A-Day Due Wed., Feb 4
B-Day: Due Thurs., Feb 5

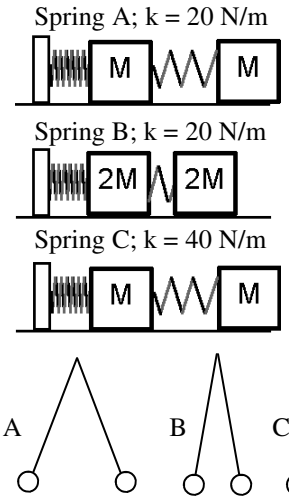
2009 PreAP Harmonic Motion 3

1. When a spring has a bigger spring constant, is it easier or harder to stretch?

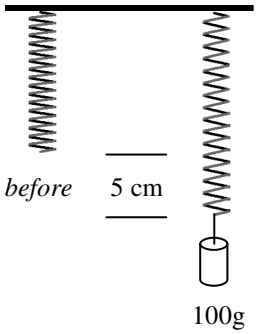
2. For a moving spring: Maximum (Mx) or Minimum (Mn)? ("*A" stands for "amplitude*"; "a" is "acceleration".)

A. ____ Ep at the endpoints.	E. ____ Ek at ends	I. ____x at equilibrium	M.____ v at x = ends
B. ____ Ek at the endpoints.	F._____ Ep at ends	J. _____F at ends	N. ____ a at x = 0
C. ____ Ek at equilibrium.	G. ____ Ek at x = 0.	K._____x at ends	O. ____ A at x = ends
D. ____ Ep at x = 0.	H. ____ F at x = 0	K._____v at x = 0	P. ____ a at x = ends

3. Using the pendulums and springs at the right, answer the following:
   - A. ____ Spring A or B has the biggest amplitude?
   - B. ____ Pendulum A or B has the smallest amplitude?
   - C. ____ Pendulum A or C has the quickest period?
   - D. ____ Spring A or C has the quickest period?
   - E. ____ Spring A or B has the quickest period?
   - F. ____ Pendulum B or C has the greatest frequency?
   - G. ____ Spring A or C requires more force to compress it?
   - H. ____ Spring B or C has the smallest amplitude?
   - I. ___ Which pendulum has the most energy?
   - J. ___ Spring A or B has the most energy?
   - K. ____ Spring A or C has the most energy?



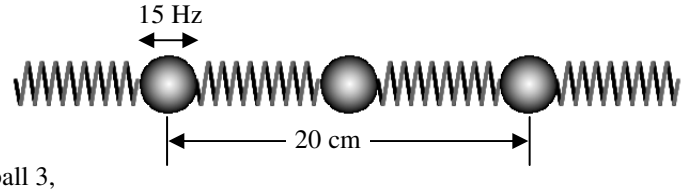
4. If M = 0.5 kg, find the period of Spring A.



5. 100g is hung on a spring. The spring stretches 5 cm. (*Use g = 10 m/s^2.*)
   - A. What is the mass of the object in kilograms?
   - B. How much force is pulling down on the spring?
   - C. Calculate the spring constant of the spring.
   - D. Calculate the period of the spring.

6. For pendulums, springs, or waves, let's derive some conversion factors we can use.
   - A. How many times do they pass the equilibrium position in one cycle? So 1 cycle = 1T = ___ eq
   - B. How many amplitudes do they move in one cycle? So 1 cycle = 1T = ____ A
   - C. If a pendulum completes 6 cycles, how many times did it pass the equilibrium position? (*use eq. above*)
   - D. If a spring has a frequency of 56 Hz and its amplitude is 12 cm, how much distance does it cover in 31 seconds?

7. A wave has a speed of 120 m/s and vibrates back and forth 45 times per second. Calculate its wavelength.



8. Three ping pong balls are attached by springs.
   The first of the balls has a frequency of 15 Hz.
   A) What is the frequency of the third ball?
   B) What kind of wave is it: transverse or longitudinal?
   C) If it takes 0.6 seconds for the wave to move from ball 1 to ball 3, calculate the speed of the wave. (*Notice distance is in cm [hint, hint]*).

   D) Calculate the wavelength of the wave.

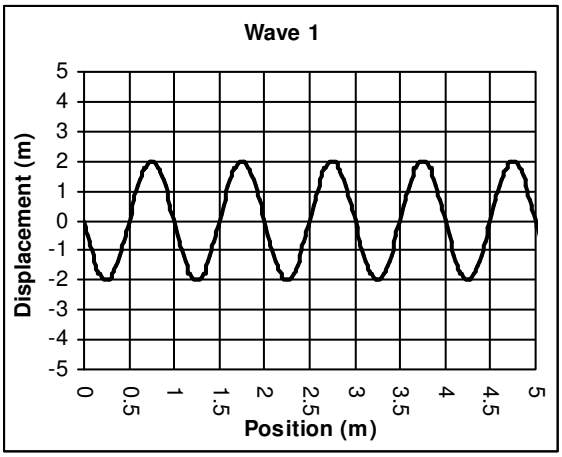
   E) Do the balls move along the with the wave?
   F) What does move?

   G) What would happen if two waves came from opposite directions?

9. What's the medium that the waves travel through?
   A. Sound in a room:
   B. Waves in the ocean:
   C. The slinky in class:

10. Can we hear sound in space?
11. Why or why not?

12. Transverse or Longitudinal Wave?
    A. The wave vibrates up and down and moves up.
    B. The wave vibrates left and right and moves forward (away from you).
    C. The slinky if you push it.
    D. The slinky when you move your hand left and right.



