Name: _____ Date: _____

WS 2.3B: Inclined Planes & Pulleys (w/Friction)

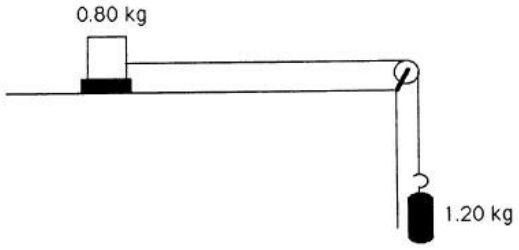
Unit 2: Dynamics and Equilibrium

Ramp and Pulley Problems:

1. A 10 kg object rests on a 30° ramp which has a coefficient of friction of 0.20. What will the object do (find the acceleration)?

2. A 9.6 kg box slides down a ramp inclined at 32° to the horizontal. At what rate will it accelerate if the coefficient of kinetic friction is 0.28?

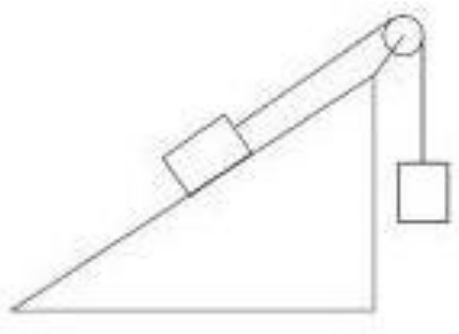
3. Consider the system on the right.
   What would be the acceleration and rope tension of the system if the coefficient of friction between the 0.80 kg mass and the table is 0.2.?



4. A skater with an initial speed of 7.60 m/s is gliding across the ice. Air resistance is negligible.
   a. The coefficient of kinetic friction between the ice and the skate blades is 0.100. Find the deceleration caused by kinetic friction.

   b. How far will the skater travel before coming to rest?

5. Two masses are connected with a rope and pulley as shown:



   a) If the mass on the ramp is m_1 and the hanging mass is m_2 **carefully complete the free-body diagram for the system**. Be sure that forces include the subscript "1" if they are associated with mass 1 and "2" if they are associated with mass 2. Assume frictionless for now.

   b) What forces (or components of forces) must we compare to determine if the box on the ramp goes up or down? Identify these forces below then circle these forces on the free-body diagram.

      _____ _____

   c) Why must we do part "b" before we label any friction forces?

   d) If m_1 = 7 kg, m_2 = 6 kg, and the angle between the ramp and the floor is 40°, which way does the block on the ramp accelerate? Show any calculations below.

   e) If the coefficient of friction between the ramp and the block is $\mu = 0.1$, what is the acceleration of the system?

   f) What is the tension in the rope?

Other 2D Force Problems:

6. A 25 kg box is pulled across a wooden floor with a rope. The rope makes an angle of 30° with the floor. The coefficient of friction between the box and floor is 0.21. A force of 75 N is exerted on the rope. How fast does the box accelerate along the floor?

7. A 50-N applied force (pulling 30 degrees up from the horizontal) accelerates a 5 kg box across a horizontal floor.
    a. What is the normal force on the box?

    b. If the coefficient of friction between the floor and box is 0.15, what is the acceleration of the box?

***Answers**: **1:** 3.2 m/s^2 **| 2:** 2.9 m/s^2 **| 3:** a=5.1 m/s^2; F_T=5.7 N **| 4:** a) 0.980 m/s^2 [opposite to direction of motion]; b) 29.5 m **| 5:** a) draw the FBD clearly; b) $F_{g1}\sin\Theta$ and F_{g2}; c) Frictional force opposes motion so we must know the way the system will move to know its direction; d) 44.095 N < 58.8 N so the block on the ramp will accelerate upwards; e) a=0.73m/s^2; f) F_T=54 N **| 6:** 0.86 m/s^2 **| 7:** a) 24 N; b) 7.9 m/s^2*