2008 Momentum 3

1. Use the equations at the right to answer the following questions (can be more than one).
   A) Which have two independent objects beforehand?
   B) Which show a combined object afterwards?
   C) Which one shows all objects are at rest beforehand?
   D) Which show all objects are at rest afterwards?
   E) Which shows an object speeding up due to a force?
   F) Which shows two objects that collide and stick together?
   G) Which shows two moving objects that collide and stop moving?
   H) Which could be two resting objects pushed apart by a spring?

M. $p_B + I = p_A$

N. $p_{1B} + p_{2B} = p_{1A} + p_{2A}$

O. $p_{1B} + p_{2B} = p_{1+2A}$

P. $p_{1+2B} = p_{1A} + p_{2A}$

Q. $p_{1B} + p_{2B} = 0$

R. $0 = p_{1A} + p_{2A}$

60 kg   30 kg   2 m/s   0 m/s   v = ?
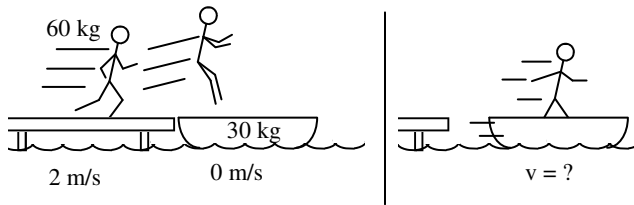
2. Slim Jim is running 2m/s on the dock and jumps into a boat. How fast is Jim and the boat moving afterwards?
   A. How much momentum is there before?

   B. How much momentum does there have to be afterwards?

   C. What is the combined mass of Jim in the boat?

   D. Under the diagram, write the conservation of momentum equation and solve for the final velocity.

3. A 6 kg object speeds up from 5 m/s to 20 m/s. Calculate the Δp (change of momentum).

4. A 10 kg object slows down from 25 m/s to 5 m/s. Find Δp.

5. A 1 kg object moving 10 m/s to the right bumps into a 12 kg object moving 2 m/s to the right. Afterwards the 12 kg object is moving 3 m/s to the right. Calculate the final velocity of the 1 kg object.
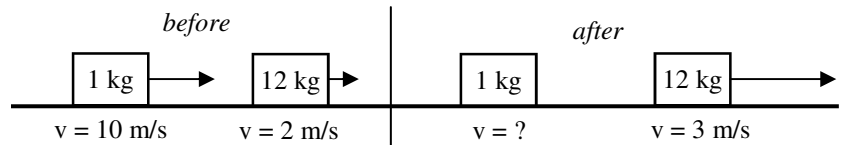
   A. On line A, write the conservation of momentum equation for this situation.

   B. On line B, put in "mv" for any "p" and "Ft" for any I.

   C. Put in what you know and solve for the final velocity of the 1 kg object.

before   *after*

1 kg   12 kg   1 kg   12 kg
v = 10 m/s   v = 2 m/s   v = ?   v = 3 m/s

$\Sigma p_{before} \pm I = \Sigma p_{after}$

A _____

B _____

6. The diagram at the right shows another collision, with the final velocities already given. Calculate the net kinetic energy before and after and decide if the collision was elastic or inelastic.
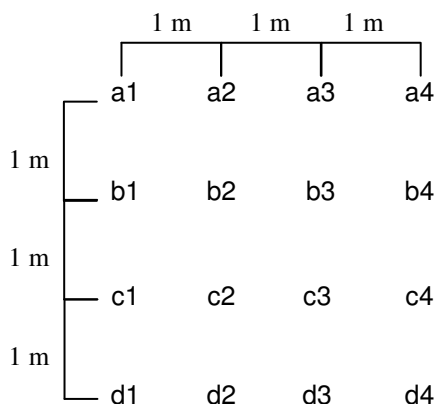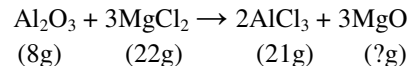

before   *after*

2 kg   10 kg   2 kg   10 kg
v = 6 m/s   v = 1 m/s   v = 1 m/s   v = 2 m/s
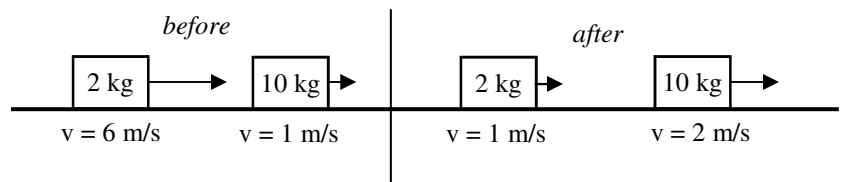
7. Two identical eggs are dropped from the same height.
    One lands on a pillow and the other on a metal plate.
    A. What kind of energy do they have when dropped?
    B. What kind of energy do they have at the bottom?
    C. Since they start at the same height, which is the fastest
        at the bottom?
    D. Since they both stop after they hit, which one experiences the
        greater change of momentum?
    E. Which one stops more suddenly (less time)?
    F. Which one experiences a greater force?
    G. Which one survives?
    H. Why? (*And don't use words like "softer" or "absorbs".*)
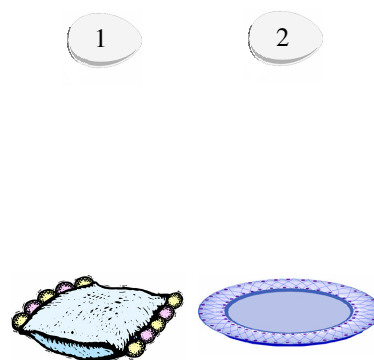
8. Balance the following two reactions. Use reaction notation to count the atoms.
    (*Help available in Chemistry Study Helps/ Chemical Reactions*)

    $$\_\_\_Cl_2 + \_\_\_KBr \rightarrow \_\_\_KCl + \_\_\_Br_2$$

    $$\_\_\_Al_2O_3 + \_\_\_MgCl_2 \rightarrow \_\_\_AlCl_3 + \_\_\_MgO$$
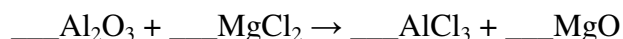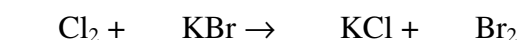
9. The chemical equation at the right is already balanced.
    A) What symbol is like an equal sign?
    B) Circle the second reactant.
    C) Underline the first product.
    D) Using the Law of Conservation of Mass, how much magnesium oxide must
        have been created?

$$Al_2O_3 + 3MgCl_2 \rightarrow 2AlCl_3 + 3MgO$$
(8g)   (22g)   (21g)   (?g)

1 m   1 m   1 m

a1   a2   a3   a4

1 m

b1   b2   b3   b4

1 m

c1   c2   c3   c4

1 m

d1   d2   d3   d4

10. (Review for finals) Remember that displacement (Δx or Δy) is
    how far an object moves from its starting point.
    A. From c1 to c4, $\Delta x =$ $\Delta y =$
    B. From a1 to d3, $\Delta x =$ $\Delta y =$
    D. From a4 to d4, $\Delta x =$ $\Delta y =$
    E. If an object moves from d1 to a3 to d4, $\Delta y =$

11. Use what you just learned for the diagram at the right.
    A. What is Δy?
    B. What is the initital y velocity?
    C. What is the initial x velocity?
    D. Is gravity an x or y-direction force?
    E. What is the acceleration in the y-direction?
    F. What is the acceleration in the x-direction?
    G. What is the final x-velocity?

8 m/s

7 m