Transverse and Longitudinal Waves; Polarisation

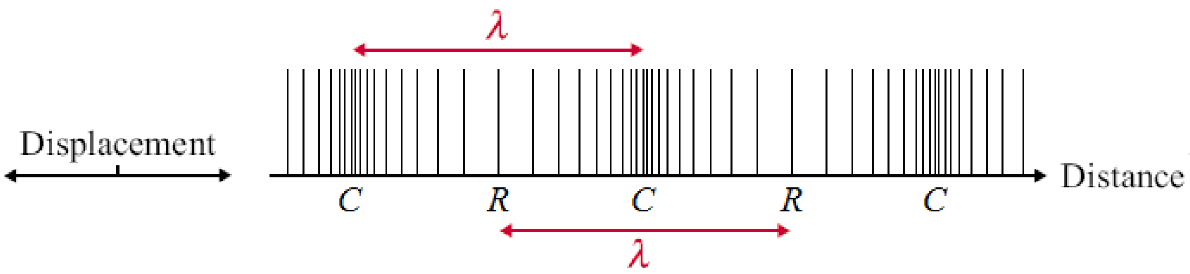
To be able explain the differences between longitudinal and transverse waves
To know examples of each
To be explain what polarisation is and how it proves light is a transverse wave

Waves

All waves are caused by oscillations and all transfer energy without transferring matter. This means that a sound wave can transfer energy to your eardrum from a far speaker without the air particles by the speaker moving into your ear. We will now look at the two types of waves and how they are different

Longitudinal Waves

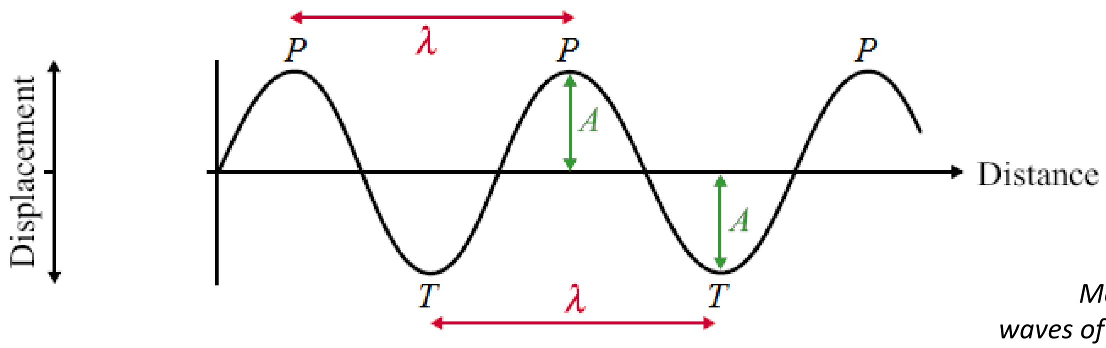
Here is a longitudinal wave; the oscillations are parallel to the direction of propagation (travel).
Where the particles are close together we call a compression and where they are spread we call a rarefaction.
The wavelength is the distance from one compression or rarefaction to the next.
The amplitude is the maximum distance the particle moves from its equilibrium position to the right of left.



<u>Example</u>:
sound waves

Transverse Waves

Here is a transverse wave; the oscillations are perpendicular to the direction of propagation.
Where the particles are displaced above the equilibrium position we call a peak and below we call a trough.
The wavelength is the distance from one peak or trough to the next.
The amplitude is the maximum distance the particle moves from its equilibrium position up or down.



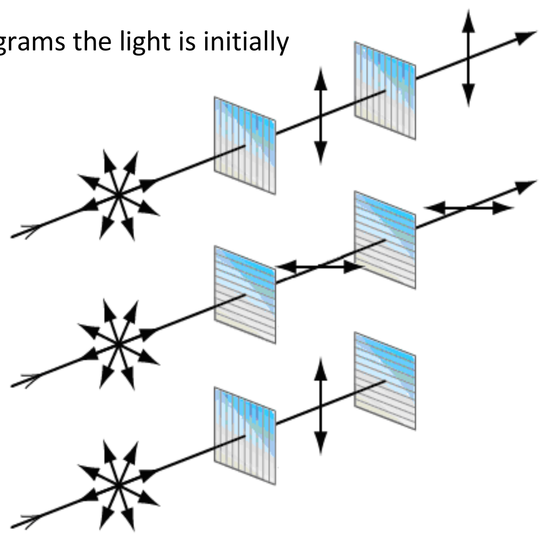
<u>Examples</u>:
water waves,
Mexican waves and
waves of the EM spectrum

EM waves are produced from varying electric and magnetic field.

Polarisation

Polarisation restricts the oscillations of a wave to one plane. In the diagrams the light is initially oscillating in all directions. A piece of Polaroid only allows light to oscillate in the same direction as it.

- In the top diagram the light passes through a vertical plane Polaroid and becomes polarized in the vertical plane. This can then pass through the second vertical Polaroid.
- In the middle diagram the light becomes polarized in the horizontal plane.



☼ In the bottom diagram the light becomes vertically polarized but this cannot pass through a horizontal plane Polaroid.

This is proof that the waves of the EM spectrum are transverse waves. If they were longitudinal waves the forwards and backwards motion would not be stopped by crossed pieces of Polaroid; the bottom set up would emit light.

Applications

TV aerials get the best reception when they point to the transmission source so they absorb the maximum amount of the radio waves.