Resonance and Guitar Strings

Read from **Lesson 5** of the **Sound and Music** chapter at **The Physics Classroom:**

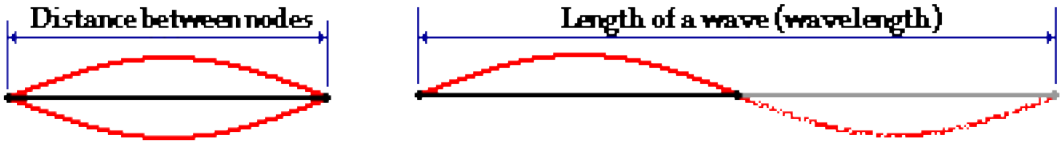
http://www.physicsclassroom.com/Class/sound/u11l5a.html
http://www.physicsclassroom.com/Class/sound/u11l5b.html

MOP Connection: Sound and Music: sublevels 6 and 7

Review

1. Standing wave patterns consist of nodes and antinodes. The positions along a medium that appear to be stationary are known as _____. They are points of **no di**splacement. The positions along a medium that are undergoing rapid motion between a maximum positive and maximum negative displacement are known as _____. They are the **opposite of** the points of **no di**splacement.

2. Use the diagram below to compare the distance between two adjacent nodes on a standing wave pattern and the wavelength of a wave. Write a sentence comparing these two distances.



Resonance in Strings:

3. Draw the standing wave patterns for the first five harmonics and complete the equations.

Harmonic #	Standing Wave Pattern	λ ---> L	L ---> λ
1		L = _____ λ	λ = _____ L
2		L = _____ λ	λ = _____ L
3		L = _____ λ	λ = _____ L
4		L = _____ λ	λ = _____ L
5		L = _____ λ	λ = _____ L

4. Determine the wavelength of the ...

a. ... wave in this 1.3-meter long string. 	b. ... wave in this 85-cm long string. 
c. ... first harmonic wave pattern for a 78.5-cm long guitar string.	d. ... fifth harmonic wave pattern for a 1.05-m long guitar string.

Use the wave equation and your standing wave patterns to solve the following problems. **PSYW**

5. A guitar string with a length of 80.0 cm is plucked. The speed of a wave in the string is 400. m/sec. Calculate the frequency of the first harmonic. **PSYW**

6. Calculate the frequency of the second and third harmonic for the string in question #5. **PSYW**

7. A pitch of Middle D (first harmonic = 294 Hz) is sounded out by a vibrating guitar string. The length of the string is 70.0 cm. Calculate the speed of the standing wave in the guitar string. **PSYW**

8. A frequency of the first harmonic is 587 Hz (pitch of D_5) is sounded out by a vibrating guitar string. The speed of the wave is 600. m/sec. Find the length of the string. **PSYW**

9. A rope is vibrating in such a manner that three equal-length segments are found to be vibrating up and down with 321 complete cycles in 20.0 seconds. Waves travel at speeds of 26.4 m/s in the rope. What is the length of the rope? **PSYW**

