B-Day Due Fri., Nov 19
A-Day: Due Mon., Nov 29

2010 PreAP Energy 4

From now on I strongly suggest that you write your Conservation of Energy equation for each problem. It tells you "stuff". I assume, now, that you can all write them. See the Energy Study Helps, if you need more help.

1. * An object is 45 m above the ground when it is dropped. How fast is the object going just before it hits the ground? *(Write the Conservation of Energy formula, then solve.)*

2. A 4 kg object is moving 2 m/s when it is pushed by a 5 N force for 7 m along a level surface.
   A. How fast is it going afterwards?

   B. What is the change of potential energy of the object?

3. A 100 N object is at rest on the ground. It is lifted up 8 m.
   A. Is 100N the mass or the weight of the object?
   So, N is a force or mg in mgh, already…
   B. * How much work was done to lift the object?

   C. How much gravitational potential energy does it gain?

   D. * How long would it take a 400 W motor to lift it?

4. Let's learn to break up a unit, the joule:
   A. Write the basic equation for work:

   B. * Put in what "F" equals (*and don't get angry*):

   C. Substitute in the units for each one and combine like terms.
   D. * So, what does a joule equal in more basic units?

5. Using what you just found, give the units of power using only basic units.

6. A 5 kg mass is at rest on a level surface. It is pushed until it reaches 12 m/s in 8 seconds.
   A. How much work was done on the object?

   B. How much power was used to push the object?

7. For each of the following, is work being done (*and why or why not*)?
   A. ____ A person holds a book in their hands for 20 minutes.
   B. ____ A force pushes down on a table.
   C. ____ A person pushes a sled across the snow.
   D. ____ Gravity keeping the moon moving around the earth.

   Definition: Mechanical energy = any PE or KE.

8. A 6 kg box is moving 8 m/s when it slides over a 3 m long patch of sandpaper. Afterwards the box is moving 3 m/s.
   A. How much mechanical energy did it lose?

   B. Where was the energy "lost" and what did it become?

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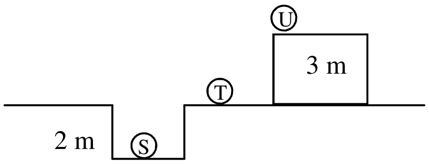


9. Three identical 1 kg objects are placed as shown in the diagram.

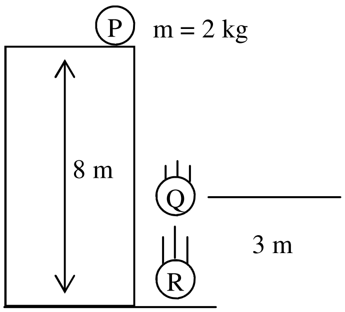
   A. Since object T is sitting on the ground, how much potential energy does it have?

   B. How much potential energy does object U have relative to the middle object?

   This is how much work would be done to lift U to this point.

   C. If T is at h = 0 m, then object S is at h = _____. (below 0)

   D. * What is the potential energy of object S relative to the ground?



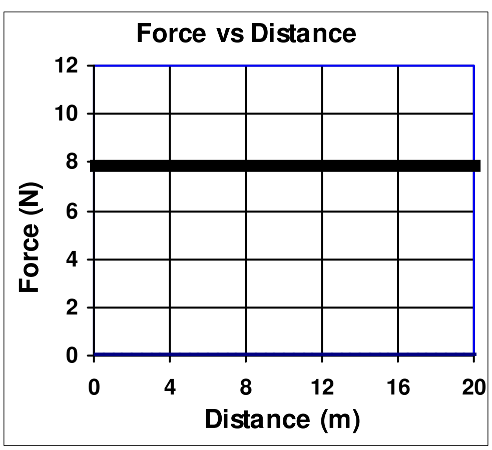
Object S is in a hole, so it would take energy to lift it out. This is how an object can have <u>*negative potential energy*</u> *and why we usually ASSUME that we have defined PE = 0J at the ground. But PE can be defined anywhere. Let's see how that could be helpful...*

10. A ball is dropped from 8 m. How fast is it going 3 m above the ground?
    A. If we define point O as our reference point (h = 0 m), how far did it drop?
    B. * Calculate its speed at point O.

11. A 20 kg object is moving 4 m/s to the left.
    A. Since it is moving to the left, is v positive or negative?
    B. * Calculate the object's kinetic energy.

12. A. Write the equation for power: B. For W, substitute Fd.
    C. What is d/t? D. * Write a new equation for power:

13. A person pushes on a object with 18N at 4 m/s. How much power is being expended?



14. A. Calculate the work done on the graph for the 20 m shown.

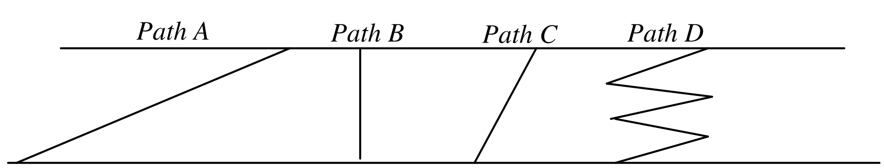
    B. If the force lifts a 50N object, how high was it lifted?

