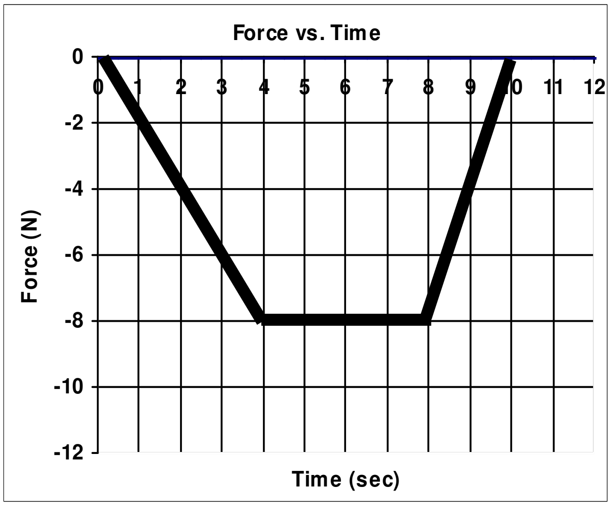
B-Day: Due Tues., Dec 14
A-Day: Due Wed., Dec 15

2010 PreAP Momentum 4



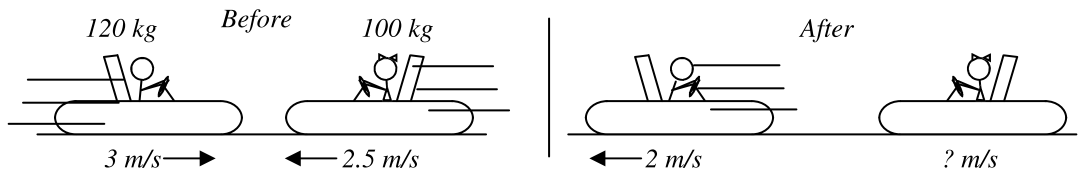
1. A 3.5 kg object moving 6 m/s experiences the forces shown.
   A. When is there a positive force?
   B. When is the object coasting (no acceleration)?
   C. * Calculate the impulse shown on the graph.

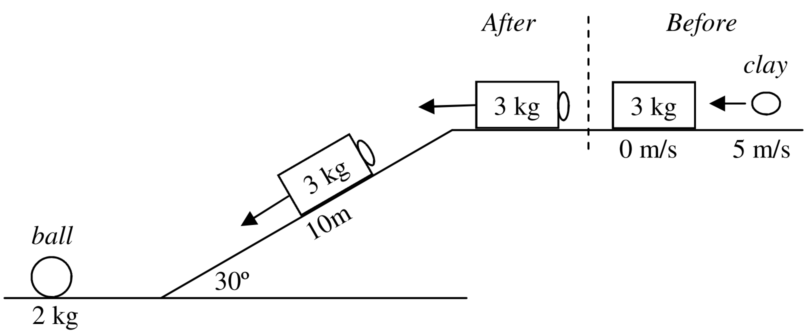
   D. Calculate the change of momentum of the object.

   E. Calculate the final velocity of the object.

2. Slim Jim and Slim Kim are in the bumper cars at the amusement park. Jim and Kim collide face to face as shown.
   A. Calculate Kim’s final v.

   B. Decide what kind of collision (give proof).



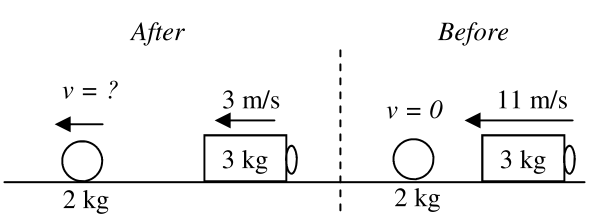


3. A 3 kg block of wood is at rest at the top of a ramp. The block is struck by a 1 kg piece of clay going 5 m/s. The clay sticks to the block.
   A. What kind of collision is this?
   B. * Calculate the velocity of the block/clay combo after the collision.

