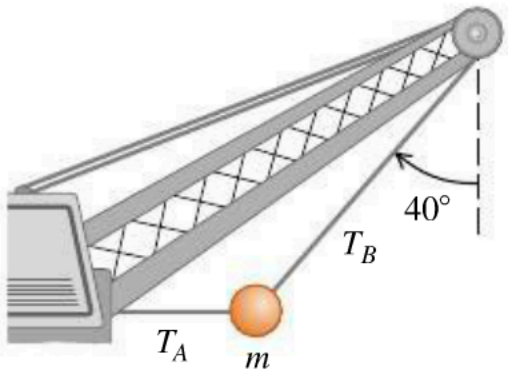
Wentworth Institute of Technology Engineering Physics I, Fall 2015
Instructor: Dr. Marissa Vogt

Problem Set #5
Due: before 4:30 p.m. in my mailbox in Ira Allen 316 *or* turned in during class, Thursday, October 15, 2015 – note that *for this problem set only* you may ask questions during office hours after class
Remember to write down the names of any classmates you worked with.

Problem 1 (20 points)

Figure E5.6



(Based on Young & Freedman 5.6) A wrecking ball is held in place by cables as shown in the figure. The ball has a mass 2000 kg.

a) What does your intuition tell you about how the tension in cable A will change if the mass increases? (Answer this without calculation, there is no right or wrong answer.)
b) What is the tension in cable A?
c) What is the tension in cable B?
d) What is the tension in cable A if the mass increases to 3000 kg? How does this compare to your prediction from part a?

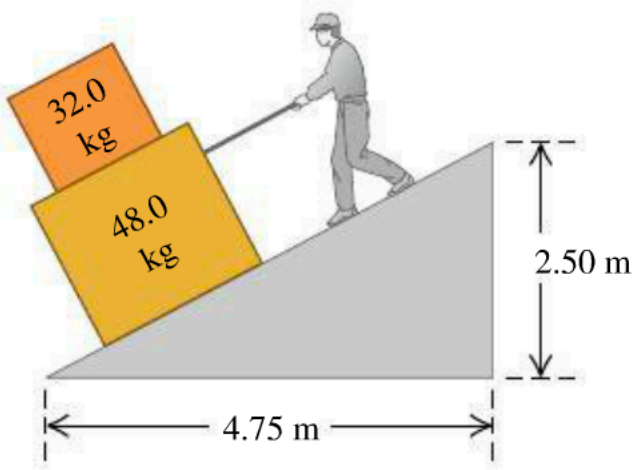
Problem 2 (20 points)

A box of mass 10 kg is on a flat horizontal surface. Gravity is directed downward. The coefficient of static friction is 0.32 and the coefficient of kinetic friction is 0.21.

a) What is the magnitude of the friction force if I apply a force of 15 N to the box?
b) What is the minimum horizontal force necessary to start the box in motion?
c) What is the minimum horizontal force necessary to keep the box in motion?
d) If I apply a force of 30 N to the box, what is the magnitude of the friction force? What is the box's acceleration?

Problem 3 (10 points)

Figure E5.33



(Based on Y&F 5.33)

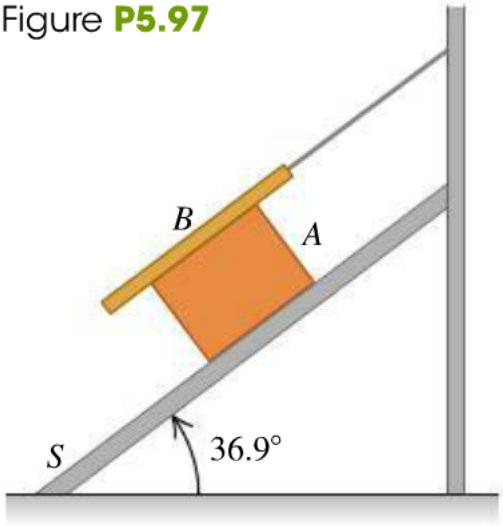
You pull two boxes up a ramp, using a rope that is parallel to the ramp's surface as shown in the figure. The coefficient of kinetic friction between

the lower box and the ramp is μ_k and the coefficient of static friction between the upper box and the lower box is μ_s.

a) What is the force you must apply to keep the boxes moving with a constant velocity? Draw a free body diagram for each box.
b) What is the maximum force you can apply without the top box slipping off of the bottom box?

Problem 4 (20 points)

Figure **P5.97**



(Based on Y&F 5.97) Block A slides with a constant velocity down an inclined plane as shown in the figure to the right. Block A has mass *m* and block B has mass *3m*. The coefficients of static and kinetic friction are the same between blocks B and A as between block A and the surface S.

a) What is the normal force between blocks B and A? Between block A and the ramp?
b) Draw a free body diagram for block A.
c) What is the coefficient of kinetic friction?

Problem 5 (30 points)

(Based on Y&F 5.50) A person swings (circularly) on a spinning carnival ride as shown in the figure.

a) Draw a free body diagram for the person. What is the net force on the person? (Hint: there is no acceleration in the vertical direction)
b) What is the person's azimuthal velocity? How long does it take for the person to swing around in a circle?
c) Does the person's mass affect the angle that the swing makes with respect to the vertical (30 degrees as shown in the figure)? What about the azimuthal velocity?

Figure **E5.50**