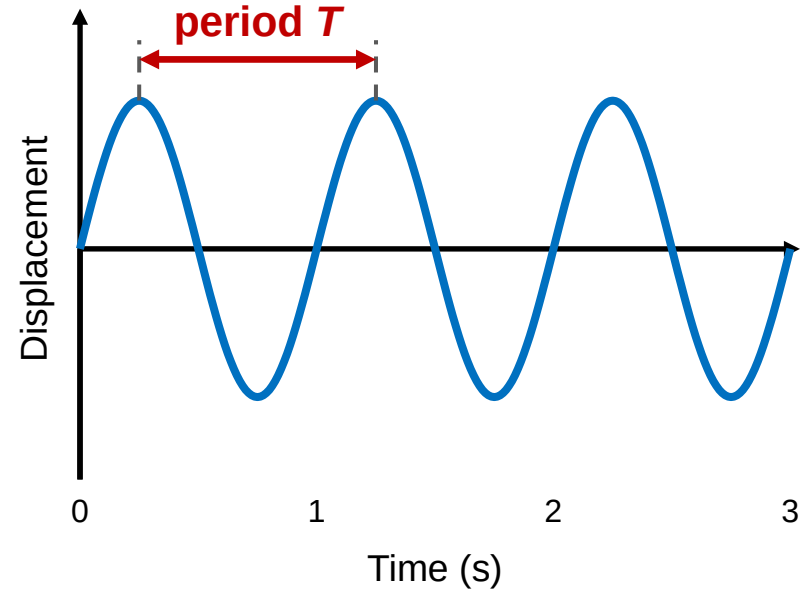


Essential Question

How fast does a wave travel?

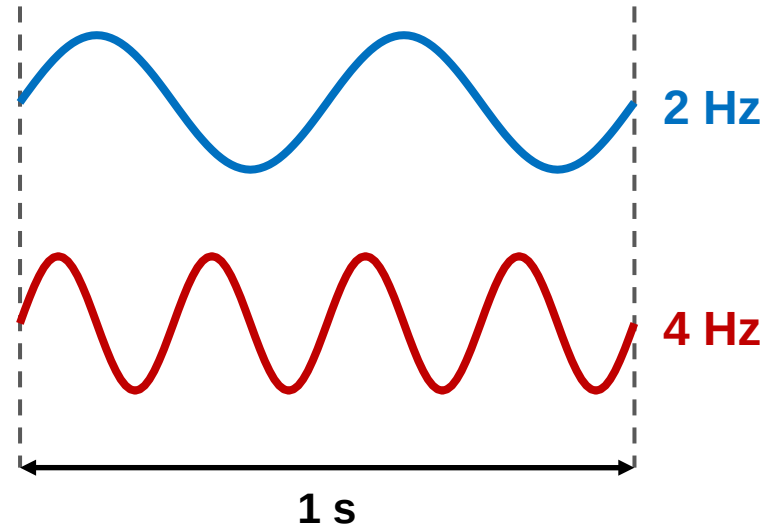
Period

- Time for one full cycle
- Symbol T
- Unit: seconds (s)



Frequency

- Cycles per second
- Symbol f
- Unit: hertz (Hz)
- 1 Hz = 1 cycle per second



more cycles per second = higher f

Frequency and Period Are Inverses

$$f = 1 / T$$

$$T = 1 / f$$

$$T = 2.0 \text{ s}$$
$$f = 0.50 \text{ Hz}$$

$$T = 0.50 \text{ s}$$
$$f = 2.0 \text{ Hz}$$

$$T = 0.10 \text{ s}$$
$$f = 10. \text{ Hz}$$

longer period, lower frequency

The Wave Equation

$$v = f \lambda$$

v

wave speed (m/s)

f

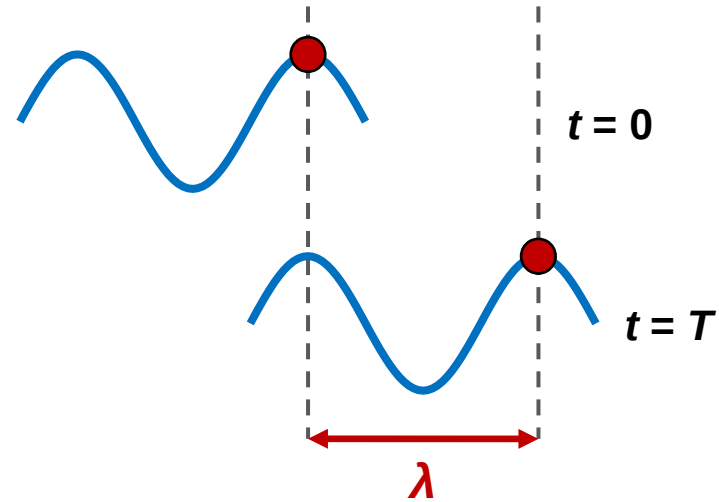
frequency (Hz)

λ

wavelength (m)

Why $v = f \lambda$

- In time T , the wave moves λ
- $v = d / t = \lambda / T$
- $1/T = f$, so $v = f \lambda$



in one period, the crest moves one λ

Speed Depends on the Medium

- The medium sets the speed
- Same medium, same speed
- Raise f , and λ gets shorter

