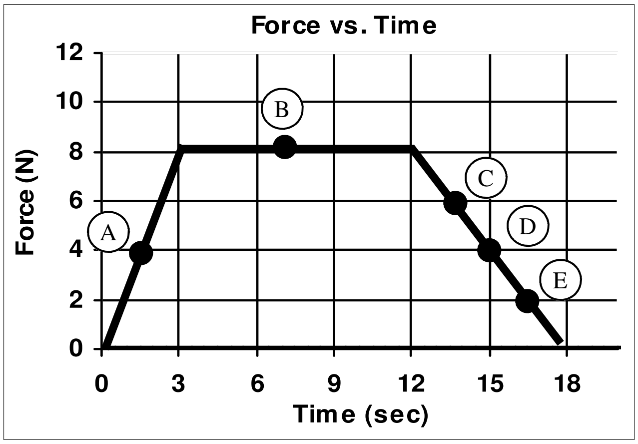
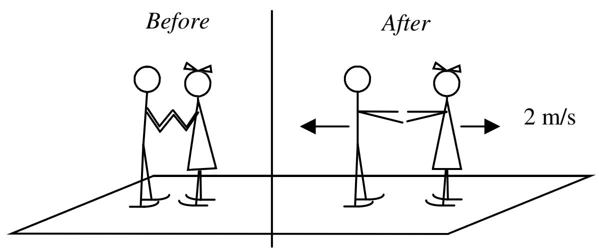
A-Day: Due Tues., Dec 15
B-Day: Due Wed., Dec 16

2009 PreAP Momentum 4

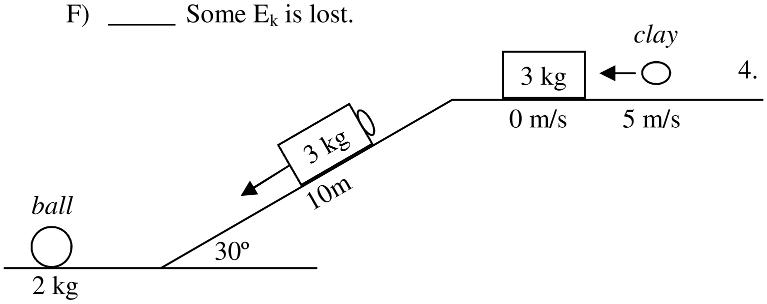


1. The graph at the left shows the force acting on an object. The object begins at rest.
   A. Which letter shows a negative force?
   B. At letter A, is the force positive or negative?
   C. So, from 0 to 3 seconds, will the object will move to the right or left?
   D. At letter B is the force positive or negative?
   E. From 3 to 12 seconds, does the object speed up or slow down?
   F. At letter C is the force positive or negative?
   G. If a 5 kg object was moving 2.5 m/s before the impulse shown, calculate its final velocity.

2. Slim Jim and Kim go ice skating. Standing amorously on the ice, they push off from each other. Jim is 60 kg and Kim is 40 kg. If Kim ends up moving to the right at 2 m/s. How fast is Jim moving?



3. What kind of collision: elastic, inelastic, perfectly inelastic?
   A) _____ The two objects stick together.
   B) _____ The two objects don't stick together.
   C) _____ Kinetic energy is conserved.
   D) _____ The experiment cars with the Velcro sides towards each other.
   E) _____ The experiment cars with the magnets towards each other.
   F) _____ Some E_k is lost.

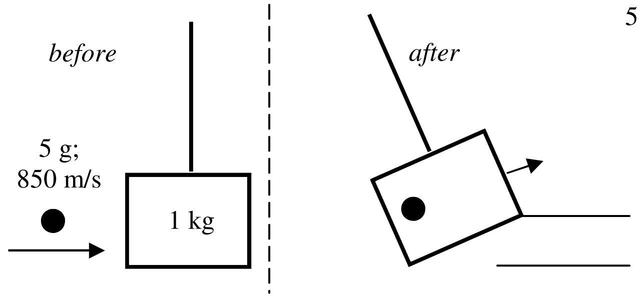


4. *A 3 kg block of wood is at rest at the top of a ramp. The block is struck by a 1 kg piece of clay going 5 m/s. The clay sticks to the block.*
   A. What kind of collision is this?
   B. Calculate the velocity of the block/clay combo after the collision.

