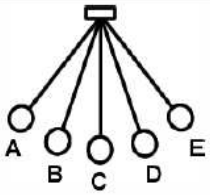
Name:_____

Harmonic Motion Basics

1. Period, Frequency, or Amplitude?
   - A. _____ This increases as it vibrates back and forth faster.
   - B. _____ A wider swing means more of this.
   - C. _____ Time for one complete cycle to occur.
   - D. _____ If a pendulum swings slower this increases.
   - E. _____ Measured from the center to the extreme.
   - F. _____ Will decrease over time.
   - G. _____ In seconds.
   - H. _____ Contains the energy.
   - I. _____ Decreases when it vibrates back and forth slower.
   - J. _____ In Hz.
   - K. _____ Could be measured in degrees, cm, or meters.

2. A. The pendulum's equilibrium position is:

   B. If the cycle begins at C going to the left, where does one cycle end?



   B. Where will the pendulum come to rest?

3. A pendulum has a period of 0.25 seconds.
   A. How many cycles will it undergo per second?

   B. What is its frequency?

4. A pendulum has a frequency of 0.65 Hz. Calculate the period of the pendulum.

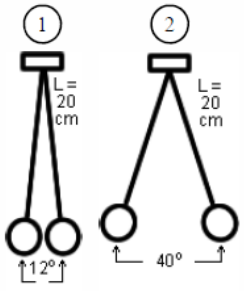
5. A. Amplitude of Pendulum 1:

   B. Amplitude of Pendulum 2:

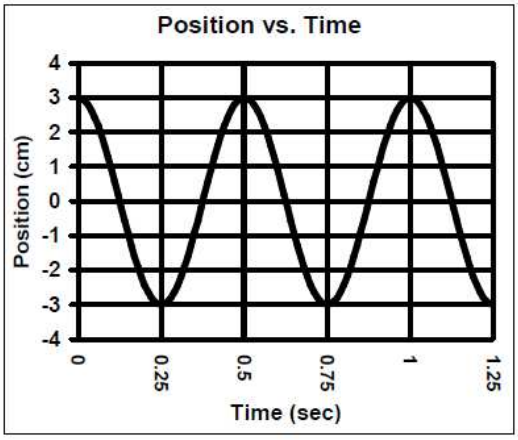
   C. Which has the most energy?

   D. Over time will the amplitude increase or decrease?

   E. This is called d_____.



6. Frequency is cycles per second, calculate the frequency of a pendulum that undergoes 35 cycles in 4.6 seconds.



7. The graph above shows the position of a pendulum moving back and forth over time.
   - A. Mark one cycle on the above graph.
   - B. How many total cycles are on the graph?
   - C. The graph shows _____ cycles in ____ seconds.
   - D. Calculate the frequency of the motion.

   E. What is the period of the graph?

   F. What is the equilibrium position?
   G. What is the amplitude of the graph?

8. How many centimeters are in a meter?

9. 45 cm = _____ m

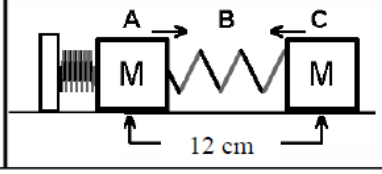
10. Calculate the period of a pendulum that has a length of 68 cm.

