Standing Waves

$$f = \frac{1}{T} \qquad v = f\lambda \qquad L = \frac{n\lambda}{4}$$

2.56 m

1. If this standing wave is 3.2 m long, what is the wavelength?

0.45 m
297.8 Hz

2. If this standing wave is 0.45 m long, what is the wavelength? If the wave speed is 134 m/s, what is the frequency?

0.72 m
86.4 m/s

3. If this standing wave is 0.36 m long, what is the wavelength? If the frequency is 120 Hz, what is the wave speed?

9.0 m

4. If this wavelength is 12 m long, how long is this standing wave?

0.525 m
163.3 Hz

5. If this wavelength is 2.1 m, how long is this standing wave? If the wave speed is 343 m/s, what is the frequency?

0.90 m
93.6 m/s

6. If this wavelength is 1.8 m, how long is this standing wave? If the frequency is 52 Hz, what is the wave speed?

0.34 m
1008.8 Hz
2017.6 Hz
3026.5 Hz

7. A pennywhistle is a both ends open pipe. If the standing wave in the pipe is 17 cm long, what is the wavelength and frequency of the fundamental mode of vibration, and what is the frequency of the next two modes of vibration? (Use 343 m/s as the waves speed)

0.66 m
290.4 m/s
880 Hz
1320 Hz

8. A violin has a 33 cm long string, and is tuned to A 440 Hz. (The fundamental frequency is 440 Hz, and it is a both ends fixed standing wave) What is the wavelength of the fundamental? What is the speed of waves along the string? What are the next two frequencies possible?

1.25 m
192 Hz
320 Hz

9. An organ pipe is being designed to make a fundamental tone of 64 Hz. If the speed of sound is 320 m/s inside the pipe, and the pipe is a one end open and one end closed pipe, what length should it be? What are the next two frequencies it can make?

0.423 m
0.634 m
930.7 Hz

10. A horn is a both ends open pipe. If the third harmonic has a frequency of 698 Hz, and sound has a speed of 295 m/s inside the pipe, what is the wavelength of the sound in the horn, and what is the length of the standing wave in the horn? What is the next higher frequency it can generate?

1492.3 Hz

11. A guitar has a wave speed of 485 m/s in its string, and a string length of 65 cm. What is the frequency of the fourth harmonic on this string?

0.329 m
1305 Hz

12. What length should a panpipe be (one end open, one end closed) if it is to create a fundamental tone of 261 Hz (middle C)? Use 343 m/s as the speed of sound in the pipe. What is the frequency of the third harmonic?

Calculate the missing quantity below. L is the length of the waveform (the picture), λ is the wavelength.

	a	b	c	d
B1	 L = 193 cm, λ = ? (386 cm)	 L = 5.76 m, λ = ? (23.0 m)	 λ = 24.0 cm, L = ? (36.0 cm)	 λ = 65.0 cm, L = ? (81.3 cm)
B2	 L = 215 cm, λ = ? (215 cm)	 L = 4.32 m, λ = ? (5.76 m)	 λ = 24.0 cm, L = ? (24.0 cm)	 λ = 2.70 m, L = ? (4.05 m)
B3	 L = 73.0 cm, λ = ? (58.4 cm)	 L = 3.82 m, λ = ? (2.55 m)	 λ = 93.5 cm, L = ? (187 cm)	 λ = 2.40 m, L = ? (2.40 m)
B4	 L = 16.1 cm, λ = ? (9.20 cm)	 L = 3.45 m, λ = ? (1.725 m)	 λ = 183 cm, L = ? (91.5 cm)	 λ = 1.80 m, L = ? (1.35 m)
B5	 L = 32.5 cm, λ = ? (14.4 cm)	 L = 5.31 m, λ = ? (2.12 m)	 λ = 63.0 cm, L = ? (158 cm)	 λ = 72.0 cm, L = ? (108 cm)

(These are just more practice problems if you are having a hard time with calculating L or λ)

More hard word problems without pictures:

13. Draw the third harmonic (The third lowest tone it can make.) of a both ends open pipe. If the speed of sound is 323 m/s, and the pipe is 57.5 cm long, what is the frequency of this harmonic? (843 Hz)
14. Draw the first harmonic (The lowest tone it can make.) of a tightly stretched string. If the string is 29.8 cm long, and the frequency of this harmonic is 322 Hz, what is the wave speed on the string? (192 m/s)
15. Draw the third possible harmonic (The third lowest tone it can make.) of a one end fixed, one end open pipe. If the pipe is 34.1 cm long, and this harmonic has a frequency of 1092 Hz, what is the speed of sound in the pipe? (298 m/s)
16. Draw the first harmonic (The lowest tone it can make.) of a both ends open pipe. If the speed of sound is 310. m/s, and the pipe is 42.1 cm long, what is the frequency of this harmonic? (368 Hz)
17. Draw the third harmonic (The third lowest tone it can make.) a guitar string. If this harmonic has a frequency of 864 Hz, and the string is 68 cm long, what is the speed of the waves in the string? (392 m/s)
18. What is the fifth harmonic (The fifth lowest tone it can make) of a 45.0 cm long panpipe? (one end fixed) if the fundamental is 180. Hz? (1620 Hz)