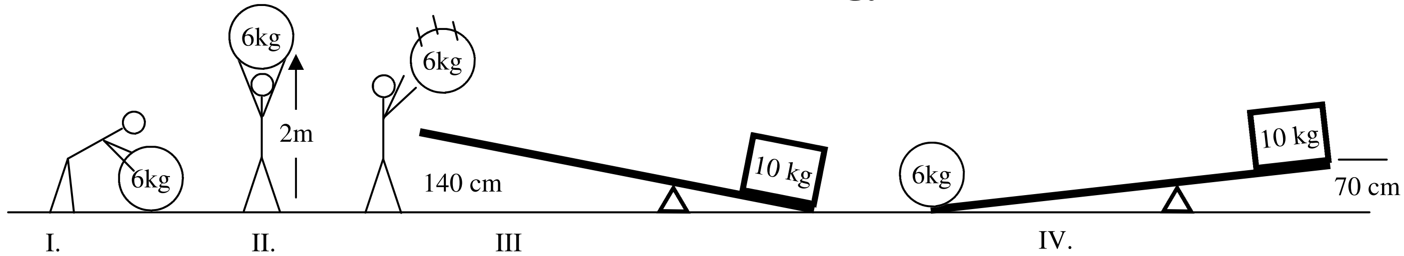
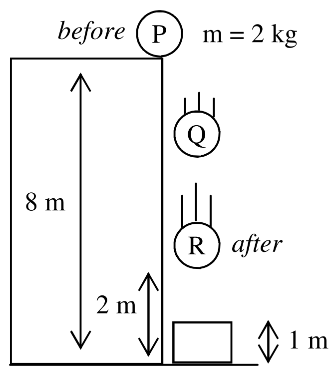
Due Mon., Nov. 28

2011 PreAP Energy 9



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.

$$Eff = \frac{W_{out}}{W_{in}} x100$$

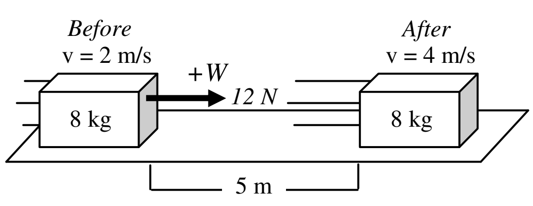


2. A 2 kg ball is dropped from an 8m tall ledge. There is no air friction.
   - A. * How fast is it going when it is still 2 m above the ground? (Hint: remember that you can set PE = to 0 at any point.)

   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.

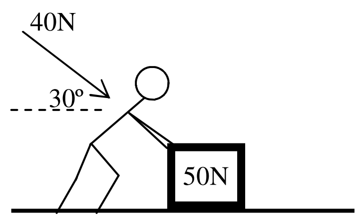
3. An 8 kg object is pushed by a 12 N force for 5 m to accelerate it from 2 m/s to 4 m/s. Do your work under the diagram.



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

   - A. * Before you calculate, since the velocity is doubled, by how much does the kinetic energy change (use the equation)?
   - B. Calculate the energies and work done.
   - 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?

More on back.

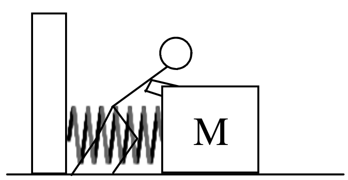


4. Slim Jim pushes on a 50N object as shown.
   A. * Calculate the normal force acting on the box.

   Remembering that only the parallel force does work.
   B. * If the box moves 12m, how much work did Slim Jim do on the box?

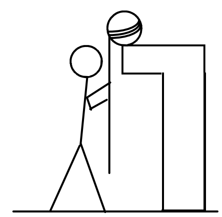
Let's solve the issue of whether or not work is done, once and for all.

Notice that BOTH Slim Jim and the spring are doing work on the mass. The spring does an amount of work equal to ½kx². That's what potential energy is: stored work OR the amount of work that will be done on the object when it is released.



PEel + W = KE.

Here both gravity and Slim Jim will do work on the ball. Gravity will do an amount of work equal to mgh, where mg is the force and h is the distance. Because Slim Jim is also pulling on the object, the object will fall faster than −9.8 m/s² and gain more than mgh of KE.



PE + W = KE.

1C: same as the PE in part II: 120 J 1D: 0 J (at rest, on ground) 1F: 85.7 N (W = Fd = 120 J lost; d = 1.4 m)
1H: 58% = mgh gained by box/ energy lost by ball = 70/120
2A: 10.95 m/s; 2B: 160 J, which is mgh for the top. Just before it hits the box it will have mostly KE, but total still = 160 J.
2C: Box does −160J of work. Find d.
3A: since v is squared, doubling v, means KE is x4
3C: 48 J (64−16) 3E: 80% 3G: no change, ever (it just changes type)
4A: 50 + 20 = 70 N. Only sin component changes normal force.
4B: 415.2 Joules

