20 Sound

Solutions to Chapter 20 Exercises

2. Sound does not travel in a vacuum.

8. The wavelength of sound from Source A is half the wavelength of sound from Source B.

10. Letting $v = f\lambda$ guide thinking, as frequency increases wavelength decreases.

16. The fact that we can see a ringing bell but can't hear it indicates that light is a distinctly different phenomenon than sound. When we see the vibrations of the "ringing" bell in a vacuum, we know that light can pass through a vacuum. The fact that we can't hear the bell indicates that sound does not pass through a vacuum. Sound needs a material medium for its transmission; light does not.

21. Sound travels faster in warm air because the air molecules that compose warm air themselves travel faster and therefore don't take as long before they bump into each other. This lesser time for molecules to bump against one another results in faster sound.

46. Waves of the same frequency can interfere destructively or constructively, depending on their relative phase, but to *alternate* between constructive and destructive interference, two waves have to have different frequencies. Beats arise from such alternation between constructive and destructive interference.

49. The possible frequencies are 264 + 4 = 268 Hz, or 264 – 4 = 260 Hz.

Chapter 20 Problem Solutions

1. Wavelength = speed/frequency = $\frac{340 \text{ m/s}}{340 \text{ Hz}}$ = **1 m**.

   Similarly for a 34,000 hertz wave; wavelength = $\frac{340 \text{ m/s}}{34\,000 \text{ Hz}}$ = 0.01 m = **1 cm**.

10. There are 3 possible beat frequencies: 2 Hz, 3 Hz, and 5 Hz. These are of differences in fork frequencies: 261 - 259 = **2 Hz**; 261 - 256 = **5 Hz**; 259 - 256 = **3 Hz**.