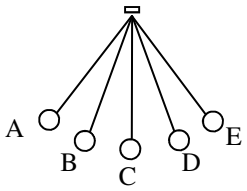
PreAP Harmonic Motion 3

Diagram 1



1. Use diagram 1 at the right answer the following:
   A. Starting at A, 1 cycle ends at ____. B. Starting at E, 1 cycle ends at _____
   C. Starting at B going right, 1 cycle ends at ?
   D. Equilibrium position = E. If A to E is 60°, the amplitude =
   F. In one cycle, the pendulum passes thru the equilibrium position _____ times.
   G. How many amplitudes does it go thru in one full cycle?
   H If it takes 0.3 seconds to go from A to E, how long is one period?

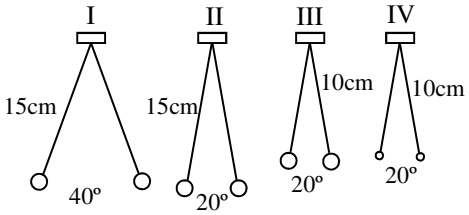
2. * If the period of a pendulum is 0.5 seconds, calculate the frequency of the pendulum.

3. If the frequency of a wave is 1.35 Hz, find its period.

4. * A spring vibrates back and forth 24 times in 9 seconds. What is its frequency?

5. Another pendulum swings back and forth 34 times in one minute. What is its period?

6. Use the pendulums at the right to answer the following. Notice IV has a smaller mass.
   A. Which has the most energy?
   B. What is the amplitude of I?
   C. Which has the smallest period: I or II?
   D. From the lab: which pendulum has the longest period: III or IV?
   E. Why?
   F. Which pendulum has the longest period: I or III?



7. If you double the mass on the end of a pendulum, does T increase or decrease?

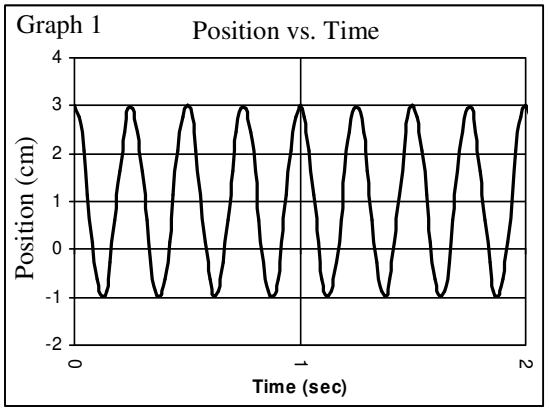
Imagine a pendulum moving back and forth with a pen attached at the bottom, touching a piece of paper. The paper is then pulled at constant speed to the left. The graphs below show the trail the pendulum's pen creates on the paper.

8. Use Graph 1 to answer the following:
   A. * Amplitude = B. # of cycle in 1 second?
   C. * Calculate the frequency shown on Graph 1 (#cycles/#sec).

   D. Calculate the period shown on Graph 1.

   E. Over time, the pendulum will d_____.
   F. * Where will it come to rest?

Graph 1

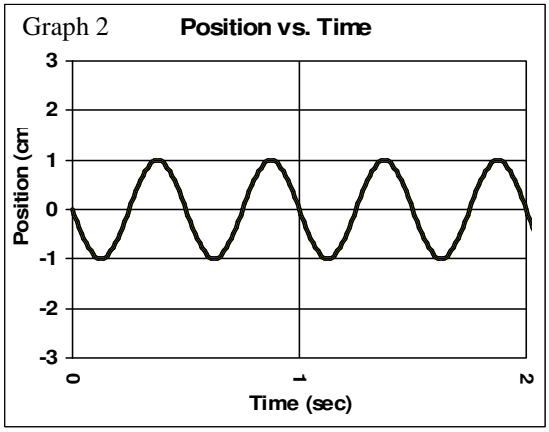


9. Use Graph 2 to answer the following:
   A. Amplitude = B. * f =

   C. T =

   D. How many cycles are shown?
   E. Equilibrium position =

Graph 2



10. Graph 1 or Graph 2
    A. Has the greatest amplitude.
    B. Has the longest period (most time).
    C. Has the greater frequency.
    D. Has the higher equilibrium position.

11. Now compare the shapes of Graph 1 and 2
    A. If the amplitude increases, how does the shape change?

    B. If the period gets smaller, how does the graph change?

12. * If a pendulum is 34 cm long, find its period.
(Hint: notice that "g" is in m/s^2.)

13. * A red pendulum has a period of 0.85 seconds. If the hanging mass has a density of 3500 kg/m^3, how long is the pendulum <u>in centimeters</u>.

Example: How long is a pendulum that has a period of 3.2 seconds?

$$T = 2\pi\sqrt{\frac{\ell}{g}}$$

$$3.2 = 6.28\sqrt{\frac{\ell}{10}}$$

$$\frac{3.2}{6.28} = \frac{\cancel{6.28}}{\cancel{6.28}}\sqrt{\frac{\ell}{10}}$$

$$0.5096 = \sqrt{\frac{\ell}{10}}$$

$$(0.5096)^2 = \frac{\ell}{10}$$

$$0.2597 = \frac{\ell}{10}$$

$$10(0.2597) = \ell$$

$$\ell = 2.597m = 259.7cm$$

2. f = 1/T = 2 Hz
4. f = #cycles/#sec = 24times/9sec = 2.7 Hz
8A: 2cm 8C: 4/1 = 4 Hz
8F: 1 cm (half way top to bottom)

8B: there are 2 cycles in the first second, so 2 Hz

12: use 0.34 m, then T = 1.17 sec
13. ℓ = .18 m, now put it in cm. And do you see density in the equation? So it is IRRELEVANT!