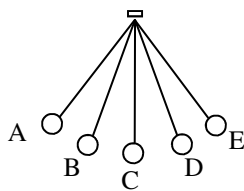


2011 PreAP Harmonic Motion 3

Diagram 1



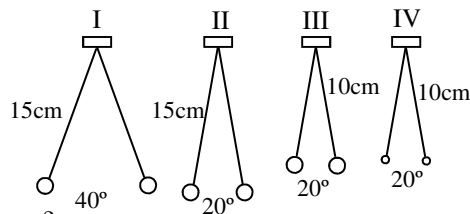
- Use diagram 1 at the right answer the following:
 - Starting at A, 1 cycle ends at ____.
 - Starting at E, 1 cycle ends at ____
 - Starting at B going right, 1 cycle ends at ?
 - Equilibrium position =
 - If A to E is 60° , the amplitude =
 - In one cycle, the pendulum passes thru the equilibrium position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

- * If the period of a pendulum is 0.5 seconds, calculate the frequency of the pendulum.
- If the frequency of a wave is 1.35 Hz, find its period.

- * A spring vibrates back and forth 24 times in 9 seconds. What is its frequency?
- Another pendulum swings back and forth 34 times in one minute. What is its period?

- Use the pendulums at the right to answer the following. Notice IV has a smaller mass.

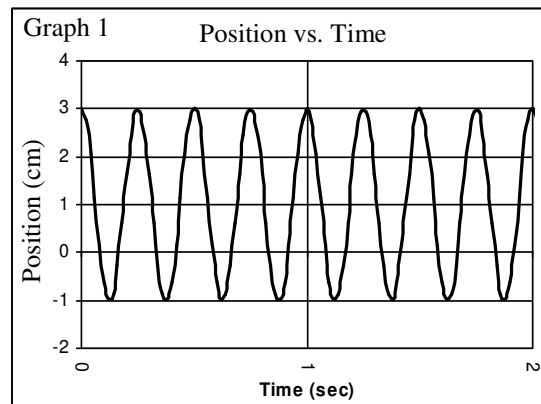
- Which has the most energy?
- What is the amplitude of I?
- Which has the smallest period: I or II?
- From the lab: which pendulum has the longest period: III or IV?
- Why?
- Which pendulum has the longest period: I or III?



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

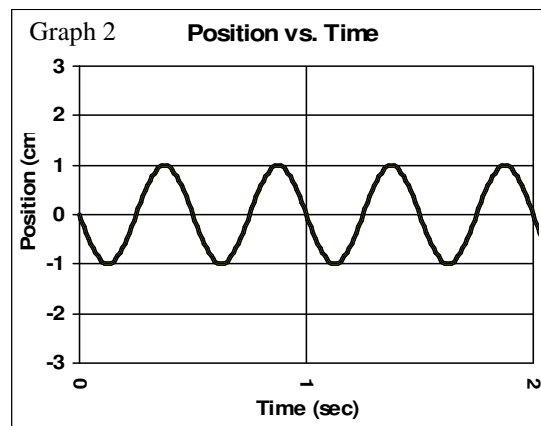
Imagine a pendulum moving back and forth with a pen attached at the bottom, touching a piece of paper. The paper is then pulled at constant speed to the left. The graphs below show the trail the pendulum's pen creates on the paper.

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



- Calculate the period shown on Graph 1.
- Over time, the pendulum will d _____.
- * Where will it come to rest?

- Use Graph 2 to answer the following:
 - Amplitude =
 - * $f =$
 - T =



- How many cycles are shown?
- Equilibrium position =

- Graph 1 or Graph 2
 - Has the greatest amplitude.
 - Has the longest period (most time).
 - Has the greater frequency.
 - Has the higher equilibrium position.

- Now compare the shapes of Graph 1 and 2
 - If the amplitude increases, how does the shape change?
 - 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/s².)

13. * A red pendulum has a period of 0.85 seconds. If the hanging mass has a density of 3500 kg/m³, how long is the pendulum in centimeters.

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

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

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

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

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

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

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

$$10(0.2597) = \ell$$

$$\ell = 2.597\text{m} = 259.7\text{cm}$$

2. $f = 1/T = 2 \text{ Hz}$

4. $f = \text{\#cycles/\#sec} = 24\text{times}/9\text{sec} = 2.7 \text{ Hz}$

8A: 2cm 8C: $4/1 = 4 \text{ Hz}$

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 $T = 1.17 \text{ sec}$

13. $\ell = .18 \text{ m}$, now put it in cm. And do you see density in the equation? So it is IRRELEVANT!