

W9.02**More sound questions to think about.**

1. Draw a transverse wave. Identify these parts of a wave: amplitude, crest, trough, wavelength, node, antinode.
2. How does the speed of a wave relate to its frequency and wavelength?
3. As the frequency of sound increases, does the wavelength increase or decrease? What happens to the wave speed?
4. What is the source of sound?
5. Distinguish between transverse and longitudinal wave.
6. Distinguish between constructive and destructive interference.
7. When a wave source moves towards a receiver, does the receiver encounter an increase in wave frequency, wave speed, or both?
8. A fire engine has a siren with frequency 500 Hz. What frequency is heard by a stationary observer when the engine moves towards him at 12 m/sec? When it moves away from him at 12 m/sec?
9. A latecomer to a concert hurries down the aisle towards his seat so fast that the middle C (262 Hz) appears 1 Hz higher in frequency. How fast is he going?
10. What is a sonic boom? How fast must an aircraft be flying in order to produce a sonic boom?
11. A note with frequency of 120 Hz is played in a pipe with two open ends in air. Assume that this is the first harmonic. Find the length of the pipe. What is the wavelength of the second harmonic?
12. A note is played in a 0.1-m pipe with one open end in air. What is the frequency of the wave?
13. The sound speed in helium is approximately 970 m/sec. Explain why a person's voice changes if they inhale helium.
14. Suppose three tuning forks of frequency 260 Hz, 262 Hz, and 266 Hz are available. What beat frequencies are possible for pairs of forks sounded together?
15. Suppose a piano tuner hears 2 beats per second when listening to the combined sound from her tuning fork and the piano note being tuned. After slightly tightening the string, she hears 1 beat per second. Should she loosen or should she further tighten the string?

16. You watch a distant farmer driving a stake into the ground with a sledge hammer. He hits the stake at a regular rate of one strike per second. You hear the blows exactly synchronized with the blows you see. And then you hear one more blow after he stops hammering. How far away is the farmer?
17. If the handle of a tuning fork is held solidly against a table, the sound becomes louder. Why? How will this affect the length of the time the fork keeps vibrating? Explain using the law of conservation of energy.
18. If one wants to increase the speed of sound in a stretched string, what should they do?
19. Two waves meet at a time when one has the instantaneous amplitude A and one has the instantaneous amplitude B. What is their combined amplitude?
20. A stretched wire 1 m long has a fundamental frequency of 220 Hz. What is the speed of sound in the string?
21. A string 180 cm long has a fundamental frequency of vibration of 300 Hz. What is the length of a similar string with the same tension that has a fundamental frequency of 200 Hz?
22. Wave crests in a lake are 5 m apart. They pass an anchored boat every 2 seconds. What is the speed of the wave?
23. A boat at anchor is rocked by waves whose crests are 40 m apart and whose speed is 10 m/sec. How often do these waves reach the boat?
24. For a sound, what does the term “intensity” mean?
25. If you stand in front of a speaker at a rock concert, the sound intensity level is 120 dB. This sound intensity level is painful. In order to make the sound less intense (and so less painful), what should you do?
26. How many times more intense is a 90-dB sound than a 40-dB sound?
27. How many times less intense is a sound at 50 m than 5 m?
28. Ten oboes produce a sound intensity level of 50 dB in a concert hall. What number of oboes needed to produce a level of 60 dB?
29. A chorus of 100 voices is singing at a sound intensity level of 70 dB. If all of the voices have the same sound intensity level, what is it?
30. The intensity of a cat’s purr is $1.0 \times 10^{-10} \text{ W/m}^2$ at 2 m. What is the intensity level of the sound in dB at this distance? How far away can a normal person hear the purr?