MECH 211-1

Spring 2009, Prof. Yakobson

Test 3

Due by Noon, Wednesday April 29, 2009 (box near MEB 233)

Show all work. Any force existing in an equation must also be denoted on an appropriate free body diagram. Clearly indicate (box) final answers.

This test is taken under the Rice Honor Code system. You may consult only the textbook (Bedford and Fowler), and notes that you have personally taken, or classnotes-materials downloaded from the course website. You may use a calculator, including programmable calculators. The test must be taken during a contiguous 3 hour period, with an optional 30 minutes break.

At the conclusion of the test, fold all sheets in half with your name (above) clearly visible, and seal them (staple or tape).

Time started: ________________________________.

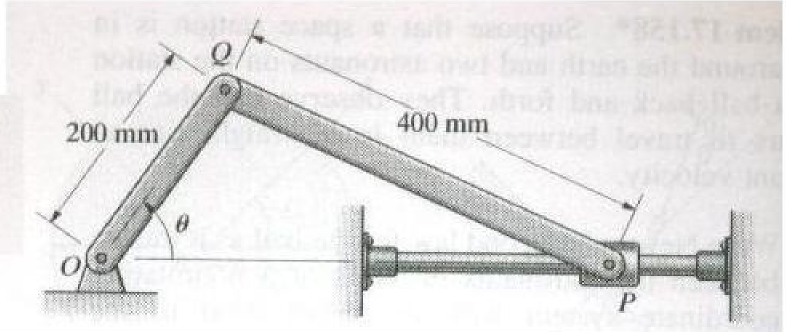
Time finished: ________________________________.

Pledge/signature: ______________________________________.

Problem 1

If $\theta = 60^\circ$ and bar OQ rotates in the counterclockwise direction at 5 rad/s, what is the angular velocity of bar PQ?

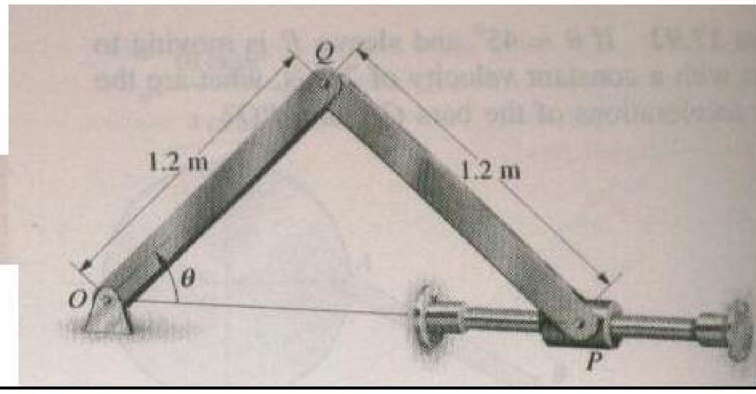
(chapter 17)



Problem 2

If $\theta = 50^\circ$ and bar OQ has a constant clockwise angular velocity of 1 rad/s, what is the acceleration of sleeve P?

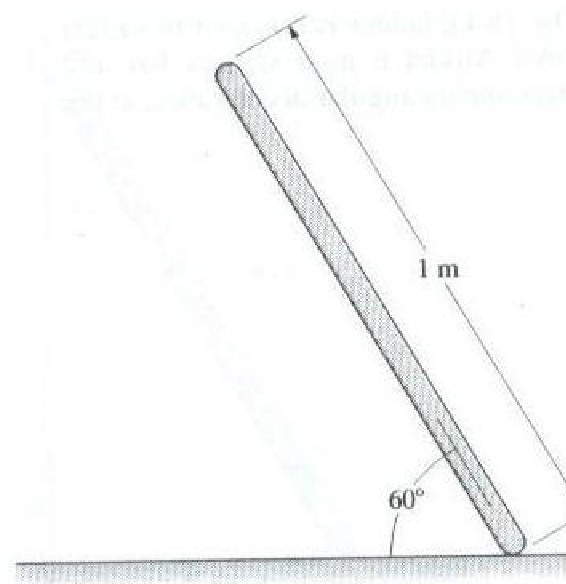
(chapter 17)



Problem 3

The 4-kg slender bar is released from rest in the position shown. Determine its angular acceleration at that instant if (a) the surface is rough and the bar does not slip, and (b) the surface is smooth.

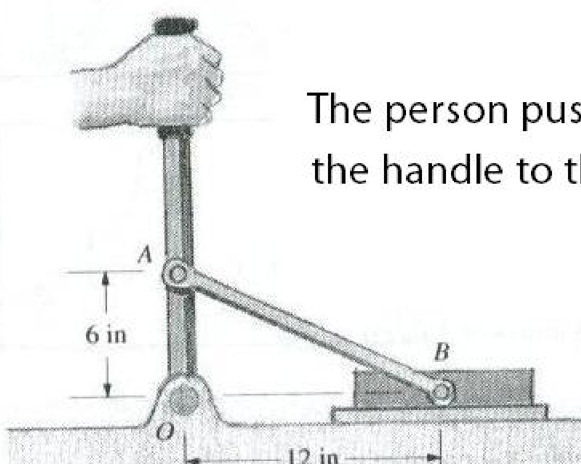
(chapter 18)



Problem 4

The moment of inertia of the vertical handle about O is 0.12 slug-ft^2. The object B weighs 15 lb and rests on a smooth surface. The weight of the bar AB is negligible (which means that you can treat the bar as a two-force member). If the person exerts a 0.2-lb horizontal force on the handle 15 in above O, what is the resulting angular acceleration of the handle?

(chapter 18)

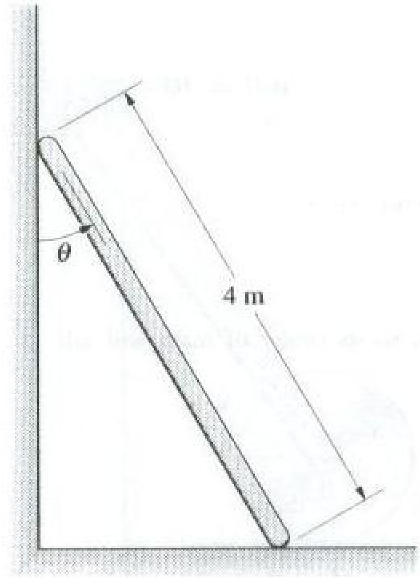


The person pushes the the handle to the right

Problem 5

The 18-kg ladder is released from rest with $\theta = 10°$. The wall and floor are smooth. Modeling the ladder as a slender bar, use conservation of energy to determine the angular velocity of the bar when $\theta = 40°$.

(chapter 19)



Problem 6

The length of the bar is 1 m and its mass is 2 kg. Just before the bar hits the *smooth* floor, it has angular velocity ω and its center of mass is moving downward at 4 m/s. The coefficient of restitution of the impact is $e = 0.4$. What value of ω would cause the bar to have no angular velocity after the impact?

(chapter 19)