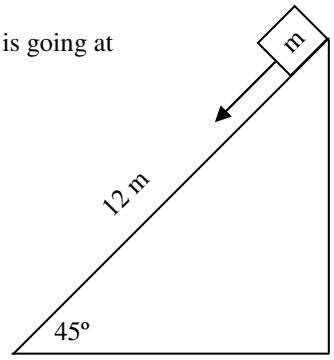
A-Day: Due Mon., Nov 3 (Assigned: 11/30)
B-Day: Due Tues., Nov 4 (Assigned: 10/31)

2008 PreAP Energy 3

1. A ball is dropped from 35 meters up. How fast is it going 15 meters above the ground?

2. A 4 kg ball is dropped. If air friction exerts 3 N of force and the ball is going 8 m/s just before it hits the ground, find how high up the ball was when it was dropped.

3. An object is at the top of a 12 m long ramp at a 45° angle. If $\mu_k = .25$, how fast the object is going at the bottom of the ramp?



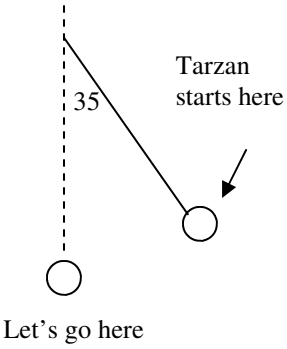
4. A 8600 N hedgehog (do you want a snail, instead?) is dropped 1.5 m onto a spring (k = 2.34 N/m).
   A) How far is the spring compressed?

   B) If the spiny little pig insectivore rebounds to a glorious 1.45 m, how much energy was lost?

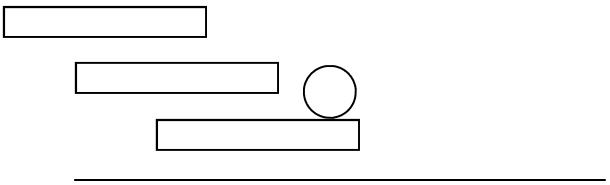
   C) How efficient was the energy transfer?

5. In order to lure Tarzan into a trap, Jane is captured by swarthy entrepreneurs. Gallant, though a little torpid, Tarzan grabs a 25 m long vine. If the vine is at an angle of 35° to the vertical to begin with and he pushes off going 2 m/s,
   A) how fast is he moving at the very bottom of the swing?

   B) In an unexpected spark of genius, Tarzan lets go of the vine at the very bottom of the swing. If, at this point, he is 20 m above the ground, how far away does he land?



6. The diagram at the right shows a 2 kg ball at rest on the first of three platforms above a table. The first platform is 1 m above the table. Each platform is 1 m above the other.
   A) How much energy is necessary to raise the ball to the second platform?

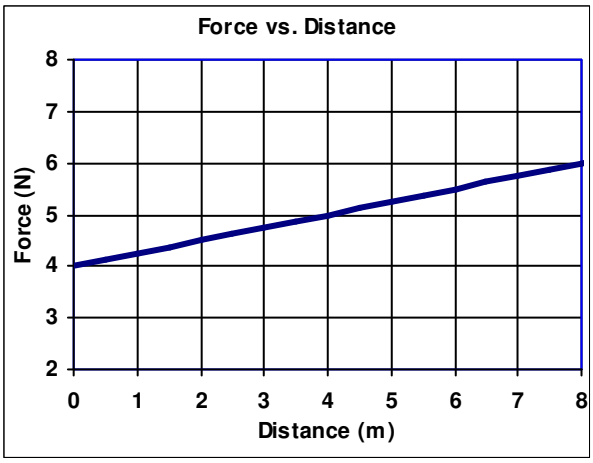


   B) So, relative to the second platform, how much potential energy does the ball have when sitting on the first platform?

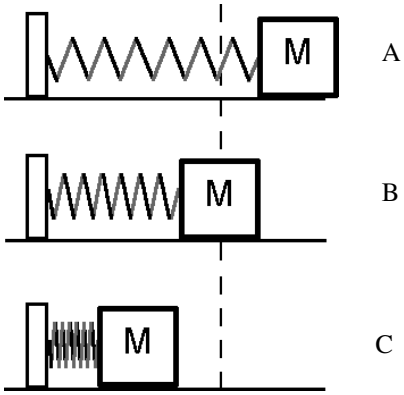
   C) How much potential energy does the ball have relative to the table?

   D) How much potential energy does the ball have relative to the top platform?

7. From the graph at the right, how much work is done on the object in the first 4 seconds?



8. The diagram at the right shows a mass-spring system sliding back and forth on a frictionless surface. The spring is fully stretched at position A and fully compressed at position C.



A) What kind of energy does it have at position A?
B) What kind of energy does it have at position B?
C) How does the amount of energy compare at B and C?

D) How does the amount of total energy compare at A, B, and C?

9. A 4 kg object is at rest on table. If it is pushed by a 6 N force for 8 m …
A) How much energy is given the object?

B) How fast should the object be going?

C) If there was friction on the table ($\mu = 0.12$), how fast is it going?

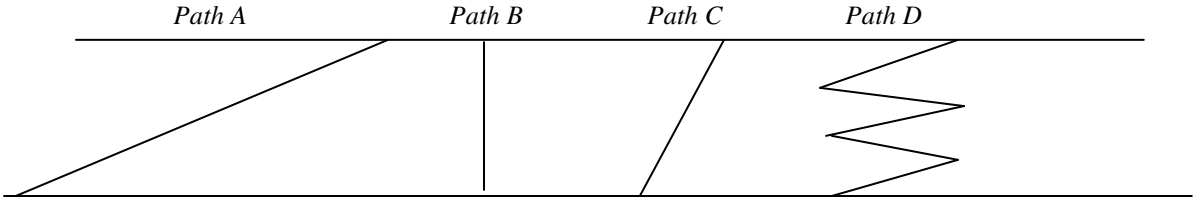
D) How much energy was converted to the heat due to friction?

E) How efficient was the energy transfer?

10. How much work is necessary to lift a 45 N object 18 meters up into the air?

Remember that "x" in the Elastic Potential Energy equation is the distance a spring is compressed or stretched from its relaxed position (also known as the equilibrium or unstretched position).

11. A spring with an unstretched position of 1.2 meters is compressed to a position of 0.8 meters. The spring constant of the spring is 0.12 N/m. If when released it launches a 0.85 kg ball, how fast is the ball launched?



12. The above shows 4 paths that could be taken to get from the ground to a vertical position "h".
    A) If there is no friction on any of the paths, which path will give an object the most potential energy?
    B) If there is no friction, which path requires the most work to move an object?
    C) Which path will require the least amount of force?
    D) Which path will require the most force?
    E) Which path has the greatest distance?
    F) Which path will require the most time?
    G) Which path will use the most power?
    H) Which path will use the least power?
    I) Which path will seem the easiest?
    J) If there IS friction, which path will require the most work?
    K) If there IS friction, which path will seem the easiest?

13. Express the units for work as base units (only sec, meters, kg, etc.).

14. If you triple the mass, how does the potential energy change?

15. If you half the velocity, by how much does the kinetic energy change?

16. If you half the mass and double the velocity, by how much does the kinetic energy change?

17. A ball is rolled down a frictionless hill. The ball has 140 J of energy at the top of the hill.
    A. What kind of energy is it losing as it rolls down?
    B. What kind of energy is it gaining?
    C. How does the total mechanical energy change during the trip?

    D. If there is friction, how does the mechanical energy change during the trip?

18. Sketch these graphs: A) Ep vs height; B) Ek vs mass; C) Ek vs velocity.