PHYSICS IN MOTION
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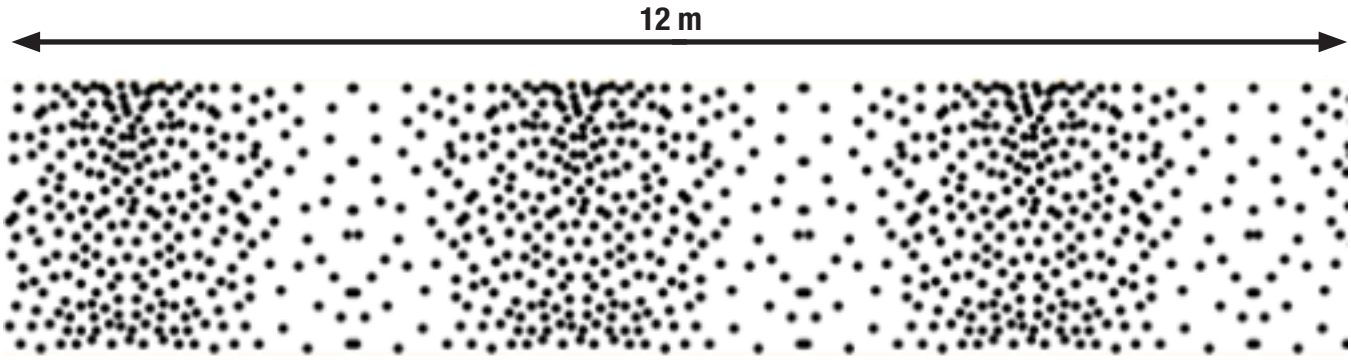
# Unit 6B
# Sound Waves
## *Practice Problems TEACHER*

**Work each of the following problems. SHOW ALL WORK.**

1. **Determine the wavelength of the longitudinal wave below:**




*The wavelength of a longitudinal wave consists of one compression region plus one rarefaction region.*

*In the diagram above, there are three of each of these regions;*

*therefore, the wavelength is the total length divided by three, which is 4 m.*

2. **A sound wave is determined to have a frequency of 1,000 Hz and a wavelength of 35 cm. What is the speed of this wave?**

$$v = \lambda f$$
$$v = (0.35\ m)(1000\ Hz)$$
$$v = 350\ {}^{m}/_{s}$$

3. **If the sound wave in the previous question is measured in air, what is the temperature of the air?**

$$v_{sound} = 331\ {}^{m}/_{s} + (0.6\ {}^{m}/_{s°C})T$$
$$350\ {}^{m}/_{s} = 331\ {}^{m}/_{s} + (0.6\ {}^{m}/_{s°C})T$$
$$19\ {}^{m}/_{s} = (0.6\ {}^{m}/_{s°C})T$$
$$T = 31.7\ °C$$

4. **What is the speed of sound in air with a temperature of 25 °C?**

$$v_{sound} = 331\ {}^{m}/_{s} + (0.6\ {}^{m}/_{s°C})T$$
$$v_{sound} = 331\ {}^{m}/_{s} + (0.6\ {}^{m}/_{s°C})(25\ °C)$$
$$v_{sound} = 331\ {}^{m}/_{s} + 15\ {}^{m}/_{s}$$
$$v_{sound} = 346\ {}^{m}/_{s}$$

**questions continued on next page**

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**Work each of the following problems. SHOW ALL WORK.**

5. **The hottest recorded temperature in United States history is 134 °F, which is 57 °C. What is the speed of sound at this temperature?**

$$v_{sound} = 331\,{}^{m}\!/_{s} + (0.6\,{}^{m}\!/_{s^{\circ}C})\,T$$
$$v_{sound} = 331\,{}^{m}\!/_{s} + (0.6\,{}^{m}\!/_{s^{\circ}C})(57\,^{\circ}C)$$
$$v_{sound} = 331\,{}^{m}\!/_{s} + 34.2\,{}^{m}\!/_{s}$$
$$v_{sound} = 365.2\,{}^{m}\!/_{s}$$

6. **The human range of hearing is between 20 and 20,000 Hz. What is the corresponding range in wavelengths for sound in air at 25 °C?**

$$v = \lambda f$$
$$346\,{}^{m}\!/_{s} = \lambda\,(20\,Hz)$$
$$\lambda = 17.3\,m$$

$$v = \lambda f$$
$$346\,{}^{m}\!/_{s} = \lambda\,(20\,000\,Hz)$$
$$\lambda = 0.017\,m$$

7. **The speed of sound in water is 1,500 m/s. What is the wavelength of a sound wave with a frequency of 15,000 Hz in water?**

$$v = \lambda f$$
$$1500\,{}^{m}\!/_{s} = \lambda\,(15\,000\,Hz)$$
$$\lambda = 0.10\,m$$

8. **How much louder is a 70 dB sound compared to a 50 dB sound?**

*Sound doubles when the decibel level increases by 10,*

*so a 70 dB sound is four times louder than a 50 dB sound.*