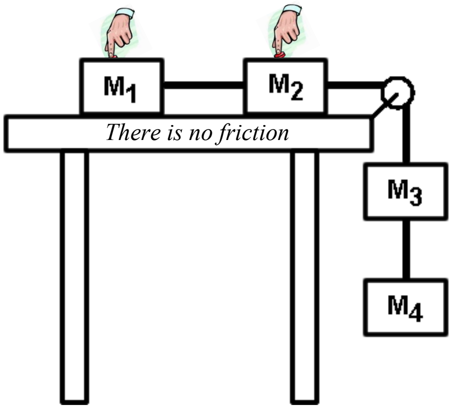
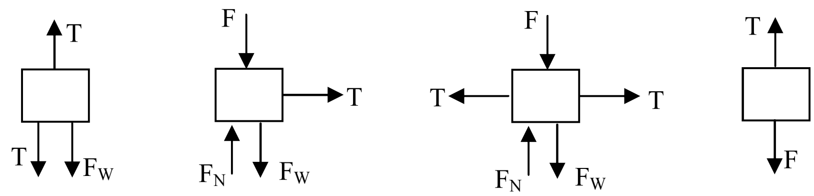
B-Day: Due Tues., Oct 26
A-Day: Due Wed., Oct 27

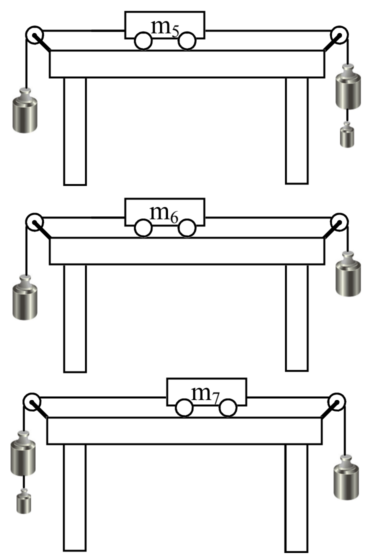
2010-11 PreAP Forces 2



1. Four masses are connected by ropes.
   A. Since they are not on the table, which force cannot be acting on m_3 and m_4?

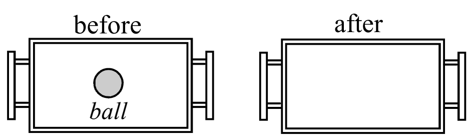
   B. Below are the force diagrams for each of the mass. Label them correctly.



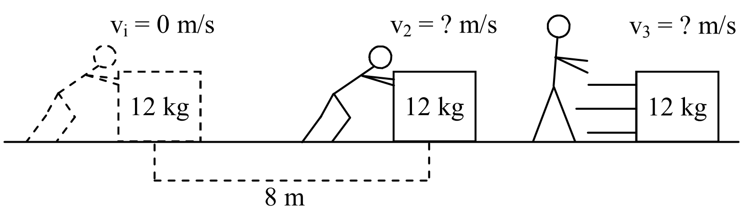


2. Use the three diagrams at the left to answer the following.

A. ____Which could be at rest?
B. ____Acceleration is negative.
C. ____Acceleration is positive.
D. _____Has a net force of 0 N.
E. _____Has a net force (Fnet $\neq 0$)
F. _____Has balanced forces.
G. ____ Could be changing direction.
H. ____ Has unbalanced forces.
I. ____ V could = 0 m/s.
J. ____ Could be a constant speed.
K. ____ Could be slowing down to the left.
L. ____ Could be slowing down to the right.



3. A force pushes the cart to the right.
   Draw where the ball ends up.



4. Slim Jim pushes on a 12 kg object for 10 seconds.
   It moves 8 m to the right while he is pushing it.
   A. * Below the picture use the kinematic equations to calculate the acceleration of the mass.

   B. Now, use F = ma to calculate the magnitude of Slim Jim's 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?

There are two major categories of forces: contact forces (when touching occurs) and field forces (forces at a distance).

