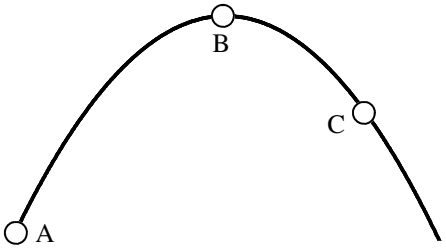
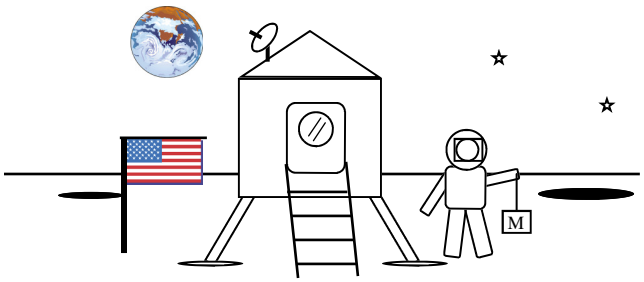
A-Day: Due Thur., 10/29
B-Day: Due Fri., 10/30

2009 PreAP Forces 6



A bit more review for projectile motion seems appropriate…

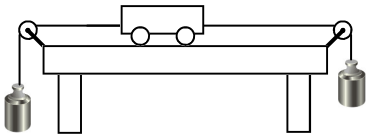
1. The diagram shows a projectile shot from ground to ground. For the following questions answer positions A, B, C, the same, or some combination.
   - A. _____Where the speed (total speed) is greatest.
   - B. _____Where the vertical acceleration is least.
   - C. _____Where the net force is greatest.
   - D. _____Where the vertical speed is greatest.
   - E. _____Where the horizontal speed is smallest.
   - F. _____Where the horizontal acceleration is zero.
   - G. _____Where the direction is zero degrees.
   - H. _____Where the total speed equals the vector addition of the vertical and horizontal speeds.



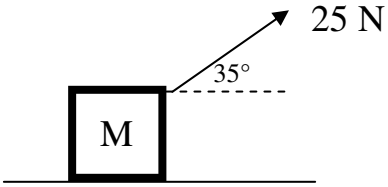
2. Slim Jim is also an astronaut. The acceleration due to gravity on the moon is 1.63 m/s^2. Jim is lifting a 18 kg object from the ground with a rope.
   - A. What is the weight of the object on the moon?
   - B. Draw a force body diagram (FBD) for the mass (below the picture).
   - C. If Jim can pull upward with a force of 450N, calculate the acceleration of the mass.

Let's use a bunch of our previous diagrams to quickly solidify the concept of force diagrams and how to put these forces in Newton's Second Law. Remember: down is can be + ONLY when there are connected objects, otherwise up is always +.

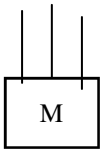
3. For each of the following situations, write $\Sigma F_x = ma_x$ and $\Sigma F_y = ma_y$. Use sin and cos when necessary. Don't calculate.



For the cart:
x-direction: y-direction:

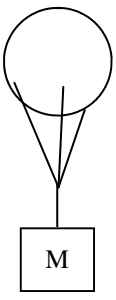


For the mass:
x-direction: y-direction:

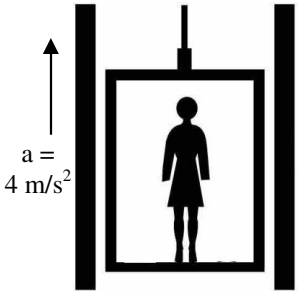


Falling in a vacuum

For the mass:
x-direction: y-direction:

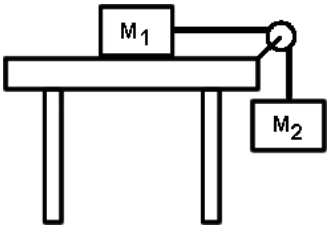


For the mass:
x-direction: y-direction:



For the woman:
x-direction: y-direction:

For Mass 1 (with friction):
x-direction: y-direction:

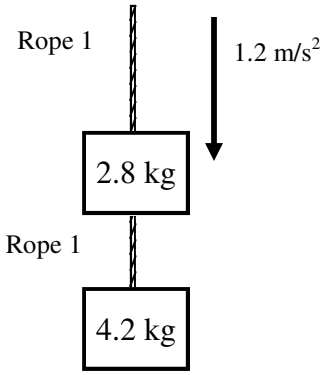


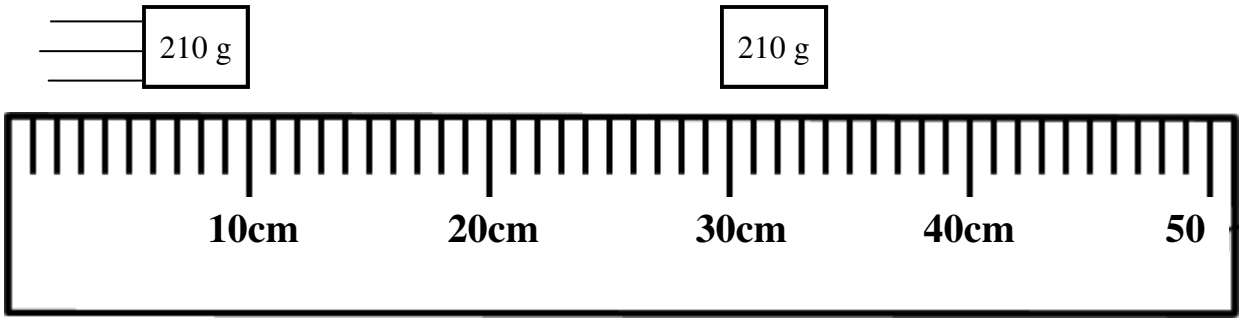
For Mass 2 (with friction):
x-direction: y-direction:

Newton's Third Law is about equal and opposite forces. These are also called force pairs or action-reaction forces. These force pairs must be the same two objects acting on each other. Ex: I push on the ball—the ball pushes on me.

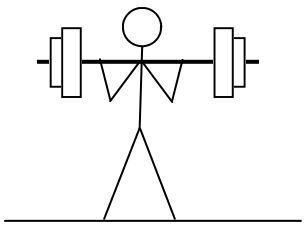
4. Give the reaction force for each of the following forces.
   A. The table pushes on a box with a normal force.
   B. The earth pulls down on a mass.
   C. A person pulls on a rope.
   D. A gun pushes on a bullet.

5. Two boxes are lowered down at a rate of 1.2 m/s^2. Calculate both tensions.





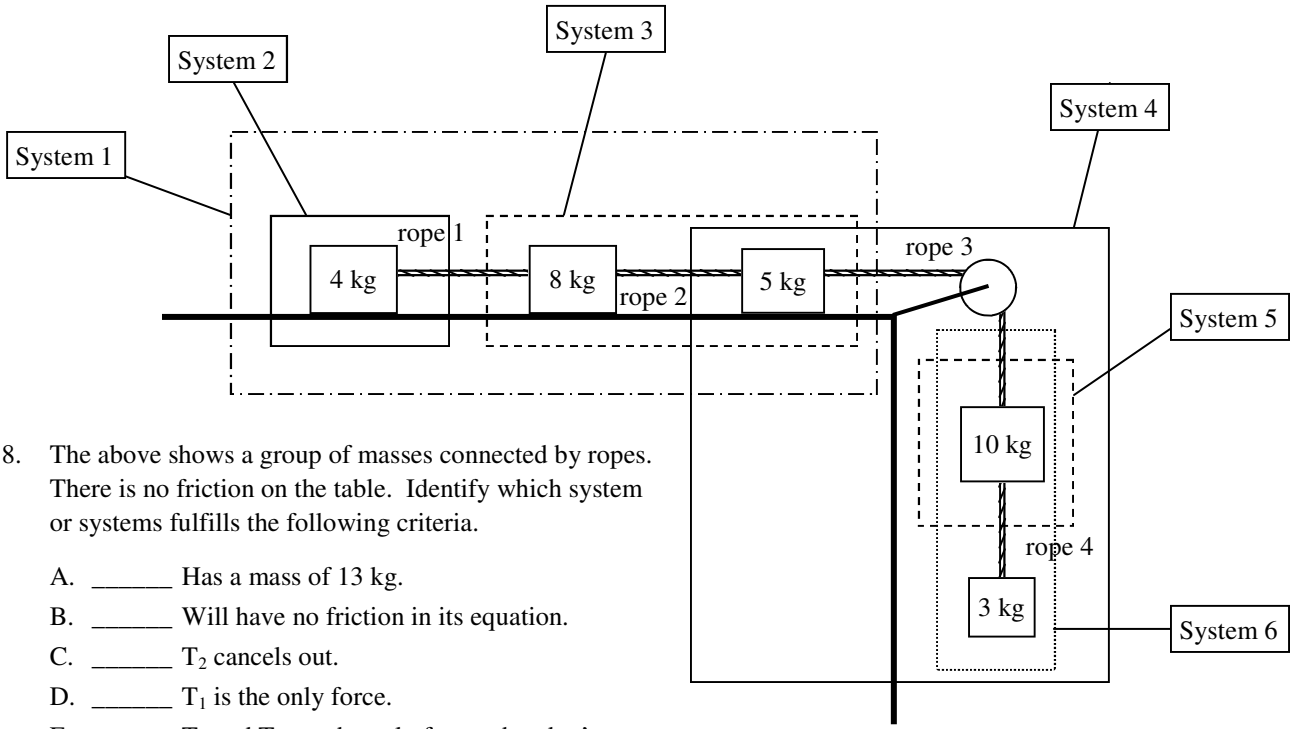
6. A 210 g object is sliding on the ground. A person starts a timer it when it crosses the 10 cm mark. It takes 1.27 seconds for it stop completely. Being sure to convert to standard units (kg and m), calculate the coefficient of friction of the surface. (*Since this is designed to help you with the block lab, I will take 20 points off if this is not finished—fight with it.)*