13. Use the graph at the left to answer the following.
    A. Wavelength = B. Amplitude =

    C. If the wave is vibrating at 380 Hz, what is its speed?

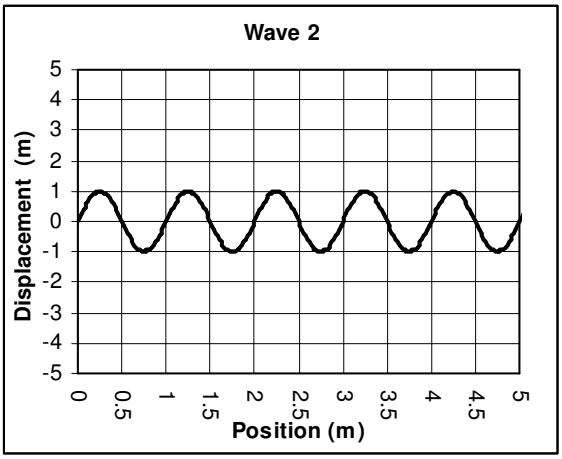
    D. If the amplitude doubles, how will the wave's speed change?

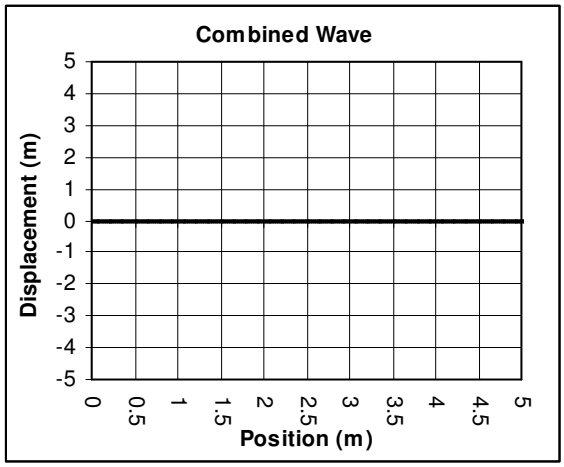
    E. If the frequency were to get smaller, how would λ change?

    F. Are waves 1 and 2 in phase or out-of-phase?

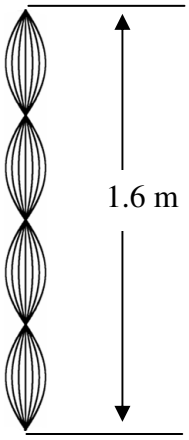
    G. If in the same medium would there be constructive or destructive interference?

    H. Using the superposition principle, draw the combined wave below.





14. A person yells to the bottom of a mine shaft. If it takes 0.6 seconds for the sound to return and the speed of sound in air is approximately 340 m/s, how deep is the shaft?



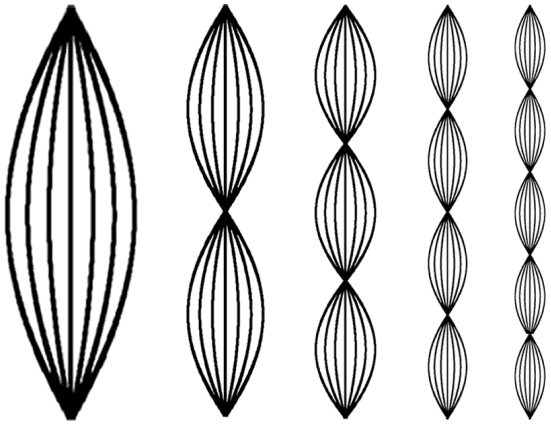
15. Use the graphic on the right to answer the following:
    A. How many antinodes does it have? B. How many nodes does it have?
    C. Which harmonic is it?
    D. If it's frequency = 20 Hz, find the frequency of the fundamental (H_1).

    E. Draw the waveform on the wave. F. Mark one wavelength on the wave (label it "λ").
    G. How many wavelengths long is this harmonic?
    H. How long is this string? (*It is given.*)
    I. Using the identity: String length = # wavelengths, find the wavelength of the harmonic.

    J. Find the speed of the wave on this string (f = 20 Hz).

    K. Find the frequency of H_2. L. What is the wave speed of H_6?

    M. Draw the fundamental on the right side of the "1.6m".
    N. What is the wavelength of the natural frequency for this string?



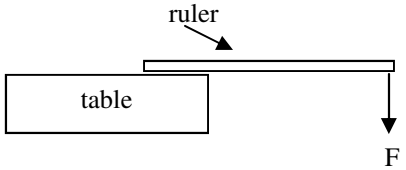
16. Which harmonic?
    A. _____ Is 1.5λ long?
    B. _____ Has 3 nodes?
    C. _____ Frequency = 6 times the natural frequency?
    D. _____ Has the longest wavelength?
    E. _____ Has the greatest amplitude?
    F. _____ Has a higher frequency: H2 or H4?
    G. _____ Has the fastest wave speed?

17. Why is the fundamental frequency called the natural frequency?

18. How many antinodes is the fundamental?

19. How many wavelengths long is the fundamental?

20. What is the wavelength of the fundamental on a 15 cm string?



21. When a ruler is pulled down and released, it vibrates.
    A. Which harmonic is this?
    B. Mark the nodes and antinodes.
    C. How many wavelengths is it?

    D. If the end of the table is at 25 cm on the ruler, what is λ for this wave?