The block/clay combo then slides down the 10 m long, frictionless ramp, which is inclined at 30°.

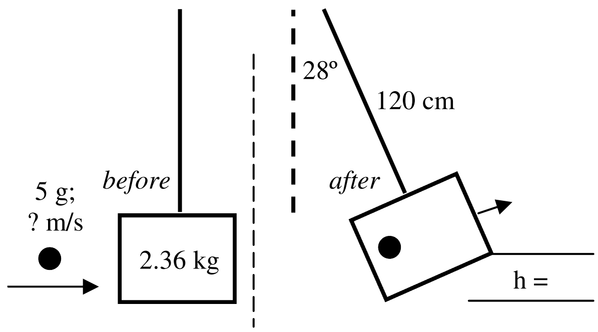
C. * How much ***height*** does the combo lose as it slides down?

D. How fast is the box/clay moving at the bottom of the ramp?



Reset: In case you made a mistake, let’s pretend the box/clay object is moving 11 m/s at the bottom. The block/clay combo then strikes a 2 kg ball. After the collision the block is still going 3 m/s to the left.

E. How fast is the ball going after the collision with the block?



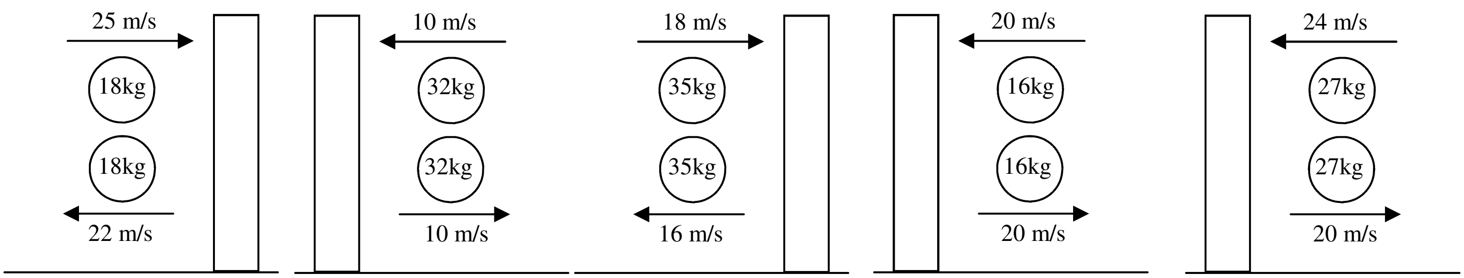
4. A ballistic pendulum is used by forensic scientists to determine the speed of bullets. Let me walk you thru how.

   A. Convert all numbers to standard units.
   B. * After the bullet is lodged in the pendulum, the block rises until it makes an angle of 28º with the vertical. Calculate h.

   C. From this height you can calculate the velocity of the block and bullet at the bottom, just after the collision.

   D. (*Reset: pretend the velocity was 1.8 m/s.*) Now you can calculate the velocity of the bullet before

5. For each of the masses below decide if the Δp is + or − and calculate Δp.



A. Δp: + or −?
*Δp = _______

B. Δp: + or −?
* Δp = _______

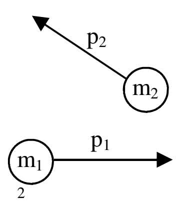
C. Δp: + or −?
Δp = _______

D. Δp: + or −?
Δp = _______

E. Δp: + or −?
Δp = _______

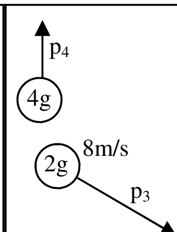
6. Rank the above from greatest to least change of momentum. If any are the same, put them on the same number. (−4 < −2, which means: rank from the most + to the most –.): 1. _______ 2. _______ 3. _______ 4. _______ 5. _______

Remember when drawing vectors, longer arrows mean greater magnitude.



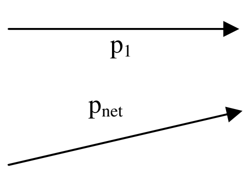
7. A. If $p_1 = p_2$ and m_2 is moving faster, which is more massive: m_1 or m_2?

