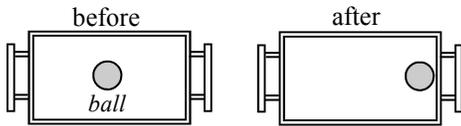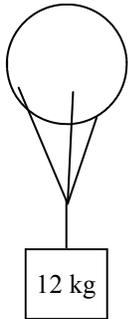# 2009 Forces 4

before   after

ball

1. A ball begins in the middle of a cart. The cart is quickly moved and the ball ends up against the right lip of the cart.
   A. Which way was the cart moved?
   B. Why did the ball end up at the right end of the cart?

   C. Which of Newton's Laws does this show?

2. A 12 kg object is suspended from a balloon by ropes.
   A. There are two forces acting on the box. Draw and label them, using arrows to show directions.
   B. The force pulling up is positive or negative?
   C. How much force is pulling down?
   D. If the object is suspended (not moving), what is its acceleration.
   E. Put the two forces, mass, and acceleration in to the following equation and solve for the tension in the rope. (*Hint: the tension is not zero.*)

   $$\Sigma F = ma$$

   F. If the balloon is actually accelerating upward at 2 m/s^2, put the new acceleration into the equation and solve for the tension.
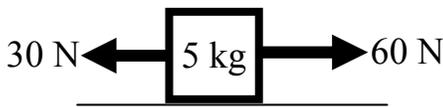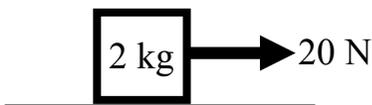
12 kg

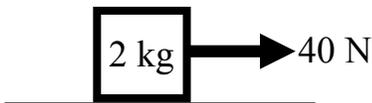3. Calculate the net force acting on the object at the left.

30 N ← 5 kg → 60 N

4. Calculate the net force acting on the object at the left.

$a = 6 \text{ m/s}^2$

5 kg
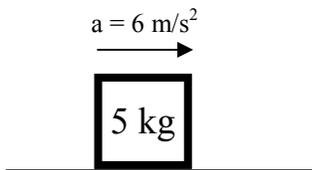
Notice that you can find the net force either by the summing up (adding and subtracting) the actual forces OR by the result (m and a).
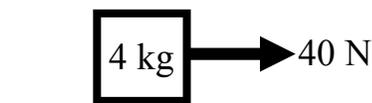
5. Let's show you how acceleration is related to force and mass.
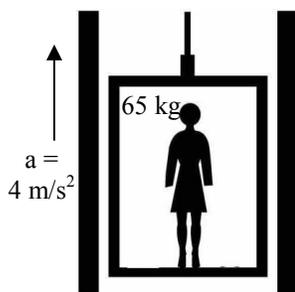   A. Calculate the acceleration of the 2 kg mass.

2 kg → 20 N

   B. If the magnitude of the force acting on the mass is doubled to 40 N, how much acceleration does it have?

2 kg → 40 N

   C. When the force is doubled, the acceleration:

   D. Now the mass is doubled. Calculate the new acceleration.

4 kg → 40 N

   E. When the force is doubled, the acceleration:

Following the bottom of the "Normal Force" notes exactly.

6. Heavier or lighter?
   A. ___ If you have a heavy book bag on.
   B. ___ If you have someone pulling up on your arms.
   C. ___ If you are on an elevator as it starts to move up.

7. In any of the above examples, did your weight actually change?
8. So, what force really gives us the feeling of weight?

9. A. Draw the forces acting on the lady.
   B. Following the notes exactly, calculate the normal force acting on the lady in the elevator.

$a = 4 \ m/s^2$

65 kg

C. Does she feel lighter or heavier than normal?

Newton's Third Law states that if an object pushes on a second object, the second object pushes back with an equal and opposite force.

10. A baseball player hits a ball. Which is greater: the force of the bat on the ball or the force of the ball on the bat?
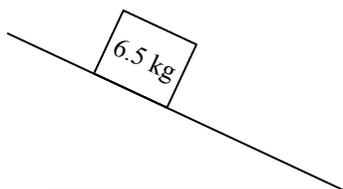
11. A 6.5 kg object is sliding down a ramp.
    A. What is the weight of the object?
    B. Which direction does weight always point?
    C. Since it is touching a surface, what force is acting on the mass?
    D. Since it is sliding down the ramp, which way does friction act?
    E. Draw and label the forces acting on the mass.

6.5 kg
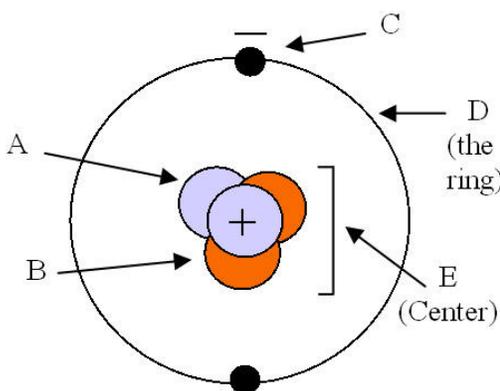
12. On the graphic at the right which letter shows:

____ Neutron
____ Proton
____ Electron orbit
____ Electron
____ Nucleus
____ Attracts an electron

____ Will repel a proton
____ Doesn't attract anything
____ Found in the nucleus
____ Changing this changes the element.
____ Adding this changes the isotope.
____ Adding this makes it a negative ion.

C
A
B
D (the ring)
E (Center)