B-Day: Due Fri., Oct 22
A-Day: Due Mon., Oct 25

2010-11 Forces 1

You will need these notes: "Forces and Newton's First Law"; "Types of Forces"; "Normal Force";

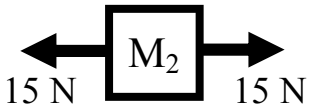
1. For each of the following pairs of objects, which one has more inertia?

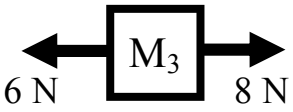
   A. A freight train or a car?
   B. A ping pong ball or a baseball?
   C. A fast bowling ball or a slow bowling ball?
   D. A 20 kg mass or a 10 kg mass?
   E. A rock on the earth or a rock in space?
   F. A fast baseball or a bowling ball at rest?

2. Identify the following forces as F (applied), T, F_W, F_f (friction), or F_N.

   A. _____ Due to a string.
   B. _____ Opposes weight for objects on surfaces.
   C. _____ You push down on an object on a table, this increase.
   D. _____ Caused by gravity.
   E. _____ Would decrease on the moon.
   F. _____ Decreases if a surface is smooth.
   G. ____ You place a heavy object onto a board. The board will break if this is too small.
   H. ____ Always vertical.
   I. ____ If a surface is tilted, this changes direction, too.
   J. ____ Has the units of newtons.
   K. ____ Doesn't exist for hanging objects.

3. While a force is acting on an object, give three things that can happen.

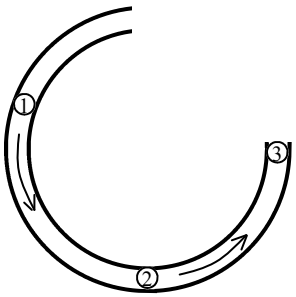




4. *What is the net force on M_1?
5. What is the net force on M_2?
6. What is the net force on M_3?

7. Which of the above masses: M_1, M_2, or M_3?

   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 ≠0)
   F. ____ Has balanced forces.
   G. ____ Could be changing direction.
   H. ____ Has unbalanced forces.
   I. ____ Could be a constant speed.
   J. ____ Could be slowing down to the left.



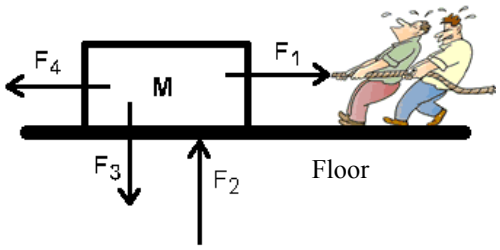
8. A ball is moving inside a tube, as shown on the diagram at the left.
   A. When it leaves the tube, will it have a circular path or a straight path?
   B. What do we call any force that keeps an object moving in a circular path?
   C. At point 1, draw an arrow to show the direction of the velocity of the object. Label it "v".
   D. At point 2, draw an arrow (labeled "a") showing its acceleration.

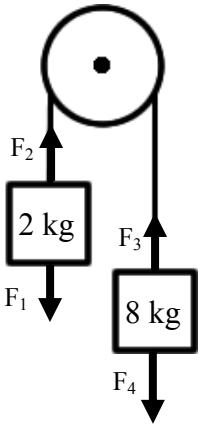
9. Static or kinetic friction?

   A. _____ Slipping friction.
   B. _____ Gripping friction.
   C. _____ Depends on the surface's roughness
   D. ____ Acts to keep an object from sliding.
   E. ____ Tries to stop an object that is already sliding.
   F. ____ Depends on weight of the object.

10. Two very small people are pulling a box. Identify the four shown forces as $F_{Applied}$; T; F_W; F_N.
    A. _____ F_1— the two men pulling WITH A ROPE.
    B. _____ F_2— the force pushing up by the floor.
    C. _____ F_3— the force pulling down on the mass.
    D. _____ F_4— the force trying to stop the mass from moving.
    E. _____ Which force is in the negative x-direction?
    F. _____ Which force is in the positive y-direction?
    G. _____ Which force is in the positive x-direction?
    H. _____ Which force is in the negative y-direction?
    I. Which forces would be used in this equation: $\Sigma F_y = ma_y$?

