

4 Waves

4.1 Waves and Vibrations

Waves that pass through a substance are vibrations that pass through a substance, they are often referred to as **mechanical waves**. When waves progress through a substance, the particles of the substance vibrate in a certain way which makes nearby particles vibrate in the same way and so on.

- Sound waves
- Seismic waves
- Waves on strings

Electromagnetic waves are oscillating electric and magnetic fields that progress through space without the need for a substance - the vibrating **electric field** generates a vibrating **magnetic field**, which generates a vibrating electric field further away, and so on.

- Radio waves
- Microwaves
- Infrared radiation
- Light
- Ultraviolet radiation
- X-rays
- Gamma radiation

Longitudinal waves are waves which the direction of vibration of the particles is parallel to the direction in which the wave travels.

- Sound waves
- Primary seismic waves

Transverse waves are waves which the direction of vibration is perpendicular to the direction in which the wave travels.

- Electromagnetic waves
- Secondary seismic waves
- Waves on a string

Polarisation

Transverse waves are **plane-polarised** if the vibrations stay in one plane only. Otherwise if vibrations change from one plane to another, then the waves are **unpolarised**.

Longitudinal waves cannot be polarised.

- If **unpolarised light** (e.g. light from a filament lamp) passes through a **polaroid filter**, the transmitted light is polarised.
 - The filter only allow through light which vibrate in a certain direction.
 - According to the alignment of its molecules.
- If unpolarised light is passed through **two polaroid filters**, the transmitted **light intensity** changes if one polaroid is turned relative to the other one.
 - The filters are said to be **cross** when the transmitted intensity is a minimum.
 - At this position, the polarised light from the first filter cannot pass through the second filter - as the alignment of the second filter is 90° to the first.

The **plane of polarisation** of an electromagnetic wave is defined as the plane in which the electric field oscillates.

Polaroid sunglasses reduces the glare of light reflected by water or glass.

- Light reflected by water or glass is **polarised**.
- The intensity of reflected light is reduced when it passes through the polaroid sunglasses.