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DUE Mon, Oct 28, 2013 at 22:00

1. [1pt]
The figure below shows a transverse standing wave on a string. Assume that \( x_1 = 2.80 \text{ cm} \), \( x_2 = -2.80 \text{ cm} \), \( L_1 = 1.79 \text{ cm} \), \( L_2 = 3.58 \text{ cm} \), \( L_3 = 5.37 \text{ cm} \) and \( L_4 = 7.16 \text{ cm} \).

What is the wavelength of the standing wave?

Correct, computer gets: 7.16 cm

What is the position of the first antinode?

Correct, computer gets: 1.79 cm

3. [1pt]
Consider the vibrating string shown below for the next two questions.

In which harmonic is the string vibrating?

A) 14th  
B) 7.5th  
C) 7th  
D) 6th

Correct, computer gets: C

4. [1pt]
How many wavelengths are represented here?

A) 3 1/2
B) 14
C) 1
D) 7

Correct, computer gets: A

5. [1pt]
If we increase the tension of a guitar string, what effect does this have on the frequency and wavelength of the fundamental standing wave formed on that string?

A) If it is an expensive guitar, both the frequency and the wavelength stay the same.
B) Increasing tension increases the speed of the wave. Because wave speed is frequency times wavelength, both frequency and wavelength increase.
C) Increasing tension increases the speed of the wave. The wavelength of the fundamental does not change, thus the frequency increases.
D) Increasing tension increases the speed of the wave. The frequency of the fundamental does not change, thus the wavelength increases.

A stays same so if \( v \) goes up

\[ v = f \lambda \]
\( \varepsilon \) has to go up too

Correct, computer gets: C

6. [1pt]
A string fixed at both ends is 4.2 m long. It resonates in its second harmonic at a frequency of 52 Hz. What is the speed of transverse waves on the string? Hint: First think about how the length of the string and wavelength are related.

2nd harmonic means \( L = \lambda \)

so \( v = f \lambda = (52 \text{ Hz})(4.2 \text{ m}) = 218 \text{ m/s} \)

Correct, computer gets: 218.400 m/s

7. [1pt]
A string 5.5 m long and fixed at both ends is vibrating in its third harmonic. The maximum displacement of any point on the string is 5.6 mm. The speed of transverse waves on this string is 44 m/s. What is the frequency of this wave?

Correct, computer gets: 12.000 Hz

8. [1pt]
What is the wavelength of this wave?

Correct, computer gets: 3.667 m
9. [1pt]
Three successive resonance frequencies for a certain string are 342., 380., and 418. Hz. What is the fundamental frequency?

\[ f_n = n f_1 \]

so \[ f_{n+1} = (n+1) f_1 \]

Correct, computer gets: 38.0 Hz

\[ (f_{n+1} - f_n) = f_1 \]

Thus \[ f = \frac{418 - 380}{3} = 38 \text{ Hz} \]

\[ f = \frac{380 - 342}{2} = 38 \text{ Hz} \]

Hint: Think about a simple case where you have the second and third harmonics. If we take \( f_3 - f_2 = 3f_1 - 2f_1 = f_1 \).

10. [1pt]
Which harmonic is the 418 Hz resonant frequency?

\[ n = \frac{f_n}{f_1} = \frac{418}{38} = 11 \]

Correct, computer gets: 11

11. [1pt]
The Tacoma Narrows Bridge collapsed a few months after it was opened in 1940. Which of the following is the best explanation for its collapse?

A) Japanese terrorist attack leading up to World War II
B) Corrupt contractors used sub-standard materials.
C) The bridge vibrated at its resonant frequency due to the wind.
D) Cars crossing the bridge lead to standing waves that made the bridge crumble.

Correct, computer gets: C

12. [1pt]
What condition is required to make a wine glass shatter with sound?

A) The wavelength of the sound must the same as the radius of the glass.
B) The sound must be at any one of the harmonic frequencies of the glass.
C) As long as the sound is loud, any frequency will work.
D) The sound must be at the resonant frequency of vibration for the glass.

Correct, computer gets: D

13. [1pt]
You are pushing your little sister on a swing that has a length of 1.6 m. At what frequency should you supply a driving force to get the maximum displacement? Recall, maximum displacement occurs at resonance.

\[ f = \frac{1}{2\pi} \sqrt{\frac{g}{L}} = \frac{1}{2\pi} \sqrt{\frac{9.8}{1.6}} = 0.39 \text{ Hz} \]

Correct, computer gets: 0.39 Hz