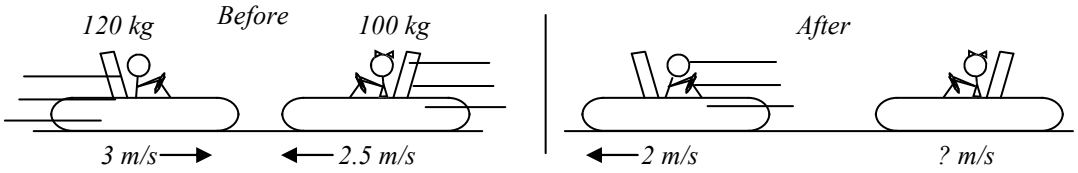
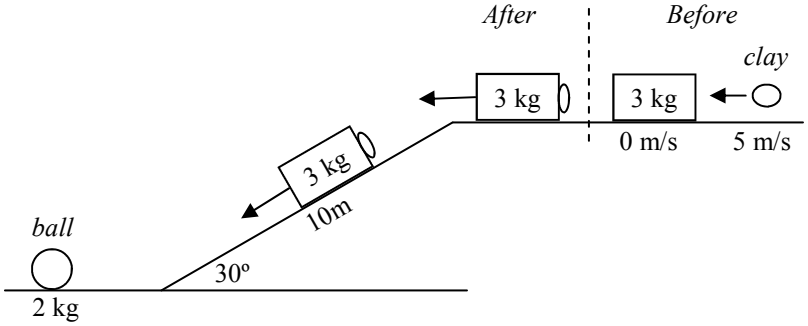
PreAP Momentum 7

1. 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).



2. 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.

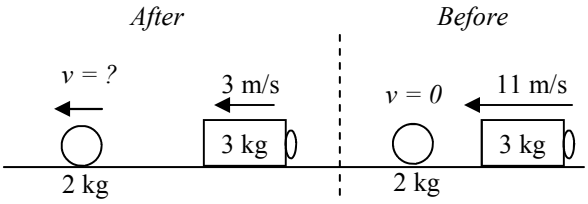
   A. What kind of collision is this?

   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°.

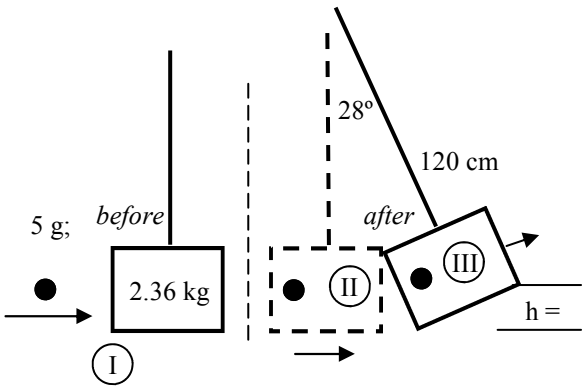
C. * How much ***height*** does the combo lose as it slides down?

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?



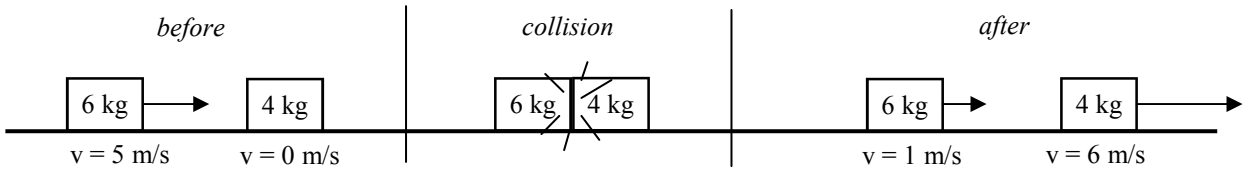
3. A ballistic pendulum is used by forensic scientists to determine the speed of bullets. Let me walk you thru how.

   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 of position III, calculate the velocity of the block and bullet at the bottom, just after the collision (pos II).

   D. (*Reset: pretend the velocity was 1.8 m/s at position II, just after the collision.)* Now calculate the velocity of the bullet before the collision (position I).

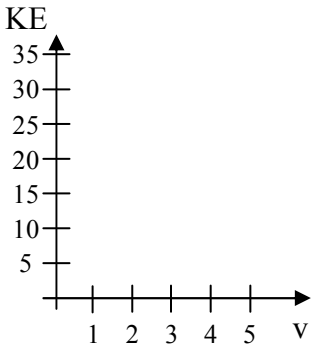


$\Sigma KE_{before} =$ $\Sigma KE_{after} =$

4. Two objects collide, as shown above. All of the initial and final velocities are given, to same time.
   A. * Under the diagram, calculate the net kinetic energy before and after the collision.
   B. What kind of collision was it?
   C. How much mechanical energy was lost during the collision?

5. A 4 kg object accelerates from rest. For each of the given velocities, calculate the kinetic energies of the object. Then graph the data, noticing the shape.

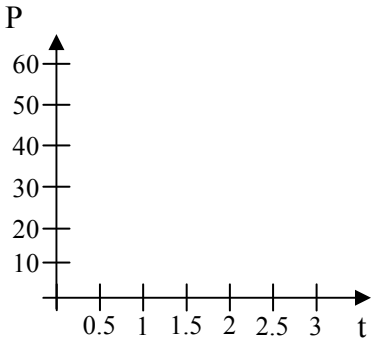
v (in m/s)	KE (in J)
0	
1	
2	
3	
4	
5	



30 J

6. A force lifts a 3 kg object 1 meter into the air.
   A. * How much energy does it gain?
   B. * How much power did the force exert if the object was lifted in 0.5 seconds?
   C. Calculate the power exerted if the object was calculated in the given times. Then graph the data and notice the shape.

t (in sec)	P (in W)
0.5	
1	
1.5	
2	
2.5	
3	



7. So what would a Elastic Energy vs. Spring Compression (PE_{el} vs. x) graph look like?
8. What would a Gravitational Potential Energy vs Height graph look like?

2B: –1.25 m/s (did you add the clay's mass to the block for the mass afterwards?)
2C: h is always the vertical distance from the ground, so that gives you the angle and length of the ramp: 5m
3B: remember that $h = L - (L\cos\theta) = 0.14m$ 3C: 1.67 m/s 4A: $\Sigma KE_{after} = 53$ J
6A: 30 J 6B: $mgh/t = 30/(0.5) = 30(2) = 60$ W