

## SAMPLE PROBLEM D

### Wave Speed

#### PROBLEM

A piano string tuned to middle C vibrates with a frequency of 262 Hz. Assuming the speed of sound in air is 343 m/s, find the wavelength of the sound waves produced by the string.

#### SOLUTION

**Given:**  $v = 343 \text{ m/s}$        $f = 262 \text{ Hz}$

**Unknown:**  $\lambda = ?$

Use the equation relating speed, wavelength, and frequency for a wave.

$$v = f\lambda$$

$$\lambda = \frac{v}{f} = \frac{343 \text{ m/s}}{262 \text{ Hz}} = \frac{343 \text{ m} \cdot \text{s}^{-1}}{262 \text{ s}^{-1}}$$

$$\lambda = 1.31 \text{ m}$$

## PRACTICE D

### Wave Speed

1. A piano emits frequencies that range from a low of about 28 Hz to a high of about 4200 Hz. Find the range of wavelengths in air attained by this instrument when the speed of sound in air is 340 m/s.
2. The speed of all electromagnetic waves in empty space is  $3.00 \times 10^8 \text{ m/s}$ . Calculate the wavelength of electromagnetic waves emitted at the following frequencies:
  - a. radio waves at 88.0 MHz
  - b. visible light at  $6.0 \times 10^8 \text{ MHz}$
  - c. X rays at  $3.0 \times 10^{12} \text{ MHz}$
3. The red light emitted by a He-Ne laser has a wavelength of 633 nm in air and travels at  $3.00 \times 10^8 \text{ m/s}$ . Find the frequency of the laser light.
4. A tuning fork produces a sound with a frequency of 256 Hz and a wavelength in air of 1.35 m.
  - a. What value does this give for the speed of sound in air?
  - b. What would be the wavelength of this same sound in water in which sound travels at 1500 m/s?