

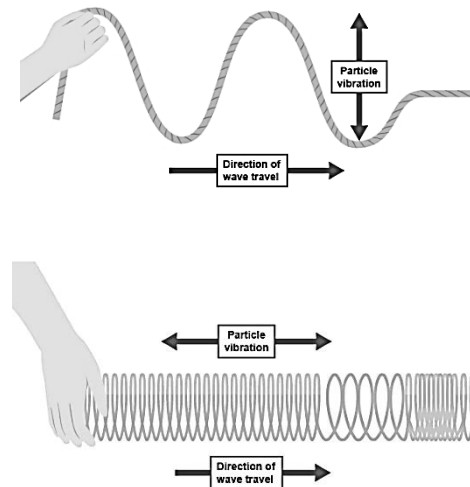
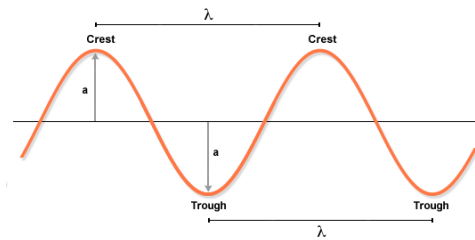
### P4: Waves

#### Lesson sequence

1. Waves
2. Wave speed
3. Core practical – investigating waves (CP13)
4. Refraction

#### 1. Waves

<b>*Waves</b>	Transfer energy without transferring matter.
<b>*Oscillate</b>	When particles vibrate backwards and forwards or up and down.
<b>*Transverse waves</b>	Waves in which particles oscillate at right angles to the direction of energy movement. E.g. water waves and light waves.
<b>*Longitudinal waves</b>	Waves in which particles oscillate parallel to the direction of energy movement. E.g. sound waves.
<b>*Medium</b>	The material that waves travel through. Light waves are the only waves that have no medium.
<b>*Seismic waves</b>	Waves of vibrating rock caused by earthquakes.
<b>*Frequency</b>	The number of waves that pass a point every second.
<b>*Hertz</b>	The unit of frequency. 1 Hz = 1 wave per second.
<b>*Period</b>	The length of time it takes for a single wave to pass.
<b>*Wavelength</b>	The distance in m from the top of one wave to the top of the next.
<b>*Amplitude</b>	The maximum distance a particle vibrates away from its resting point,
<b>*Velocity</b>	The speed of a wave in m/s.



#### 2. Wave speed

<b>*Speed, distance and time</b>	$\text{wave speed (m/s)} = \frac{\text{distance (m)}}{\text{time (s)}}$
<b>*Speed, frequency and wavelength</b>	$\text{wave speed (m/s)} = \text{frequency (Hz)} \times \text{wavelength (m)}$
<b>**Measuring wave speed</b>	Time how long they take to travel a certain distance.

**\*\*\*Changing speed** Waves travel at a different speed in a different medium. Light is slower in water than air.

#### 3. Core practical – investigating waves (CP13)

<b>*CP13 - Aim</b>	To measure the speed of waves in a liquid and a solid.
<b>*CP13 – Water waves 1</b>	<ol style="list-style-type: none"> <li>1. Count the number of waves in 10 s and use this to find the frequency.</li> <li>2. Measure the wavelength with a ruler</li> <li>3. Wave speed = frequency x wavelength</li> </ol>
<b>*CP13 – Water waves 2</b>	<ol style="list-style-type: none"> <li>1. Time how long a wave takes to pass two points, 0.3 m apart.</li> <li>2. Wave speed = dist / time</li> </ol>
<b>*CP13 - Waves in a solid</b>	<ol style="list-style-type: none"> <li>1. Hit suspended metal bar with hammer and measure the frequency using an app.</li> <li>2. Measure the metal bar – double the length gives the wavelength</li> </ol>

#### 4. Refraction

<b>Refraction</b>	Bending of waves when they enter a new medium at an angle.
<b>Interface</b>	The boundary between two media (mediums) such as air and water.
<b>Normal</b>	An imaginary line drawn at 90° to where light hits an interface (boundary).
<b>Travelling from air to glass or water</b>	Light bends towards the normal
<b>Travelling from glass or air to water</b>	Light bends away from the normal.
<b>Explaining refraction</b>	Light waves slow down as they go from air to water. The 'bottom' of the wave hits the water and slows down first, causing refraction.

