

B-Day: Due Fri., Apr 9  
 A-Day: Due Mon., Apr. 12

# 2009-10 Harmonic Motion 9 Test Review

$$\text{per (sec)} T = 2\pi \sqrt{\frac{l}{g}}$$

$$\text{per } T = 2\pi \sqrt{\frac{m}{k}}$$

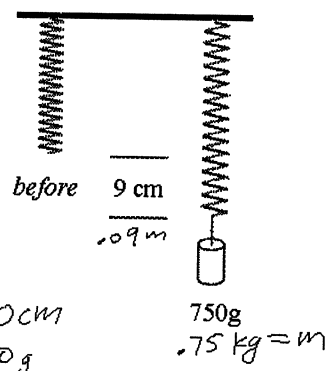
$$\text{vel. } v = f\lambda$$

$$F = -kx$$

$$S = \frac{D}{T}$$

From the "Harmonic Motion Basics" Table:

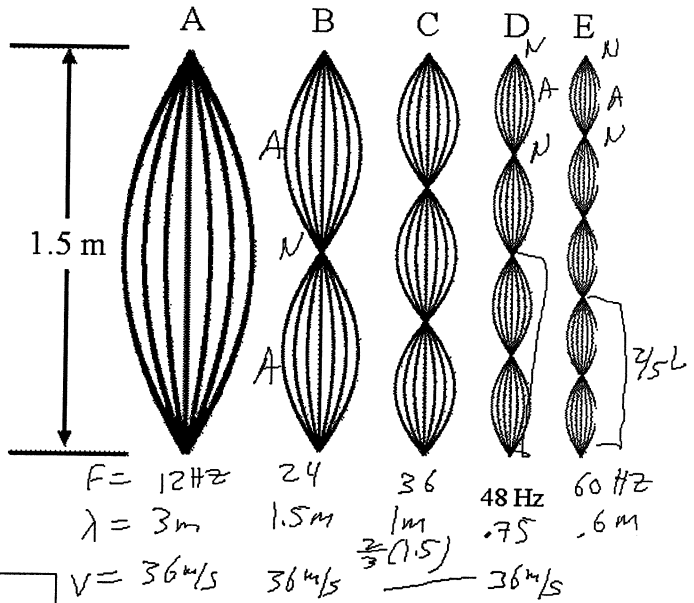
- Which equation do you use? (May be used more than once.)
  - 2 Find the period of a spring given the mass and spring constant.
  - 6 Find how far a wave travels in a 8 seconds.
  - 4 Calculate the period of a spring that has a frequency of 10 Hz.
  - 1 Calculate the length of a pendulum that has a period of 0.5 seconds.
  - 3 Calculate the wavelength of a 20 Hz wave.
  - 5 Find the spring constant of a spring given the force and how far it stretches.
  - 4 Find the frequency of a sound wave, given the period.



- A 750 g mass is attached to a spring. The spring stretches 9 cm.
  - On the diagram, change the numbers to standard units.
  - How much **force** is pulling down on the spring?  
 $F_w = mg = .75(10) = 7.5 N$
  - By Newton's 3rd Law, with how much force is the spring pulling up?  $7.5 N$
  - How far is the spring stretched?  $.09m$
  - Calculate the spring constant of the spring.  
 $F = -kx$   
 $7.5 = -k(.09)$   
 $k = \frac{7.5}{.09} = 83.3 \frac{N}{m}$   
-2w -4bl -1units
- What is the period of a pendulum that is 55 cm long?  
 $T = 6.28 \sqrt{\frac{.55}{10}} = 1.47 sec$   
-2w -4bl.

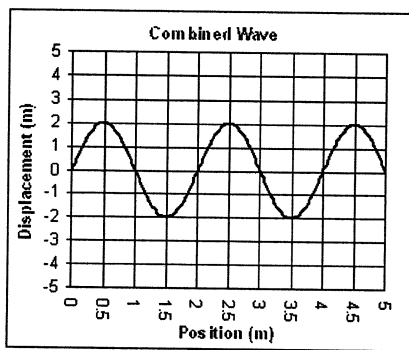
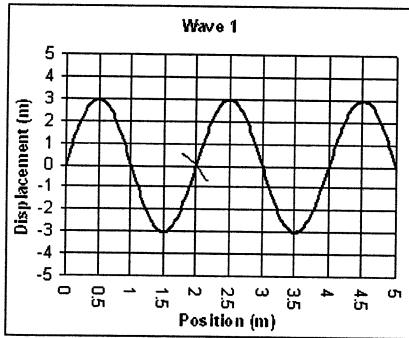
From "Standing Waves"

- Which harmonic is 2.5 wavelengths long? 5
- Which harmonic has the fastest wave speed? same
- Which harmonic has 5 nodes? 4
- What is the natural frequency for this string? 12 Hz
- What is the wavelength of the fundamental frequency?  
 $2L = 3m$
- What is the wavelength of the 3rd harmonic?  $\frac{2}{3}L = \frac{2}{3}(1.5) = 1m$
- What is the frequency of H<sub>3</sub>?  $12(3) = 36 Hz$
- What is speed of the third harmonic?  
 $1(36) = 36 m/s$   
-2w -4bl.
- What is the speed of the 4th harmonic?  
 $48(\frac{1}{2}1.5) = 36 m/s$



From "Wave Interactions":

- The superposition principle is how we add the energy of waves together. Wave 2 is not shown.
  - What must Wave 2's amplitude be?  
 $-1m$
  - Is Wave 2 in phase or out of phase with Wave 1?  
 cause it decreased 1's ampl.
  - Wave 1's wavelength =  
 $2m$



From "Sound"

6. Which has a lower frequency (smaller number): a high note or a low note?
7. Which has a longer wavelength: a high note or a low note?
8. A louder note has more or less amplitude than a quiet note?
9. We hear 10 more decibels as: *twice as loud*
10. Is sound faster in gases or solids? In elastic substance (springy) or inelastic?
11. What is faster: sound or light?

From "Ancillary Sound Topics"

12. A gun is fired in a cave. The echo returns in 1.8 seconds. How deep is the cave?
13. A 560 Hz sound and a 555 Hz sound are played together.
  - A. How many beats are heard each second?
  - B. If the frequencies get closer are there more beats or less beats per second?
  - C. What causes the beats?
14. A clarinet and a trumpet can be playing the same notes, but they sound different because they have different timbres. This is because the actual sounds are made up of different amounts of different harmonics.

$$S = \frac{2D}{T}$$

$340 = \frac{2(D)}{1.8}$       - (units)  
 $340(1.8) = 2D$       - 2w  
 $D = 306m$       - 4bl.

Just as velocity is in m/s (meters divided by seconds) and frequency is in cycles/sec (cycles divided by sec), wavelength is in meters for each wave OR # meters/# of waves (cycles).

15. A. How long is the graph? *2m*
- B. How many wavelengths are shown? *2.5λ*
- C. Calculate the wavelength of the wave.

$$2.5\lambda = 2m$$

$$\lambda = \frac{2}{2.5} = .8m$$

*-2w  
-4bl.*

And do the TAKS homework.

