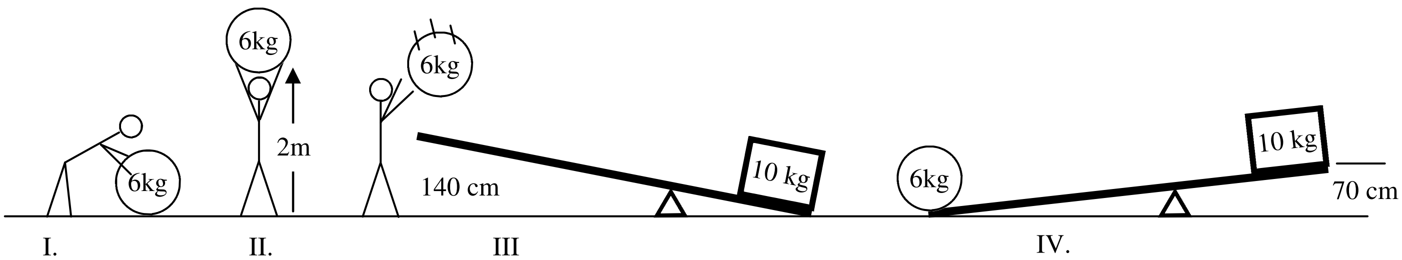
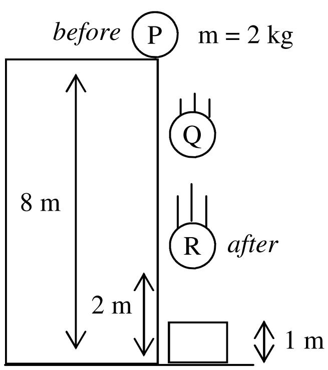
B-Day Due Tues., Nov 30
A-Day: Due Wed., Dec 1

2010 PreAP Energy 5



1. The above sequence shows Slim Jim lifting a medicine ball above his head and then dropping it onto a lever.
   - A. What kind of energy does the ball start with?
   - B. Calculate the ball's energy in part II.
   - C. * How much total energy does the ball have as it falls?
   - D. * In part IV, how much energy does the ball have?
   - E. So, how much energy did the ball lose in part III?
   - F. * If the ball lowers the lever 140 cm, what is the average force applied by the lever?
   - G. How much energy does the 10 kg box have in part IV?
   - H. * Use the equation for efficiency at the right to calculate the efficiency of this energy transfer.

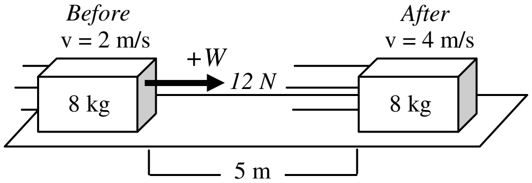
$$Eff = \frac{W_{out}}{W_{in}} \text{x}100$$



2. A 2 kg ball is dropped from an 8m tall ledge. There is no air friction.
   - A. * How fast is it going when it is still 2 m above the ground? (Hint: remember that you can set PE = to 0 at any point.)

   The ball then crushes a box as it stops at the bottom.
   - B. * Since there is no air friction, how much total energy does the ball have just before it hits the box?
   - C. * Use Conservation of Energy to solve for the average force applied by the box to stop the ball.

3. An 8 kg object is pushed by a 12 N force for 5 m to accelerate it from 2 m/s to 4 m/s.
   - A. Before you calculate, since the velocity is doubled, by how much does the kinetic energy change?



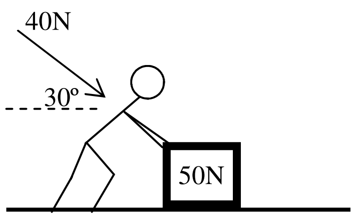
KE_{before} = W = KE_{after} =

   - B. Calculate the energies and work done below the diagram.
   - C. How much mechanical energy was gained by the object?
   - D. How much energy did the force try to add to the object?
   - E. Calculate the efficiency of the energy transfer.
   - F. Where did the lost energy go?
   - G. How did the total energy of the universe change?

4. *A 200 W motor acts on a 30 N object for 6 seconds. If the object begins at rest, how fast is the object moving afterwards?

