A-Day: Due Tues., 10/27
B-Day: Due Wed., 10/28

2009 PreAP Forces 4

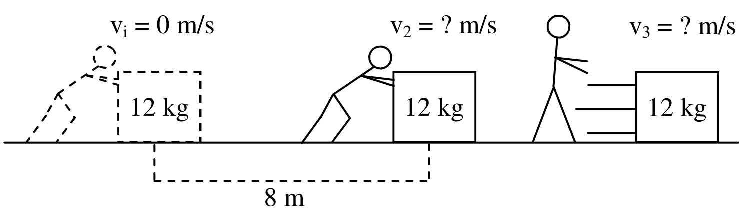
1. Write Newton's Three Laws:
   I.

   II.

   III.

2. A 70 N force pushes on a 15 kg box at an angle of 30° below the horizon. $\mu_s = .12$ and $\mu_k = .08$
   A. If the box starts at rest, decide if the box will slide. If it does not, how much additional force is necessary to start it sliding.

   B. If it is already moving, what is the acceleration of the box?

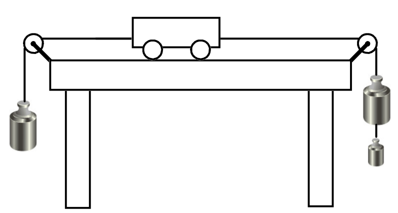


3. Slim Jim pushes on a 12 kg object for 10 seconds. It moves 8 m to the right while he is pushing.
   A. Calculate the acceleration of the mass.

   B. Calculate the magnitude of Slim Jim force.

   C. If the surface is frictionless, how does v_3 compare to v_2?

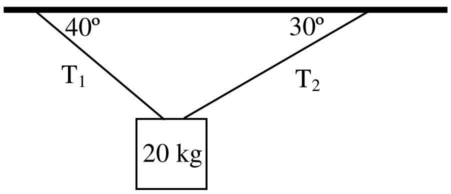
   D. If the surface has friction, how does v_3 compare to v_2?



4. A low friction cart is pulled by the three masses as seen at the left.
   A. Is the object at equilibrium?
   B. In which direction is the acceleration acting?
   C. How could the object be moving to the left?

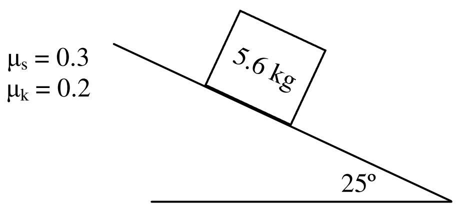
   D. How could the object have a velocity of zero?

This next question requires that you have faith in the process. If you follow the procedure, you will get the answer.



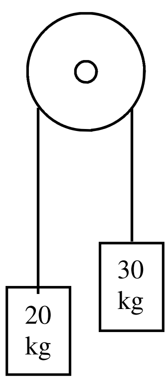
5. A 20 kg object is suspended by two ropes. Calculate the tension in each rope.
   A. Since it is suspended, its acceleration must equal what?
   B. Break up the tensions into their x and y-components (*you will use just variables*).
   C. Write the x and y equations for Newton's Second Law and solve. There will be two unknowns and two equations. Solve.

$\Sigma F_x = ma_x$ $\Sigma F_y = ma_y$

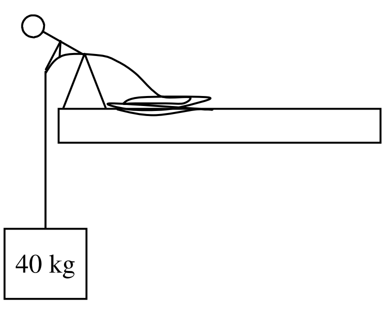


6. A. As the ramp tilts higher, does the normal force increase or decrease?

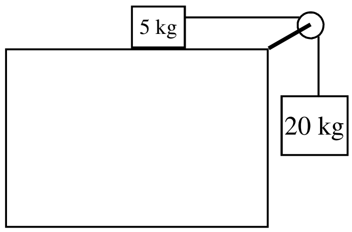
   B. Decide whether or not the object on the ramp will slide or not. If it will slide, find the acceleration. If it doesn't slide, what additional force is necessary to make it move.



7. Two masses are suspended from a frictionless, massless pulley. Following the "Connected Object and Ramps" notes exactly, calculate the acceleration and tension for the system.



8. Slim Jim has a rope attached to an 40 kg box.
   A. If the box is not moving or at constant speed, what is it's acceleration?
   B. What is the tension in the rope?
   C. If Slim Jim pulls the object up with an acceleration of 2.5 m/s^2, find the tension in the rope?

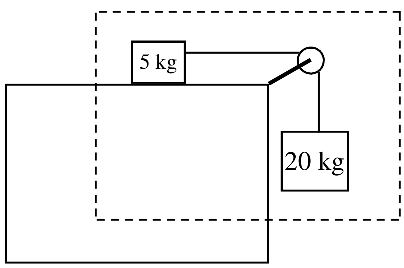


9. Two masses are connected with a rope over a frictionless, massless pulley. Assume there is no friction on the table.
   A. Draw the force diagrams on each mass.

   B. Since they are connected objects, which way is positive for the 20 kg object?

   C. Following the notes exactly, calculate the tension in the rope and acceleration of the system.

Now let's learn the easy way. We've talked about the x-direction and y-directions, in this problem we can talk about the T direction (the direction of the rope). This means we are going to use the x-direction for the 5 kg object and the y-direction for the 20 kg.

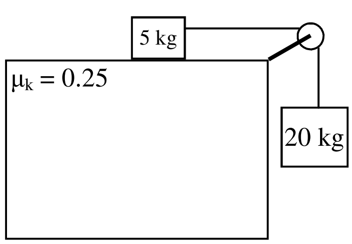


10. A. Using only the "T-direction", what is the external force on the system?

    B. What is the mass of the system (the inertial quantity) of the system?

    C. Put the above into this equation: $\Sigma F_{external} = m_{system}a$ and solve for "a".

    D. Now that you have the acceleration of the 5 kg mass, use F = ma on just the 5 kg object to find the tension in the rope.



11. This time the table has friction. We will assume the 5 kg mass will slide.
    A. Calculate the force of friction on the 5 kg object.

    B. Calculate the acceleration and tension in the rope. You may use either method.