   B. * Draw the p_{net} of the system.



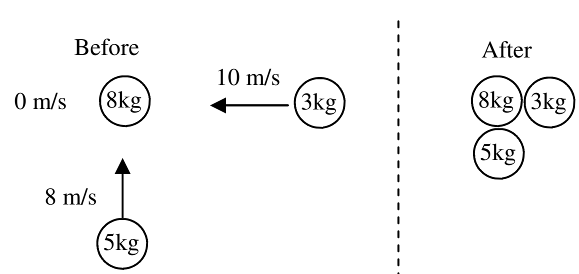
8. A. If $p_3 = 2p_4$, what is the velocity of the 4g mass?

   B. Draw p_{net}.



9. The momentum of m_1 and p_{net} are given.
   A. Draw the momentum of m_2.
   B. If $m_1 = m_2$, which mass is moving faster?

10. Three hockey pucks are on frictionless ice. Two hockey pucks slam into and attach to the third puck.
   A. Since they stick together, m_{final} =
   B. * Calculate the initial net momentum.
   C. What must be the final net momentum?
   D. Calculate the final velocity of the combined object.



11. What moves: protons or electrons?

12. An object is negative because it __________________. An object is positive when it _______________.

13. Which of the following are possible: an object gains 2.5 electrons; an object loses 8 electrons; an object gains 2 protons.

14. Which of the following amounts of charge is possible? * -1.602×10^{-18} C; 1.922×10^{-18} C; 2.9477×10^{-18} C.

15. Conductor or Insulator?
    A. _____ Resists flowing electrons.
    B. _____ Allows electrons to flow.
    C. _____ Metals
    D. _____ Plastic

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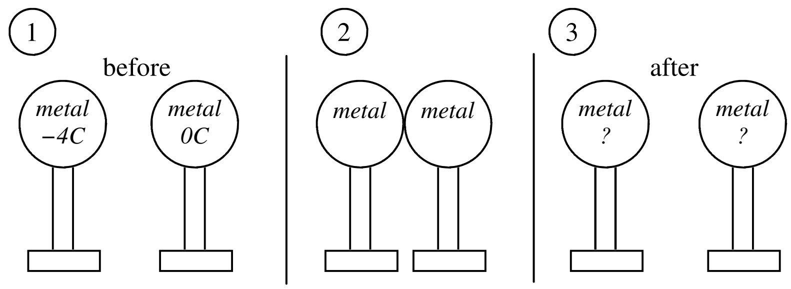
16. A metal sphere has a charge of –4C. It is touched to another metal sphere that is neutral to begin with.
    A. Are the spheres conductors or insulators?
    B. Will they allow electrons to flow?
    C. Will the electrons attract or repel each other?
    D. Will the electrons want to stay together or move away from each other?
    E. * What will be the charge of the right sphere afterwards?



Q1C: -56 kgm/s
Q3B: -1.25 m/s. Be sure to add the clay's mass to the block on the after side.
Q3C: h is always the vertical distance from the ground. It gives you the angle and length of ramp. (5m)

Q4B: remember that $h = L - (L\cos\theta) = .14$ m
Q5A: change is negative, since it started + and ended −. $\Delta p = -846$ kgm/s Q5B: + change; $\Delta p = 640$ kgm/s
Q7B: Crazy and Lazy. Q9A: p_{net} is Lazy. You have one of crazy's paths. Find the other one that makes Lazy's path.
10A: Find p1 and p2, then do pyth and inverse tan to find p_{net}. Be sure to do a quadrant check for the angle.
Q14A: do conversions for each. First one is here:
10 e's is possible. 9.5 would not be.

$$\left(\frac{-1.602\times10^{-18}\ \text{C}}{1}\right)\left(\frac{1\text{e}}{-1.602\times10^{-19}\,\text{C}}\right)=10\ \text{e}$$

Q15E: −2C. The electrons will spread out so that half of the extras will be on each sphere.