A-Day: Due Wed., Dec 9
B-Day: Due Thur., Dec 10

2009 PreAP Momentum 2

1) A 6 kg object speeds up from 5 m/s to 20 m/s. Find Δp.

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

3) What is the impulse for Q1 above: What is the impulse for Q2 above:

4) Can an object ever have a negative kinetic energy? Why or why not?

5) Can an object ever have a negative momentum? Why or why not?

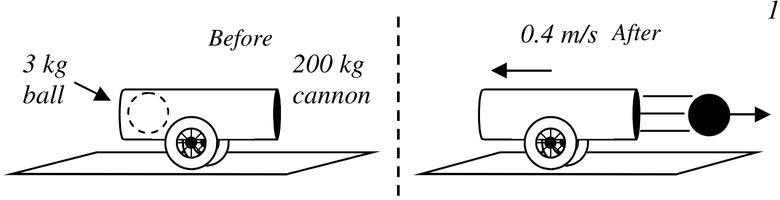
6) If an object's kinetic energy is zero, what is its momentum?

7) Use the equations at the right to answer the following questions.
   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 show an object speeding up due to a force?

A) $p_B + I = p_A$
B) $p_{1B} + p_{2B} = p_{1A} + p_{2A}$
C) $p_{1B} + p_{2B} = p_{1+2A}$
D) $p_{1+2B} = p_{1A} + p_{2A}$
E) $p_{1B} + p_{2B} = 0$
F) $0 = p_{1A} + p_{2A}$

8) If the net momentum before equals the net momentum after, is there an external impulse?

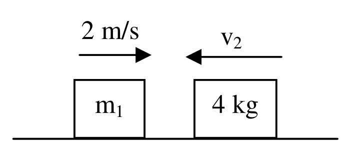
9) A 2 kg object going 30 m/s feels a -4 N force for 8 seconds, find the object's final velocity.
   Conservation of Momentum Equation: Solve:



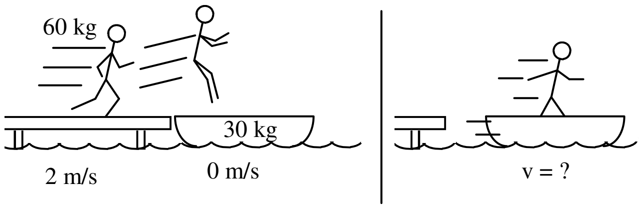
$$\Sigma p_{before} \pm I = \Sigma p_{after}$$
$$0 = p_{cannon} + p_{ball}$$

10) A 3 kg cannonball is shot from a 200 kg cannon. The cannon recoils backwards at 0.4 m/s backwards. What is the velocity of the ball after it is shot?
   A. Since the ball is sitting in the cannon, beforehand, what is the initial velocity of the cannon and ball?
   B. What is the net momentum before?
   C. Since momentum MUST be conserved, how much total momentum must there be afterwards?
   E. Is the final velocity of the cannon + or −?
   F. Use the given equation to solve for the final velocity of the ball.

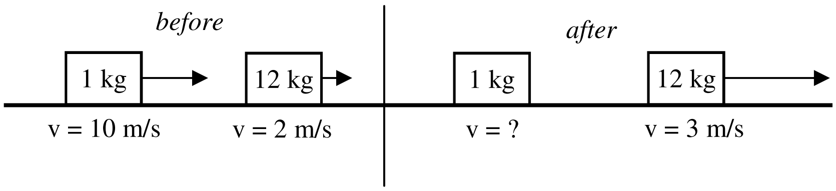
11) What is the net momentum of the two objects shown?
   (*Your answer will have variables in it.*)



Type of Collision	**Momentum**	**Kinetic Energy**	**Objects Combine?**	**Example During the Lab**
Elastic	Conserved	Conserved ($\Sigma Ek_B = \Sigma Ek_A$)	No	Magnet sides
Inelastic	Conserved	Not conserved	No	Magnet again Velcro (some Ek lost)
Perfectly Inelastic	Conserved	Not conserved	Yes	Velcro to Velcro (they attach)



12) 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. What kind of collision is this?
   E. Under the diagram, write the conservation of momentum equation and solve for the final velocity.



