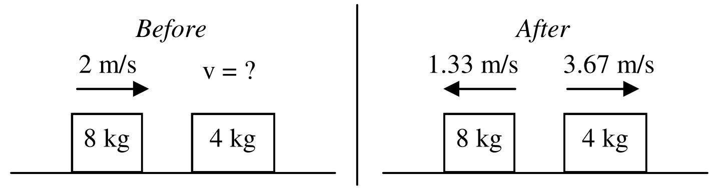
Due: Fri., Dec 7

2012 PreAP Momentum 5

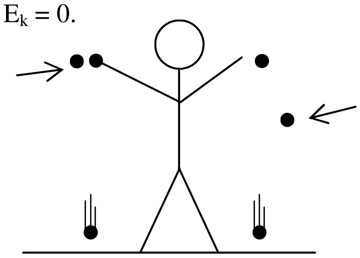
1. Two object collide as shown in the picture at the right.



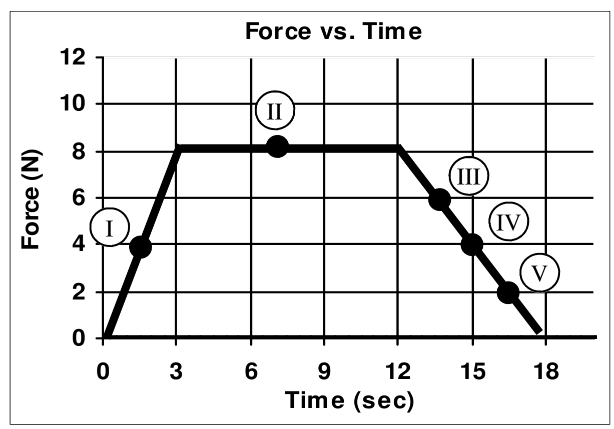
   A. * Working under the diagram, calculate the initial velocity of the 4 kg object.
   B. What kind of collision could this not be?
   C. Why?
   D. Calculate the net kinetic energy before:
   E. Calculate the net kinetic energy after:
   F. What kind of collision is this?
   G. Were the objects damaged in the collision?
   H. * How do you know?

2. Given group of objects, are they moving or not moving?
   A) ____ * If $p_{net} = 0$, but $E_k \neq 0$. B) ____ If $p_{net} \neq 0$, but $E_k \neq 0$. C) ____ If $p_{net} = 0$, and $E_k = 0$.

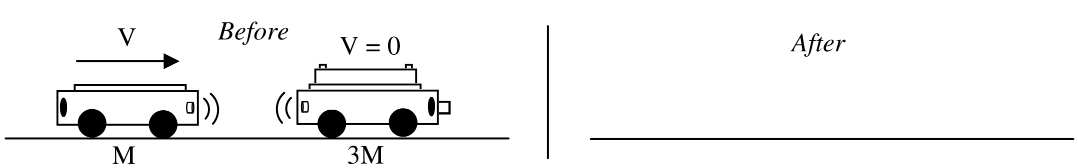
3. Are the following elastic, inelastic, or perfectly inelastic? (*or some combination*)
   A) ____ The spaceshuttle docking with the International Space Station.
   B) ____ If an object is moving and it explodes into multiple pieces.
   C) ____ Two cars collide, do not stick, and the cars are badly damaged.
   D) ____ * If there is <u>a lot</u> of sound during a collision.
   Slim Jim drops 2 equal mass balls from equal heights. The arrow shows how high each ball bounces after it hits the ground.
   E) ____ The left ball. F) ____ The right ball.



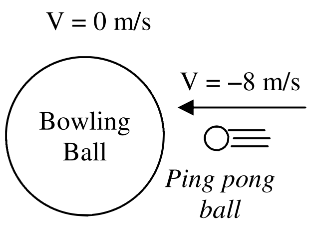
4. An object is at rest. The graph at the right shows the force acting on the object during 18 seconds.



   A. At I, is the force positive or negative?
   B. So, from 0 to 3 seconds, does it have a + or – acceleration?
   C. At II is the force positive or negative?
   D. From 3 to 12 seconds, does the object speed up or slow down?
   E. At III is the force positive or negative?
   F. Where on the graph is a negative force?
   G. Where does the object slow down?
   H. * Calculate the impulse from 3 to 12 seconds.



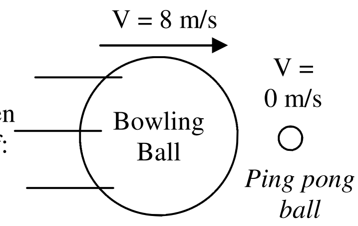
5. The following refers to the diagram above (*and, obviously, the lab*).
   A. Draw what happens after.
   B. How much momentum does the right cart have before the collision?
   C. How much net momentum is there before (*use variables*)?
   D. How much net momentum must there be afterwards?
   E. As the right cart gets heavier, what happens to the left cart?
   F. If the right cart were infinitely heavy (or held in place),
      I. What is the final velocity of the left cart?
      II. * Remembering that $\Delta v = v_f - v_i$, what is the change of velocity of the left cart?



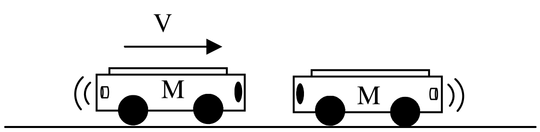
6. * A. The distance between the balls is closing at what speed?

B. Afterwards the distance between them is increasing at a speed of:

C. * The balls Δv between before and after is:



7. If the ping pong ball is at rest and struck by the bowling ball going 8 m/s, what is the final speed of the ping pong ball?



8. The two carts at the left collide and stick.
Both have equal mass M. The left cart is moving at V and the right cart is at rest.
A. * What is Σp_{before}?
B. What does Σp_{after} have to be?
C. Since the objects are combined after, what kind of collision is this?

D. What is the combined object's mass after the collision?
E. Calculate the combined object's velocity.

From 2011 Energy 11:

For each of the following questions begin by writing the equation.

9. * If I double the spring constant, the potential elastic energy:

10. * If I double the mass, the potential elastic energy:

11. If I double the mass, the kinetic energy:

12. If I double the height, the gravitational potential energy:

13. * If I double the velocity, the kinetic energy:

14. If I half the velocity, the kinetic energy:

Q1A: −3 m/s Q1H: Hint: damage has to come from energy.
Q2A: p_{net} can be neg, but not KE: the objects are moving, since KE ≠ 0. $p_{net} = 0$, they are moving opp. directions and p's cancel
Q3E: again, sound comes from energy. Lots of sound = lost KE, so inelastic.
Q4H: Calculate the area from 3—12 seconds = 8 N(9sec) = 72 Nsec = 72 kgm/s
Q5FII: −2V
Q6: A. −8 m/s. 6B: 8 m/s 6C: 16 m/s (or 2V) The point (and big hint for Q7): This is relative motion: beforehand the distance between the objects gets smaller at a speed of V. Afterwards the distance between them expands at a speed of V. So the difference is 2V. This is the same as in Q5 when the right cart is infinitely bigger than the left cart.
Q8A: MV
Q9: doubles, since k has a power of 1 in $PEel = ½kx^2$, so $PEel \propto k$ (elastic energy is directly proportional to k).
Q10: no change. Not in the equation.
Q13: x4, since v is squared.