    So, ANYTIME two quantities are multiplied in an equation (like F = ma, W = Fd, etc) on the graph you find the area.

15. A 2 kg object is moving 2 m/s. It then accelerates to 4 m/s.
    A. Calculate its initial kinetic energy.

    B. Calculate its final kinetic energy.

    C. So, by doubling its speed, its kinetic energy:



16. An object is moved up the paths shown.
    A. If there is no friction, which path will give the most potential energy?
    B. If there is friction, which path will give the most potential energy?
    C. If there is friction, which will take the most work to move an object up?
    D. If there is friction, on which path will an object have the most kinetic energy at the bottom?
    E. Which path will require the most time (assuming constant velocity)?
    F. Which path will require the most power?

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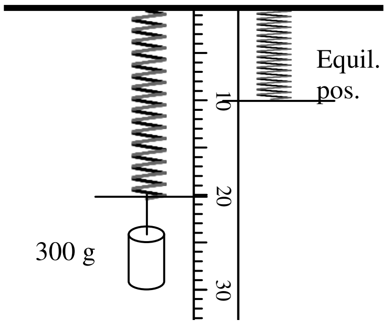


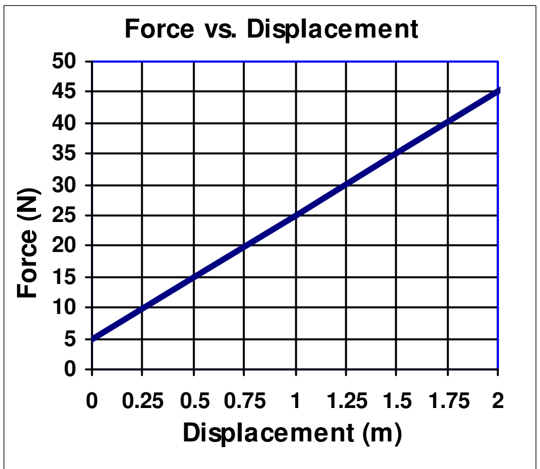
Lab questions:

17. A 300 g mass is placed on a spring that 10 cm long, when relaxed. The spring stretches to 20 cm.

    A. * Calculate the force pulling on the spring.

    B. * What is "x" in ½kx^2?

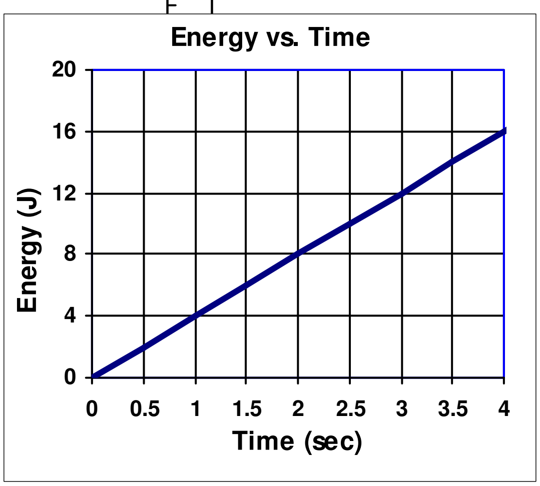
    C. Calculate the spring constant for this spring.



But this is not the most accurate way of finding "k".
We graphed it, instead.

18. What are the units for the spring constant?
19. Calculate the spring constant shown on the graph at the left.
20. Which axis is dependent?
21. Which axis is independent?
22. Which axis is manipulated?
23. Which quantity did we manipulate?
24. Why did we switch our graph?

Turns out that ANYTIME there is division of units or in an equation you look for the slope of a graph. Examples: N/m (spring constant); m = F/a; v = D/T; a = ΔV/t.



25. Given the units on the graph at the left, find the slope of the graph and figure out what it means (units will help).

Q1: mgh = ½mv^2; v = 30 m/s; Q3B: 800 J; Q3D: 2 sec;
Q4B: since W = Fd and F = ma, then W = mad; Q4D: (kgm/s^2)m = kgm^2/s^2 Yup, that's what a joule equals.
Q10B: if point O is now our zero point, then h = 5 m and mgh = ½mv^2; v = 10 m/s
Q11B: 160 joules. KE can't be negative
Q12D; W = Fv
Q17A. 1000g = 1 kg and Fw = mg, so F = 3N Q17B: 10 cm, which is 0.1 m (have to be in m)

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