Chapter 10 HW Answers

Review Questions:

5. No, the medium does not travel with the wave. For example, when we did the "ball park wave" the wave moved from one end of the room to the other but you did not.

18. Each station has its own frequency, and the only one you here is the one that matches the natural frequency you have chosen on your radio.

24. Node: place of no vibration
Antinode: place of maximum vibration

Exercises:

2. Frequency would be half. If one quantity is doubled, the other must be halved because they are inverses of each other.

$$f = \frac{1}{T} \quad \rightarrow \quad f = \frac{1}{(2T)}$$

8. Bats hear the shorter wavelengths. The smaller the frequency is the longer wavelength.

12. Light travels faster than sound, so you see the event before you hear it.

17. The Moon has no atmosphere, nothing through which sound may travel. Sound requires a medium.

24.
1) Sound cannot be heard in space.
2) It is not possible for sound and light to reach an observer at the same time. Sound and light travel at very different speeds.

37.
a. Frequency will increase when the train moves toward you.
b. The wavelength will decrease (shorten) when the train moves toward you.
c. The speed of the sound will not change.

38. No, if the listener has the same motion as you, there is no Doppler shift, so there is no apparent change in the frequency.

Problems:

3. f = 2.45 GHz = 2.45×10^9 Hz

v = velocity of light = 3×10^8 m/s

$v = f\lambda$

$$\lambda = \frac{v}{f} = \frac{3 \times 10^8 \text{ m/s}}{2.45 \times 10^9\text{/s}} = \mathbf{0.012\ m}$$

6. $t = 0.1$ sec for round trip

$t = 0.05$ sec from bat to cave wall

$v = 343$ m/s average speed of sound in air

$s = \frac{d}{t}$ general equation for speed

$d = st = (343 \text{ m/s})(0.05 \text{ s}) =$ **17 m**

<u>Additional:</u>

A. There are 101.7 million vibrations each second.

101.7 MHz = $\mathbf{101.7 \times 10^6}$ **cycles/sec**

B. The incoming wave frequency must match the natural frequency of the material.

C. $f = 256$ Hz = 256 cycles/sec

The frequency and period are related by the equation…

$$f = \frac{1}{T}$$

$$T = \frac{1}{f} = \frac{1}{256\text{ /s}} = \mathbf{3.9 \times 10^{-3}\ seconds}$$

The wavelength can be found from the equation…

$v = f\lambda$

$$\lambda = \frac{v}{f} = \frac{343 \text{ m/s}}{256\text{ /s}} = \mathbf{1.33\ m}$$

D. **answer c**
The compression and rarefaction produced by the shock must have time to travel down to you.