7. I'm sure you are all wondering where Slim Jim gets his great physique. Yup, he works out at the gym a lot. Here we've caught Jim doing reps with a barbell of only 70 kg.
   A. Draw a force body diagram for the barbell next to the picture.
   B. How much force does he have to use to press the barbell up with an acceleration of 1.8 m/s^2?

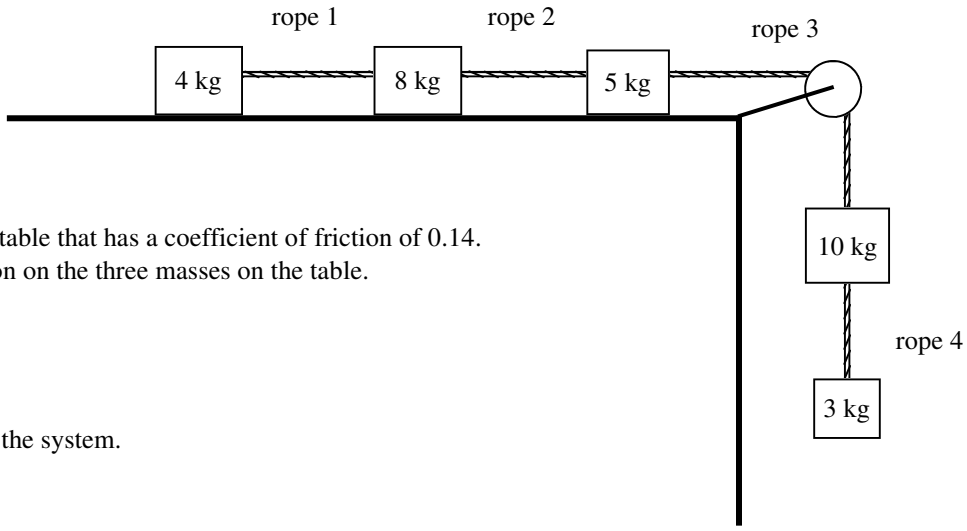
   C. With how much force does the barbell push down on him?
   D. Since Jim is 60 kg himself, how much normal force must the floor of the gym give to Jim and the barbell?

   E. Is this more or less than when the barbell is stationary in Jim's hands?



8. The above shows a group of masses connected by ropes. There is no friction on the table. Identify which system or systems fulfills the following criteria.

A. _____ Has a mass of 13 kg.
B. _____ Will have no friction in its equation.
C. _____ T_2 cancels out.
D. _____ T_1 is the only force.
E. _____ T_1 and T_3 are the only forces that don't cancel.
F. _____ T_3 will cancel in its equation.
G. _____ Has F_w as one of its forces.
H. _____ Has 18 kg of inertia.
I. _____ Could be used to calculate T_2.
J. _____ $T_1 = ma$
K. _____ $T_3 - T_1 = ma$
L. _____ $30 + 100 - T_3 = ma$
M. _____ $30 + 100 - T_2 = ma$
N. _____ $T_4 + 100 - T_3 = ma$
O. _____ $T_3 = ma$



9. Now the masses are moved to a table that has a coefficient of friction of 0.14.
A. Calculate the forces of friction on the three masses on the table.

B. Calculate the acceleration of the system.

C. Calculate the tension in rope 3.