5. Contact or Field force?

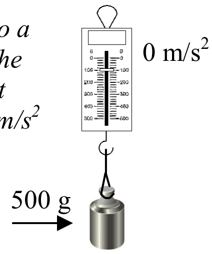
A. _____Tension
B. _____Normal force
C. _____Can cause accelerations
D. _____Gravity
E. _____Electrostatic force (*like a balloon rubbed on hair*)

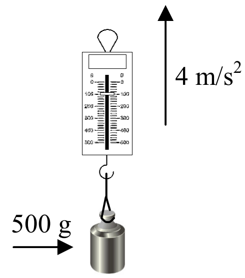
Why this matters: Newton's Third Law: "For every force there is an equal and opposite force." But this opposite force must be of the same type: contact forces oppose contact forces; field forces oppose field forces.

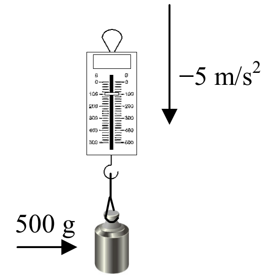
6. A box is sitting on a table.
   A. What force opposes the normal force pushing up on the box?
   B. What force opposes the force of weight pulling down on the box?

A 500 g object is attached to a spring scale by a string. The mass is given three different accelerations. Use g = 10 m/s²

Big Hint:
1000g = 1 kg
(work in kilograms)







7. A. * Calculate the tension in the string when a = 0 m/s².

   B. Does the scale read more, less, or the same as the weight of the object?

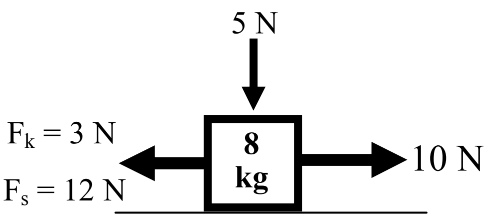
8. A. Calculate the tension in the string if the a = 4 m/s².

   B. Does the scale read more, less, or the same as the weight of the object?

9. A. Calculate the tension in the string if the a = 4 m/s².

   B. Does the scale read more, less, or the same as the weight of the object?

10. *An 8 kg object is pulled by a 10 N force while a 5 N force pushes down on it. Friction is trying to oppose the 10 N force.



A. Calculate and label the weight and normal force. (Use g = 10 m/s².)

B. How much force tries to keep the object from sliding?

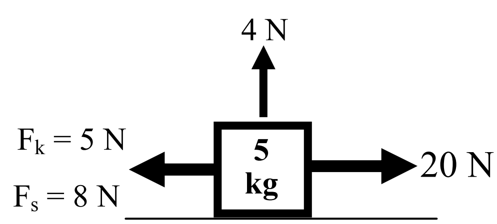
C. How much force tries to stop the object from sliding (if already moving)?

D. Is the 10 N force strong enough to move the object?
E. How much more force is necessary for it to break free?

F. If the object is already sliding, calculate the acceleration of the object.

G. If $F_s = \mu_s F_N$ and $F_k = \mu_k F_N$, calculate the coefficients of friction for this surface (μ_s and μ_k).

11. Use the diagram at the left to answer the following.



A. Calculate and label the weight and normal force. (Use g = 10 m/s².)

B. How much force tries to keep the object from sliding?

C. How much force tries to stop the object from sliding (if already moving)?

D. Is the 20 N force strong enough to move the object?
E. If the object doesn't slide, how much more force is necessary for it to break free?

F. If the object does slide, calculate the acceleration of the object.

G. Calculate the coefficients of friction for this surface.

Q4A: You have v_i, t, and x, so $a = 0.16\ m/s^2$

Q7: First, convert to kilograms: m = 0.5 kg
Then F = ma. Put in the forces, mass, and acceleration: $T - mg = ma$; $T - (0.5)10 = (0.5)0$; $T - 5 = 0$; $T = 5$ N, which is the same as the weight because the acceleration is zero.

Q10: A. mg = 80 N; $F_N = 80 + 5 = 85$ N; Normal force is increased when an additional force pushes down.
B. 12 N (static friction tries to keep an object from sliding)
C. 3 N (kinetic friction only occurs when the object is already sliding)
D. No, 12 > 10.
E. You can figure this out.
F. F = ma and since it is sliding you have to use kinetic friction.
$10 - 3 = 8a$; $7 = 8a$; $a = 7/8 = 0.875\ m/s^2$
G. $F_s = \mu_s F_N$ So, $\mu_s = F_s/F_N = 12N/85N = .14$ (no units, since units cancel)
$F_k = \mu_k F_N$ So, $\mu_k = F_k/F_N = 3N/85N = .035$