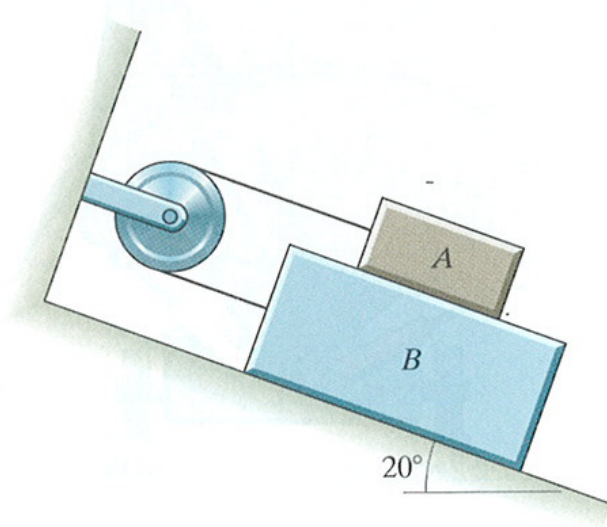
### Logistics Notes:

- Time allowed: 2 hours.
- Problems count 25 points each (total=100 points).
- Exam is closed-book and closed-notes (except for one sheet of “notes”:  $8.5 \times 11$  in., both sides)
- State your assumptions, methods, and procedures. Show your work on these exam sheets. (Add additional sheets, if needed.)
- Calculators are allowed.
- Laptops and cell phones are not allowed.

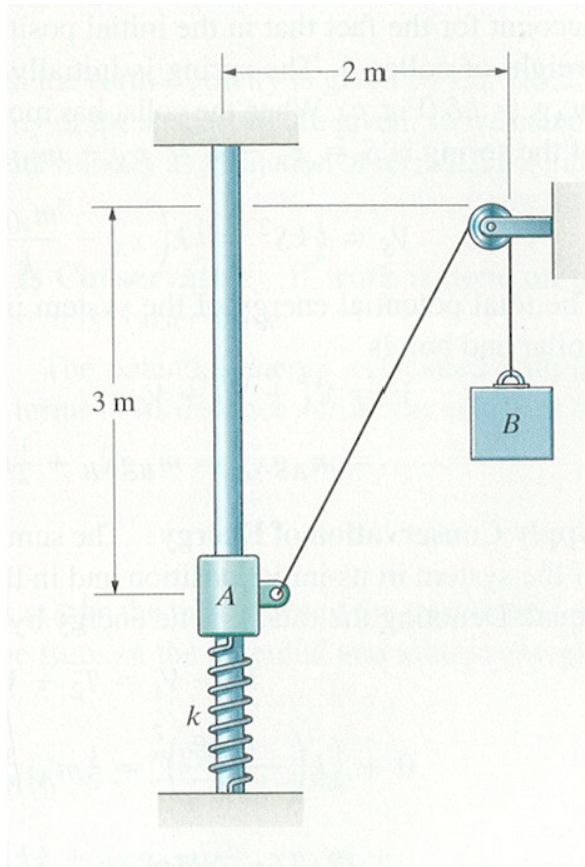
1. In the cam-follower mechanism, the slotted bar rotates with constant angular velocity  $\omega = 12 \text{ rad/s}$ , and the radial position of the follower A is determined by the profile of the stationary cam. The slotted bar is pinned a distance  $h = 0.2 \text{ m}$  to the left of the center of the circular cam. The follower moves in a circular path  $0.42 \text{ m}$  in radius. Determine the acceleration of the follower when  $\theta = 40^\circ$  in terms of polar coordinates.



2. If A weighs  $20lb$ , B weighs  $100lb$  and the coefficient of kinetic friction between all surfaces is  $\mu_k = 0.15$ , what is the tension in the cord as B slides down the inclined surface?



3. The spring with spring constant  $k = 300\text{ N/m}$  is connected to floor and to a  $90\text{ kg}$  collar  $A$ . Collar  $A$  is at rest, supported by the spring, when the  $135\text{ kg}$  box  $B$  is released from the position shown. What are the velocities of  $A$  and  $B$  when  $B$  has fallen  $1\text{ m}$ ?



4. The two weights are released from rest at time,  $t=0$ . The coefficient of kinetic friction between the horizontal surface and the 5lb weight is  $\mu_k = 0.4$ . Determine the magnitude of the velocity of the 10lb weight at  $t=1s$ .