5. A. * A motor can produce 100W. How high can it lift a 15 kg object in 2 minutes?

   B. If the motor was more powerful how would the above problem change?



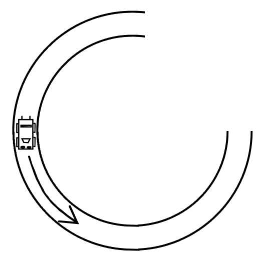
No friction

6. Slim Jim pushes on a 50N object as shown.
   A. * Calculate the normal force acting on the box.

   B. If the box moves 12m, how much work did Slim Jim do on the box?

7. A 1200 kg car is driving 15 m/s around a curve that has a 65 m radius.
   A. Calculate the centripetal acceleration of the car.

   B. What force provides this acceleration?
   C. * What is the direction of this force?
   D. * What is the direction of its velocity?
   E. What is the angle between the force and velocity?
   F. If the force is 250N calculate the work it does in 10 m.



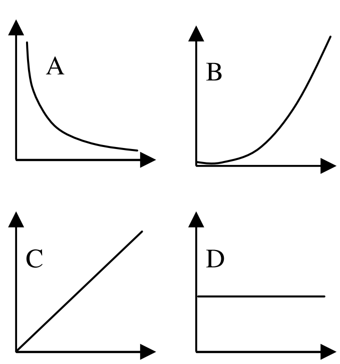
8. Use the different energy equations to answer the following proportionality questions.
   A. * If you triple the mass of an object, but how much does its gravitational potential energy change?

   B. * If you double the velocity of an object, by how much does the potential energy change?

   C. If you compress a spring half as far, but how much does the potential elastic energy change?

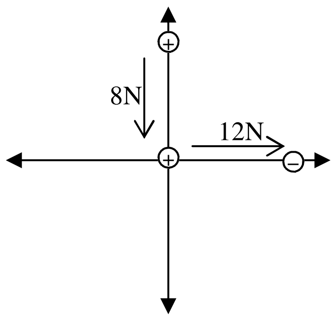
   D. If you double the spring constant, by how much does the potential elastic energy change?

   E. If an object gains the same amount of potential energy in half the time, by how much did the power change?

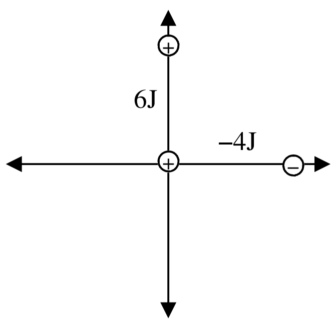


9. Which graph shows the following?
   A. _______* Kinetic energy vs. velocity.
   B. _______Gravitational potential energy vs. mass.
   C. _______Elastic potential energy vs. spring constant.
   D. _______Power vs. Time
   E. _______* Kinetic energy vs. time
   F. _______ Elastic potential energy vs. displacement.
   G. _______Gravitational potential energy vs. height
   H. _______Work vs. force.

Getting ahead with scalars vs. vectors...



10. Three charges are aligned as shown at the left. The + charge at the origin is movable, but the others are fixed. Notice that the charge at the origin is repelled by the other + charge and attracted by the – charge. Knowing that forces are vectors. Calculate the net force on the charge at the origin.



11. The same configuration is shown, but this time with the potential energies given.
    A. What is conspicuously missing on this diagram?
    B. Why?
    C. * Calculate the total energy of the charge at the origin.

Q1C: same as the PE in part II: 120 J Q1D: 0 J (at rest, on ground) Q1F: 85.7 N (W = Fd = 120 J lost; d = 1.4 m)
Q1H: 58% = mgh gained by box/ energy lost by ball = 70/120
Q2A: 10.95 m/s; Q2B: 160 J, which is mgh for the top. Just before it hits the box it will have mostly KE, but total still = 160 J.
Q2C: Box does −160J of work. Find d. Q4: 30 N = Fw, so m = 3kg. 1200 J = KE gained, find v.
Q5: 80 m Q6A: 50 + 20 = 70 N. Only sin component changes normal force.
Q7C: toward center; Q7D: forward (tangential); Q8A: PE triples if m triples. Q8B: no change: no v in PE.
Q9A: B, since v is squared, KE keeps increasing faster and faster (parabolic); Q9E: D, doesn't depend on time, so constant.
Q11C: 2 joules, PE is a scalar