Air: 343 m/s

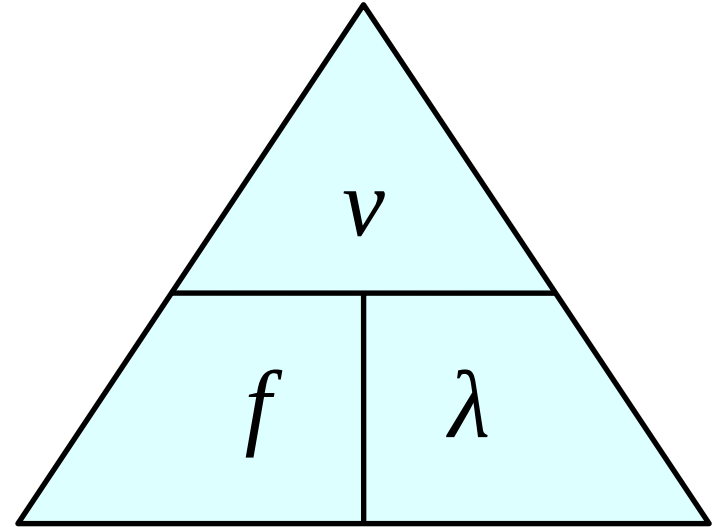
Water: about 1,500 m/s

Steel: about 5,900 m/s

speed of sound in different media

Solving for Any Variable

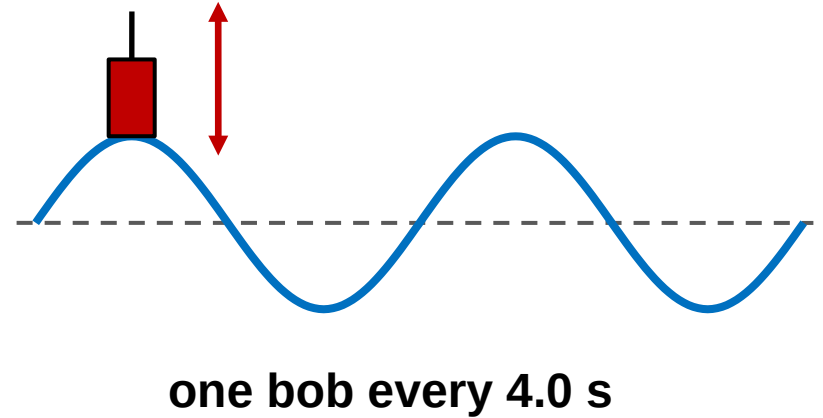
- Find speed: $v = f \lambda$
- Find frequency: $f = v / \lambda$
- Find wavelength: $\lambda = v / f$



cover the one you want

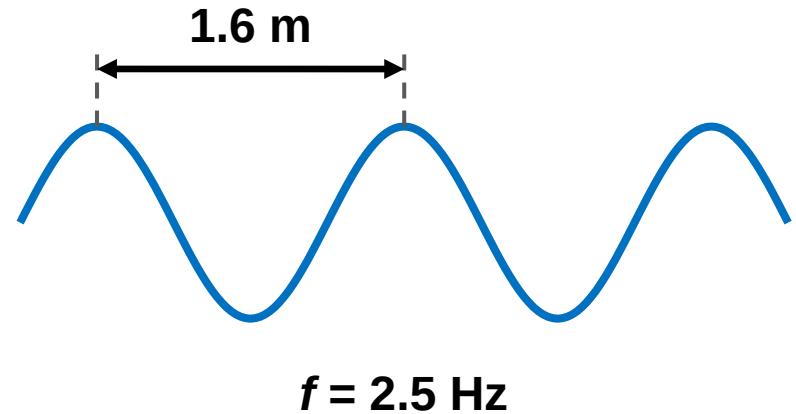
Example: Bobbing Buoy

A buoy bobs up and down once every 4.0 s as waves pass. What is the frequency of the waves?



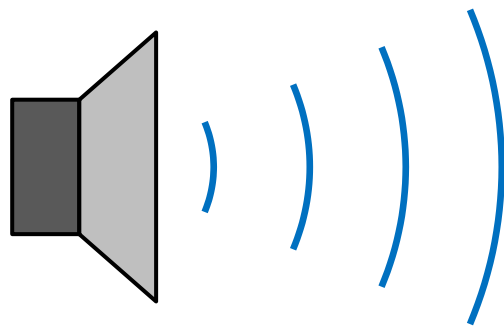
Example: Wave Speed on a Rope

You shake a rope at 2.5 Hz, and the waves have a wavelength of 1.6 m. How fast do the waves travel along the rope?



Example: Wavelength of a Sound

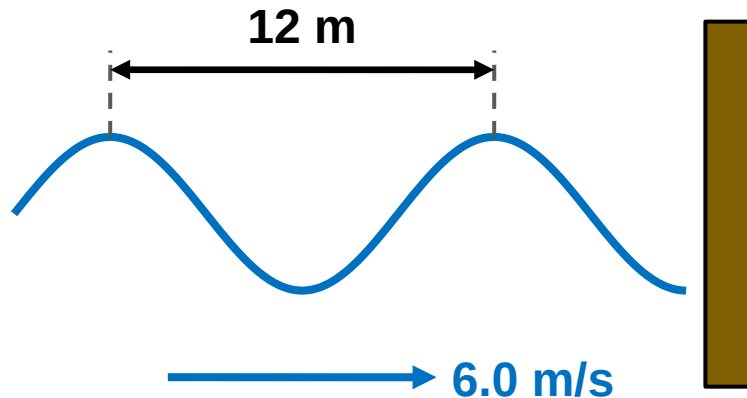
A speaker plays a note at 686 Hz.
Sound travels through the air at 343 m/s.
What is the wavelength of the sound?



$$f = 686 \text{ Hz}$$
$$v = 343 \text{ m/s}$$

Example: Ocean Waves

Ocean waves travel toward a pier at 6.0 m/s . The crests are 12 m apart. Find the frequency and the period of the waves.



Big Ideas

- Period T : seconds per cycle
- Frequency f : cycles per second (Hz)
- $f = 1/T$ and $v = f \lambda$
- The medium sets the wave speed