Wave Properties
Video Notes

Waves are repeated and periodic disturbances in a medium that cause particles to vibrate about a fixed position. Five quantities – frequency, period, amplitude, wavelength, and speed – are commonly used to describe either the particles' motion and/or the resulting wave pattern.

Five Wave Quantities

... that either describe the particles' motion and/or the wave pattern.

Frequency
Period

Wavelength
Amplitude

Speed
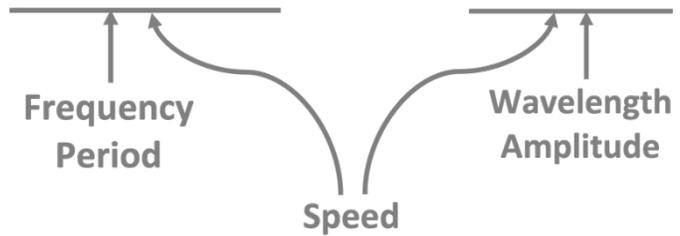
Wavelength (λ)

- the length of the repeating pattern
- measured as the horizontal distance from one crest to the next adjacent crest
- The horizontal distance between a crest and an adjacent trough is one-half wavelength

λ

½•λ
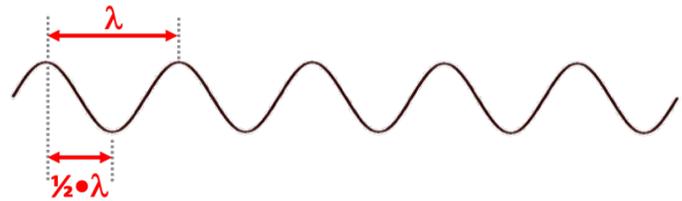
Example:

"Two boats are anchored in the harbor, separated by a horizontal distance of 35 m."

"When one boat is at its high point, the other is at its low point and there are two wave crests between them."

λ   λ   ½•λ
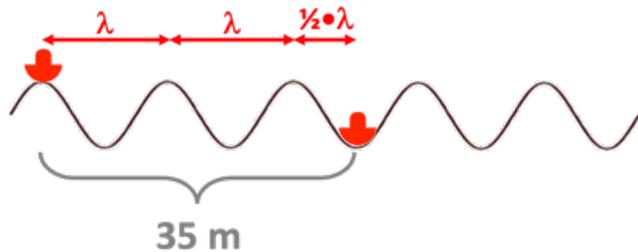
35 m

Divide both sides by 2.5

$2.5•λ = 35 \text{ m}$ ➡ $λ = 35 \text{ m}/2.5$

$λ = 14 \text{ m}$

Amplitude (A)

- The height of the wave relative to the rest or equilibrium position.
- A particle vibrates as far below the rest position as it does above it.
- Measure from rest to a high point or to a low point and not from high point to low point.

A

A

Rest Postion

Frequency (f)

- refers to **how often** the particles complete a back-and-forth vibrational cycle.
- the number of vibrations or cycles per time
- calculated by dividing the number of cycles by the time
- units = cycles/second or Hertz (Hz)

$$\text{Frequency} = \frac{\text{\# of cycles}}{\text{time}}$$

Example:

"Each boat makes exactly 5 complete up-and-down cycles every 40.0 s." ➡ $f = \dfrac{5 \text{ cycles}}{40.0 \text{ s}} = $ **0.125 Hz**

Period (T)

- refers to **how much time** it takes a particle to complete one full vibrational cycle.
- the time per cycle
- calculated by dividing the time by the number of cycles
- frequency and period are reciprocals of one another.

$$\text{Period} = \frac{\text{time}}{\text{\# of cycles}}$$

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

Example:

"Each boat makes exactly 5 complete up-and-down cycles every 40.0 s." ➡ $T = \dfrac{40.0 \text{ s}}{5 \text{ cycles}} = $ **8.0 s**

Speed (v)

- refers to **how fast** it moves
- the distance a crest travels per unit of time
- can be calculating from wavelength and frequency

$$v = f \bullet \lambda$$