    J. Which forces would be used in this equation: $\Sigma F_x = ma_x$?



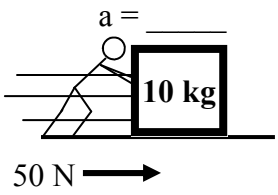


11. Two masses are attached by a rope that is threaded around a pulley, as shown. Identify the four forces.
    A. ____ F_1 (the force pulling down on the 2 kg mass).
    B. ____ F_2 (the force of the rope pulling up on the 2 kg mass).
    C. ____ F_3 (the force pulling up on the 8 kg mass).
    D. ____ F_4 (the force pulling down on the 8 kg mass).
    E. Which two forces are equal? F. Why?

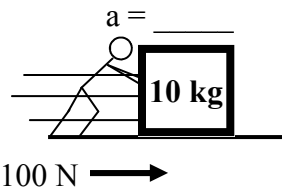
    G. Calculate F_1. H. Calculate F_4.

    I. Which forces are y-direction forces? J. Which forces are x-direction forces?

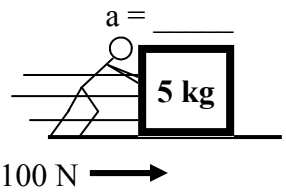
Use ∑F = ma to answer the following.



12. *Slim Jim pushes on a 10 kg mass with 50 N. Calculate (and label) the acceleration of the mass.



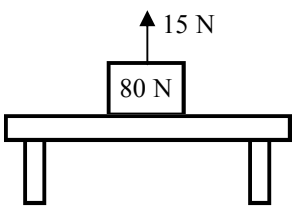
13. Slim Jim then doubles his force. Calculate (and label) the new acceleration of the mass.

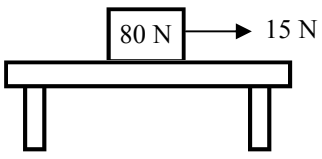


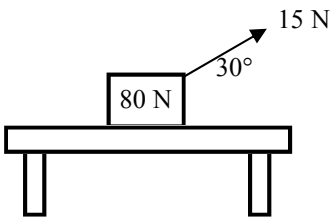
14. The mass of the object is then halved. Calculate the new acceleration.

15. So, from what you just learned:
    A. If you double the applied force the acceleration:
    B. If you half the mass, the acceleration of the object:
    C. If you applied four times the force, the acceleration would be:
    D. If you doubled the mass of the object, the acceleration would:

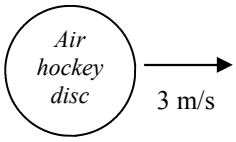
16. Calculate the normal force for each of the following three situations.





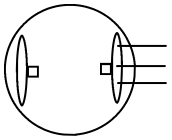


Imagine a giant air hockey table, several miles across (way cool!). Because there is a layer of air everywhere, there is NO friction. We will also assume (for you crazies) that the disk is very low and has no air resistance.



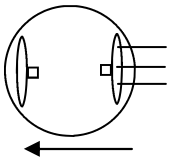
17. The disc is pushed and moves with an initial velocity of 3 m/s to the right. How far will the disc go?
18. Because there is no friction, what will its speed be after 40 seconds?

Now imagine two fans are placed on the disc to push it either left or right. If the right fan turns on, the disc will be pushed to the left. If the left fan turns on, the disc will be pushed to the right.



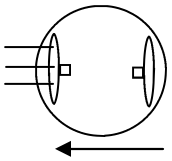
Vi = 0 m/s

19. If the disc is at rest to begin with and the right fan comes on what happens to the disc?



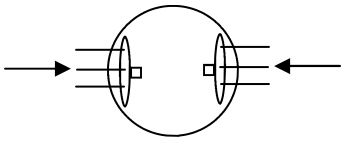
Vi = 2 m/s

20. If the disc is moving 2 m/s to the left and the right fan comes on, what happens to the disc?



Vi = 2 m/s

21. If the disc is moving 2 m/s to the left and the LEFT fan comes on, what happens to the disc?



22. If the disc is moving at a constant 4 m/s to the left and both fans come on at the same time and with the same force, what will happen to the disc?

Q4: $F_{net} = F_1 + F_2 \ldots = 25 - 30 = -5$ N (which means 5 N left)
Q12: F = ma, so 50 = 10a, so a = 50/10 = 5 m/s2