

## Waves Basics

### Definitions

Waves carry energy.

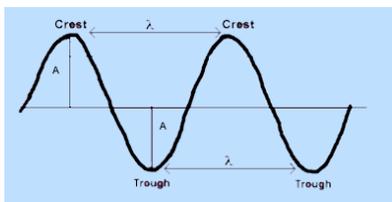
Electromagnetic waves:

- Can travel through a vacuum
- Maximum speed:  $3 \times 10^8 \text{ m s}^{-1}$
- Radio, micro, infra-red, visible, ultra-violet, X rays, gamma (Remember My Instructions Visible Under X ray Glasses)

Mechanical waves:

- Need a medium
- Water waves
- Waves made on ropes/string/springs
- Sound waves **speed:  $330 \text{ m s}^{-1}$**  in air
- Earthquakes

Useful quantities when measuring waves include wave velocity, wavelength, frequency and amplitude.



The greater the amplitude of a wave then the more energy it is carrying.

### Terms

**Amplitude (of waves):** The maximum displacement of particles of the medium from their mean positions during the propagation of a wave

**Crest:** The point of maximum positive displacement on a transverse wave

**Frequency:** The number of waves which reach an observer in one second

**Time Period (of a wave):** The time taken by a wave to travel through a distance equal to its wavelength is called its time period

**Trough:** The point of maximum negative displacement on a transverse wave is called a trough

**Wave velocity:** The distance traveled by a wave in one second

**Wavelength:** The distance between the two nearest points on a wave (two adjacent crests or two adjacent troughs)

### Equations

$v = f\lambda$	Velocity	v	$\text{m s}^{-1}$
	frequency	f	Hz
	Wavelength	$\lambda$	m
$f = \frac{1}{T}$	frequency	f	Hz
	Time period	T	s
$v = \frac{d}{t}$	velocity	v	$\text{m s}^{-1}$
	distance	d	m
	time	t	s

### Questions

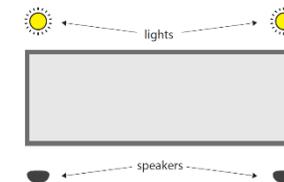
#### LIGHT WAVES AND BARRIERS (2022;2)

Helen decides to investigate wave movement and barriers. She starts by shining a purple light, with a frequency of  $7.5 \times 10^{14} \text{ Hz}$ , on the wall.

- (a) Calculate the wavelength of the purple light.

#### THE WAVE MACHINE (2020;3)

- (c) On one side of the pool there are two lights, and on the other side of the pool there are two speakers. Describe and explain the differences between the waves emitted by the lights, and the sound waves emitted by the speakers.



Your answer should include comparison of the wave type, the need for a medium, and the speed of the waves.

### Tips

- **Transverse waves** oscillate in a direction **perpendicular** to the direction of propagation of wave e.g., visible light waves.
- **Longitudinal waves** oscillate in the **same direction** as the direction of propagation of wave e.g., sound waves.

### Answers

(a)  $v = f\lambda \Rightarrow \lambda = \frac{3.00 \times 10^8}{7.5 \times 10^{14}} = 4.0 \times 10^{-7} \text{ m}$

(c)

Characteristic	Light	Sound
Speed	Faster	Slower
Type	Transverse (or EMR)	Longitudinal (or Mechanical)
Medium	Does not need a medium	Needs a medium