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

A. ______________________________

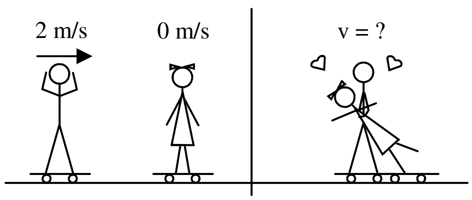
B. ______________________________

$\Sigma Ek_{before} =$

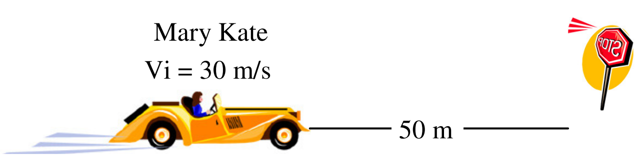
$\Sigma Ek_{after} =$

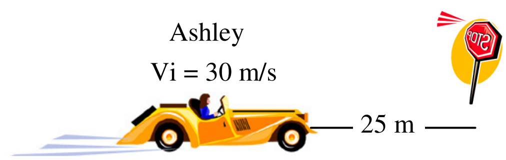
13) A 1 kg object moving 10 m/s to the right bumps into a 12 kg object moving 2 m/s to the right. Afterwards the 12 kg object is moving 3 m/s to the right. Calculate the final velocity of the 1 kg object.
   A. On line A, write the conservation of momentum equation for this situation.
   B. On line B,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

   D. Calculate the total kinetic energy before and afterwards and decide what kind of collision it was.



14) When Slim Jim started to learn to skate boarding, he learned very fast. On the first day, though, he lost control and "met" Slim Kim. We know Jim is 60 kg. Kim is only 40 kg. How fast are the two moving afterwards?





$p_b =$ $p_a =$

$\Delta p =$

$p_b =$ $p_a =$

$\Delta p =$

15) The Olsen Twins are driving identical 1,000 kg cars (*it's a twins thang*).
   A. Calculate and label the initial momentum of each.
   B. When they stop, what is their final momentum?
   C. Calculate and label Δp for each car.
   D. Which one had a bigger change of momentum?
   E. Which one took more time to stop?
   F. Which one needed a bigger force to stop?
   G. Remembering that impulse (Ft) equals the change of momentum, which one had the bigger impulse?
   H. Using a kinematic equation, find the time for Mary Kate to stop.

   I. Using momentum, calculate the time for Ashley to stop.

Electric Field

$$E = k_c \frac{q}{r^2}$$

Electric Field (*in N/C*)

Charge producing the electric field (*in C*)

Distance from the charge (*in m*)

Coulomb's Constant $= 9 \times 10^9 \text{ Nm}^2/\text{C}^2$

Coulomb's Law

$$F_e = k_c \frac{q_1 q_2}{r^2}$$

Electric Force (*in N*)

Charge 1 (*in Coulombs*)

Charge 2 (*in C*)

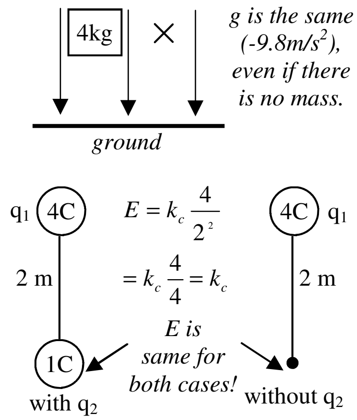
Distance between the two charges (*in m*)

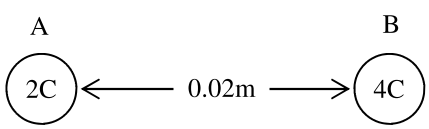
Coulomb's Constant $= 9 \times 10^9 \text{ Nm}^2/\text{C}^2$

E is about the position

g (gravitational field) is the same near the earth for any mass because g depends on the mass of the earth NOT a mass above the earth.

Likewise, q_1 sets up a field and q_2 feels a force due to q_1. E is about the position, not the charge at that position.





16) Calculate the force on charge A.

17) Calculate the force on charge B.

18) Calculate the electric field at the position of charge A.

19) How would the electric field at position A change if the 2C charge was removed?

20) Calculate the electric field at the position of charge B.