The block/clay combo then slides down the 10 m long, frictionless ramp, which is inclined at 30°.
B. At the top of the ramp, what kind or kinds of energy do the objects have?
C. How much ***height*** does the combo lose as it slides down?

D. Use energy to calculate the final velocity of the combo at the bottom.

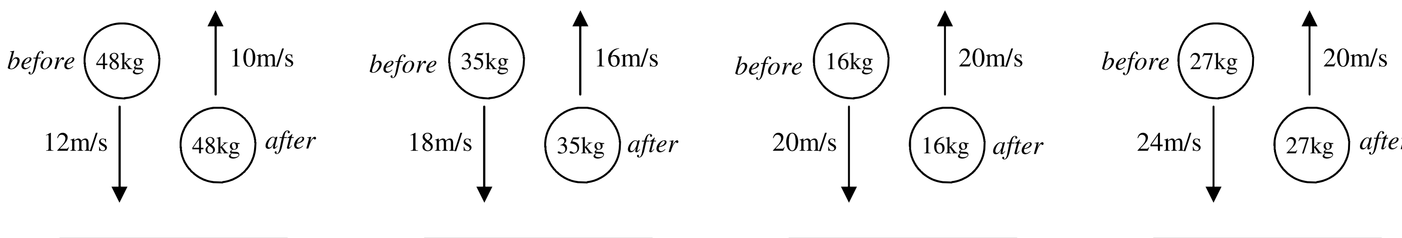
The block/clay combo then strikes a 2 kg ball. After the collision the block is still going 3 m/s to the left.
E. How fast is the ball going after the collision with the block?



5. A ballistic pendulum is used by forensic scientists to determine the speed of bullets. In our example a 5 g bullet is shot into a 1 kg block of wood, which is at rest to begin with.
   A. After converting all numbers to standard units, calculate the velocity of the block and bullet after the collision.

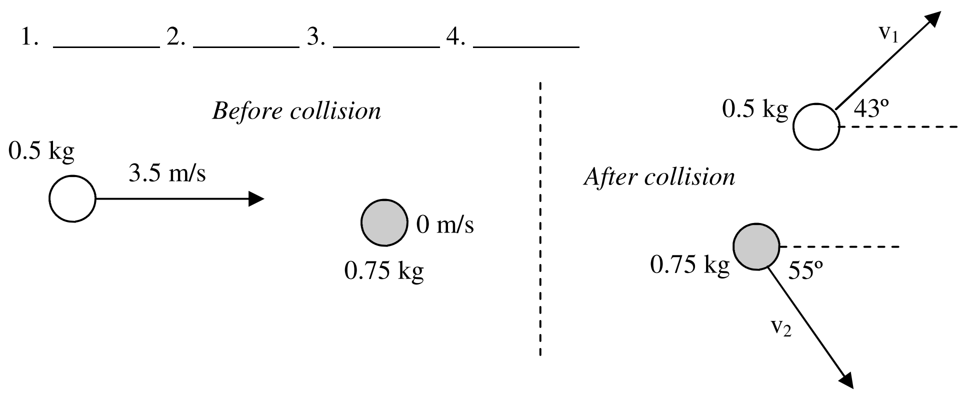
   B. The pendulum then swings. How much height does the pendulum gain?

6. A. Write the equation for momentum:
   B. Write the equation for change of momentum:
   C. Take out the mass and rewrite the equation:



7. A. Calculate the change of momentum for each of the above masses.
   B. Rank the above masses from greatest to least magnitude. If any are the same, put them on the same number.

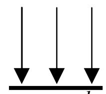
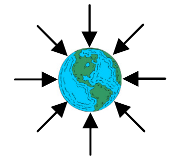
   1. ________ 2. ________ 3. ________ 4. ________



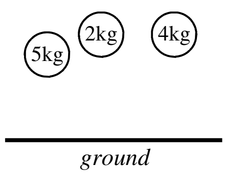
Let me walk you thru a two-dimensional collision. Remember: *momentum is conserved in every dimension*. (*Minus 20 points for blank*.)

