Unit 8: Waves

1 - Waves

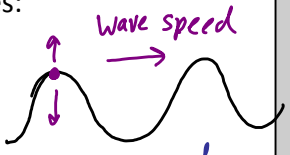
A **wave** is... disturbance or vibration that transmits energy but not matter.

Ex. Sound, light, radiowaves, earthquakes

There are 3 types of mechanical waves:

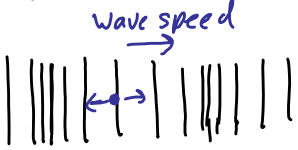
(1) Transverse

Particles move perpendicular to wave motion



(2) Longitudinal

Particles move parallel to wave motion.



(3) Surface

Combination of transverse and longitudinal

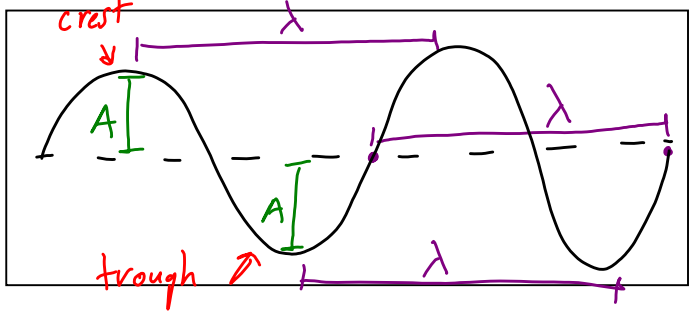
Medium: material that wave travels through

Crest: high point of wave

Trough: low point of wave

Amplitude (A): Max displacement from rest

Wavelength (λ): distance travelled by a single wave



Period (T): time for one complete cycle (in s)

Frequency (f): complete cycles per second (in Hz)

Frequency and period are reciprocals, that is:

$$f = \frac{1}{T} \quad \text{or} \quad T = \frac{1}{f}$$

Ex: Playing middle C on a piano produces a sound with a frequency of 256 Hz. What is the period of the sound wave?

$$T = \frac{1}{f} = \frac{1}{256\,Hz} = 0.00391\,s$$

Remember that speed is:

$$v = \frac{d}{t}$$

If we look a single wave then:

(1) The distance travelled is one wavelength, λ

(2) The time is one period, T

This gives us the **Universal Wave Equation**:

$$v = \lambda f$$

Where:

v = speed

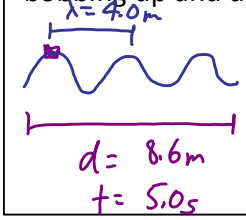
λ = wavelength

f = frequency

Ex: An air horn sounds at a frequency of 220 Hz. If the speed of sound in air is 330 m/s what is the wavelength of the sound wave?

$$v = \lambda f \qquad \lambda = \frac{v}{f} = \frac{330\,m/s}{220\,Hz} = 1.5\,m$$

Ex: The distance between successive crests in a series of water waves is 4.0 m, and the crests travel 8.6 m in 5.0 s. Calculate the frequency of a block of wood bobbing up and down on these water waves.



$$v = \frac{d}{t} = \frac{8.6\,m}{5.0\,s} = 1.72\,m/s$$

$$f = \frac{v}{\lambda} = \frac{1.72\,m/s}{4.0\,m} = 0.43\,m$$