# 2009-10 PreAP Harmonic Motion 4

1. To double the period of a pendulum, by what factor does its length need to be changed?

2. If a spring-mass system has its mass halved and its spring constant tripled, by how much does the spring's period change?

3. A pendulum has a period of 0.72 seconds on the earth (use 9.8). On planet Zorg it has a period of 0.55 seconds. What is the acceleration due to gravity on Zorg?
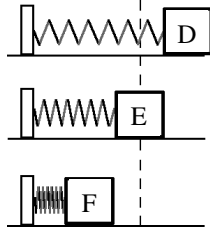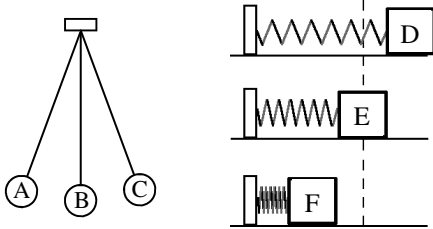
	Pendulum	Spring
PE = max	A, C	D, F
PE = min		
KE = max		
KE = min		
v = 0		
v = max		
acc = max		
acc = 0		
F = max		
F = 0		

4. Use the pictures of the pendulum and spring-mass system shown at the left. Fill in the table, deciding at which position (or positions) the conditions exist. The first one is done for you. The pendulum and spring do not stop.

5. Which harmonics are possible?
   A. On a string _____?
   B. In a closed pipe _____?
   C. In an open pipe _____,

6. What are the wavelengths of the first four harmonics on a 1.2 m long string?

7. What are the frequencies of the first two possible harmonics on a 30 cm closed pipe. Use 343m/s for the speed of sound in air.

704 Hz

12 cm
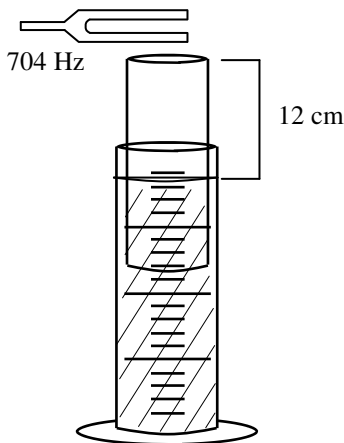
8. A graduated cylinder has water in it almost to the top. A smaller tube of glass is set inside. A tuning fork is struck and it is put above the movable tube. The inside tube is adjusted until the tube amplifies the sound of the tuning fork.
   A. The inside tube gets loud due to r_____.
   B. Is the inside tube open at both ends or is it closed at one end (to the air)?
   C. Is the amount of the wave in the cylinder 1/2 or 1/4 of λ?

   D. What is the wavelength of the harmonic produced in the tube?

   E. Since you know the wavelength and the frequency, calculate the speed of sound in air for this room at this time.

9. Fill in the table for the first harmonic (fundamental frequency) of each situation.

   p. 482—*Be sure to read to read about speed of sound at the bottom and read the table*.

10. Which has a faster speed of sound?
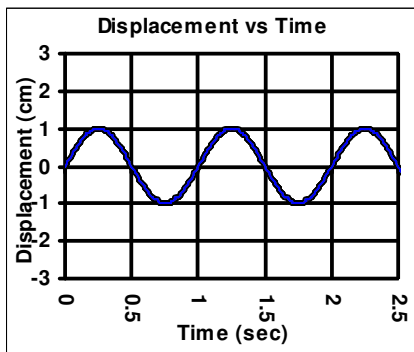   A. Air or helium?
    B. Air or steel?

	string	open pipe	closed pipe
Draw the first harmonic			
# of nodes			
# of antinodes			

11. A sound source generates 0.75 W of power.
    A. What is the intensity of the sound 20 meters away?

    B. How many decibels is that (use the book)?
    C. What is the intensity of the same source, 40 meters away?

    D. By what factor would the intensity change if the distance is four times as great?

12. If a sound increases by 30 dB, by how much does the intensity change?

    From the notes "Ancillary Sound Topics".
13. What are beats and how are they created?

14. Two notes vibrate with frequencies of 125 Hz and 123 Hz, how many beats are heard?

15. If one note has a frequency of 350 Hz and 3 beats per second are heard, what frequency is the other note?

16. A clarinet and a trumpet can play the same note, but you hear them as different. Explain and use the correct vocab word.
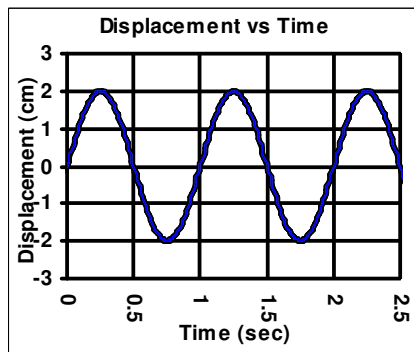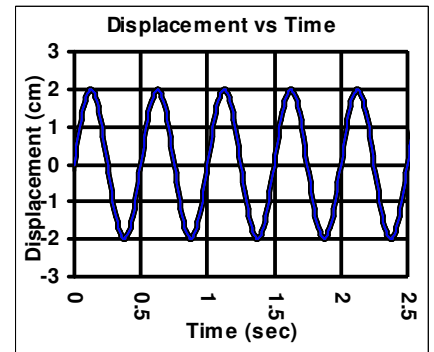
Graph A: Amplitude: _____   **Graph B:** Amplitude: _____   **Graph C:** Amplitude: _____

Period: _____   Period: _____   Period: _____

Spring _____ Pendulum _____   Spring _____ Pendulum _____   Spring _____ Pendulum _____

Spring A; k = 40 N/m

Spring B; k = 20 N/m

Spring C; k = 20 N/m

A   30°   B   C   15°   30°
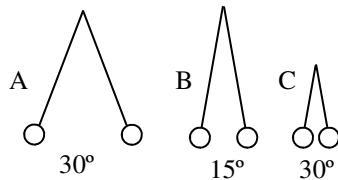
17. A. Find the amplitude and period for each of the graphs above.

    B. Which graph has an amplitude different than the others?
    C. Which spring has an amplitude different than the others?
    D. Which pendulum an amplitude different than the others?
    E. Using this same logic, decide which graph

belongs to which pendulum or spring.

18. Two pulses waves are sent toward each other on a slinky as shown above.
    A. What will happen when they cross?

    B. What is this called?

19. What will happen to the amplitude of the two pulses shown above when they cross?

20. If the pulse on the right is reflected from the right, is the right side of the slinky fixed or movable?