11. A pendulum is 125 cm long. Calculate its period.

12. A pendulum has a period of 1.4 seconds. How long is it?

13. A spring moves back and forth, turning at points A and C.

   A. What is its amplitude?



   B. What distance does the spring travel in one complete cycle?

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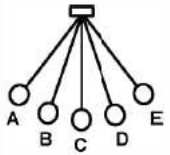
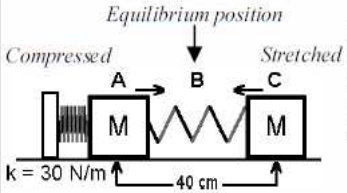
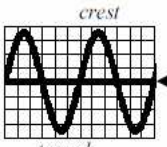
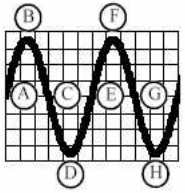
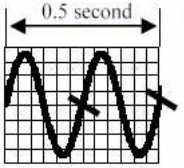
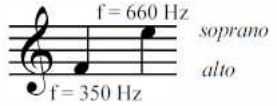
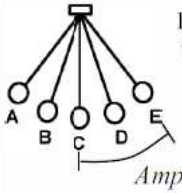
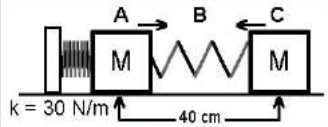
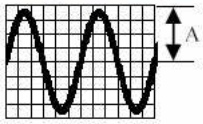
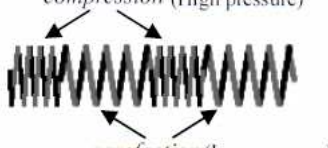
Harmonic Motion Basics

	Basic Definitions	Pendulums	Spring-Mass Systems	Waves	Sound (*Special Longitudinal Wave*)
Equilibrium Position	Where it comes to rest OR where it was before it was disturbed.	 At the bottom of the swing: point C.		 Halfway between crest and trough.	Silence. 0 dB
Disturbance	Adding the initial energy OR moving the object away from equilibrium position; starts harmonic motion.	Move the pendulum away from the equilibrium position; give it potential energy.	Compress or stretch spring (move to one side and release).	Giving energy to the medium (pushing down on water; moving a long spring side to side; etc).	Any vibration of matter due to striking, rubbing, spinning, plucking, etc.
Period (T in sec) $T = \frac{\#\text{ sec}}{\#\text{ cycles}}$	Amount of time it takes one cycle of the motion to repeat OR $T = \frac{1}{f} = \frac{\#\text{ sec}}{1\text{ cycle}}$	$T = 2\pi\sqrt{\frac{\ell}{g}}$ l is length (in m); g is 9.8 m/s^2	$T = 2\pi\sqrt{\frac{m}{k}}$ k - spring constant (in N/m); m - mass (in kg)	 Time between any two repeated points on the wave: A to E; B to F; etc.	Find frequency first, then calculate period. $f = \frac{1}{T}$
Frequency (f in Hz) $f = \frac{\#\text{ cycles}}{\#\text{ sec}}$	How many cycles occur in one second. $f = \frac{1}{T} = \frac{\#\text{ cycles}}{1\text{ sec}}$	How many times it swings back and forth in one second.	# of times it goes back and forth or up and down each second.	 # of cycles in 1 sec. This graph shows: 2 cycles in 0.5 sec, so the frequency = $\frac{2\text{ cycles}}{0.5\text{ sec}} = 4$ Hz	Higher frequency = higher note or *pitch*. 
Amplitude (A in cm, m or degrees [θ])	Amount of energy; strength of the motion; A = ½(side-to-side) 4A during 1 cycle. Does not affect T or f. Dampens (*see below*)	 From A to C OR C to E. In degrees or radians.	 From A to B OR B to C. Amplitude = 20 cm	From equilibrium to maximum displacement (crest or trough)  Amplitude = $\frac{1}{2}$(side-to-side)	How ***loud*** a sound is; measured in decibels (dB). +10dB = twice as loud. +20 dB = 4 times as loud, etc. More Ampl. = more pressure.
Other	Damping: gradual reduction of amplitude (loss of energy) over time.	Amplitude does not affect period if < 15°.	$F_{spring} = -kx$ x – distance from equilibrium position (in meters). *More mass = lower equilibrium position (hanging springs only).*	$v_{wave} = f\lambda$ ← *λ (lambda) is wavelength (in m)* Wave speed depends *only* on medium it travels thru (water, air, etc). If medium changes (temperature; pressure; substance), v changes, too.	

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