8. A 0.5 kg ball collides with a 0.75 kg ball. The diagram above shows the situation before and after the collision.
   A. On the diagram, break v_1 and v_2 into their x and y components on the after side. Ex: Vsin30º would equal 0.5v.
   B. How much y-direction momentum is there before?
   C. How much y-direction momentum is there after?
   D. Below, write the conservation of momentum equations for each direction and solve for the final velocities. There will be 2 unknowns and two equations, so you will have to solve for one unknown and substitute it into the other equation.

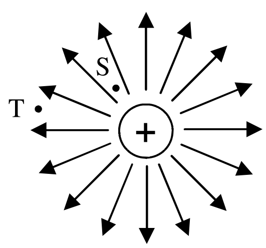
   $\Sigma p_{Xbefore} = \Sigma p_{Xafter}$ $\Sigma p_{Ybefore} = \Sigma p_{Yafter}$

		Constant Field— (Field lines are parallel, like near the earth or near a charged flat plate)  ground		Point Sources (2 particles) Field lines radiate outward 	
		Gravitational (caused by mass)	Electric (caused by charge)	Gravitational (caused by mass)	Electric (caused by charge)
Vectors	Force (F)	$= mg$ (in N)	$= qE$ (in N)	$F_g = G\dfrac{m_1 m_2}{r^2}$ (in N)	$F_e = k_c \dfrac{q_1 q_2}{r^2}$ (in N)
	Field (potential for a force)	$= g$ (in N/kg)	$= \mathrm{E} = \dfrac{V}{\Delta d}$ (in N/C)	$= G\dfrac{q_1}{r^2}$ (in N/kg)	$E = k_c \dfrac{q_1}{r^2}$ (in N/C)
Scalars	Potential Energy (PE or U)	$= mg\Delta h$ (in J) *h=0 on ground*	$\Delta PE = -qE\Delta d$ (in J)	$PE = G\dfrac{m_1 m_2}{r}$ (in J)	$PE = k_c \dfrac{q_1 q_2}{r}$ (in J)
	Potential (for energy) or Voltage	$= g\Delta h$ (in J/kg)	$\Delta \mathrm{V} = -E\Delta d$ (in J/C)	$= G\dfrac{m_1}{r}$ (in J/kg)	$V = k_c \dfrac{q_1}{r}$ (in J/C)

Remember that the quantities that are per coulomb are about position only.

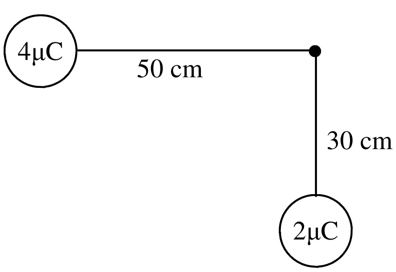


9. Three masses are above the ground.
   A. Which feels a greater force: 2kg or 4kg?
   B. Which has a greater gravitational field acting on it: 2kg or 4kg?
   C. Which has more potential energy: 5kg or 2kg?
   D. Which has more potential for energy: 5kg or 2kg?
   E. Which has more potential for energy: 2kg or 4kg?



10. Imagine two positions near a positive charge. Which position...
    A. ...has the greater electric field strength?
    B. ...has the greatest force?
    C. ...has the greatest electric potential energy?
    D. ...has the greatest electric potential (voltage)?

11. Remembering that μ is "$\times 10^{-6}$",
    A. Calculate the magnitude of the electric field at the dot due to each charge.



Electric field direction is the defined as the direction a positive charge would want to move.

    B. On the dot, draw arrows showing the electric fields you calculated with the correct direction.

    C. Electric fields are vectors. Calculate the net electric field's magnitude and direction.

    D. Calculate the electric potential (voltage) for each charge.

    E. Electric potential energy and electric potential are scalars. Find the total electric potential by adding or subtracting algeabraically.