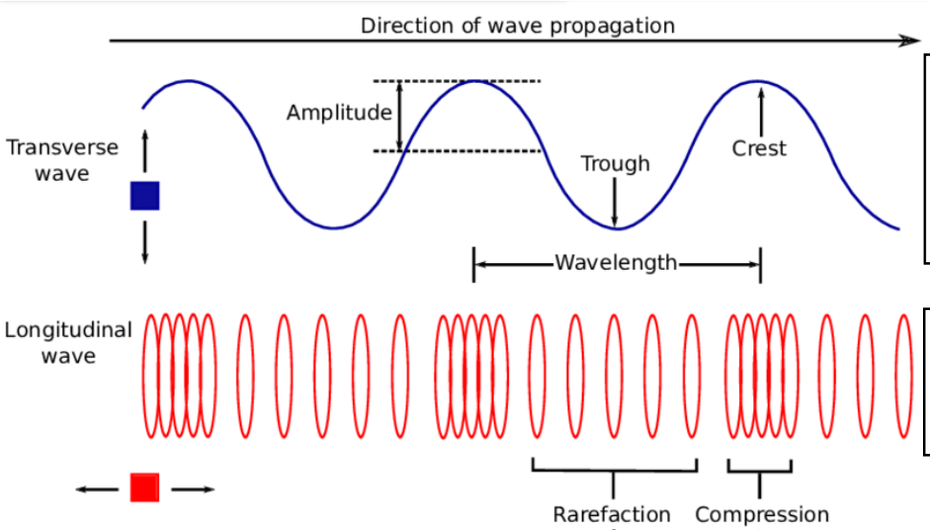
AQA - P6 Waves Combined Higher

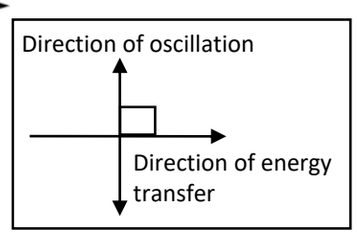
Required practical's for this topic:
1. **Ripple tank**
2. **Waves on a string**
3. **Infrared**

Properties of Waves

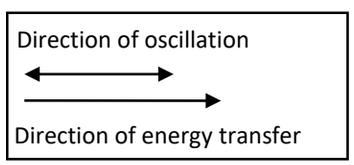
Key word	Definition/description
oscillation	Vibrating back and forth about a fixed position.
wave	The transfer of energy from one place to another without the transfer of matter.
rest position	The undisturbed position of particles when they are not vibrating.
crest (peak)	The highest point above the rest position.
trough	The lowest point below the rest position.
amplitude	The distance from the rest position to the crest or trough.
wavelength	The distance from one point of one wave to the same point on the next wave. Usually measured from crest to crest or trough to trough. Wavelength is measured in metres (m)
frequency	The number of waves passing a point each second. Frequency is measured in hertz (Hz)
perpendicular	Lines that form an angle of 90° when they meet.
parallel	Lines that do not meet.
transverse waves	Where the direction of vibration is perpendicular to the direction of the energy transfer.
longitudinal waves	Where the direction of vibration is parallel to the direction of the energy transfer.

Transverse and Longitudinal waves





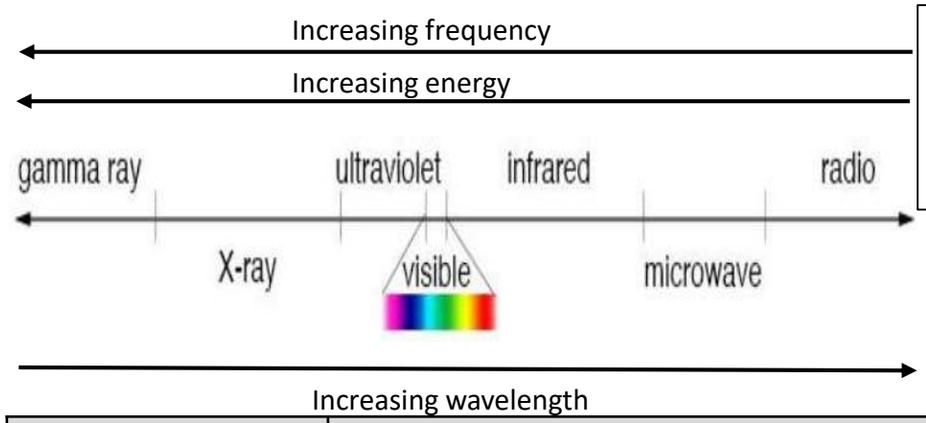
e.g. water, light and secondary S waves of earthquakes



e.g. sound waves and primary P waves of earthquakes

For a transverse wave the direction of oscillation is perpendicular to the direction of energy transfer, whereas for a longitudinal wave the direction of oscillation is parallel to the direction of energy transfer

The Electromagnetic spectrum – Transverse Waves



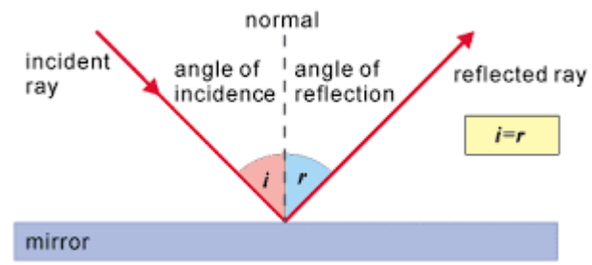
- Shiny surface → smooth → specular reflection
- Matte surface → rough → diffuse reflection
- White and shiny surfaces reflect infrared radiation
- Black and matte surfaces absorb infrared radiation

EM Wave	Danger	Use
Radio	Safe	Communications, TV, Radio
Microwave	Burning if concentrated	Mobile phones, cooking, satellites
Infrared	Burning if concentrated	Heating, remote controls, cooking
Visible	Damage to eyes	Illumination, photography, fibre optics
Ultra Violet	Sunburn, skin cancer	Security marking, disinfecting water
X-ray	Cell destruction, cell DNA mutation, cancer	Imaging bones, airport security
Gamma	Cell destruction, cell DNA mutation, cancer	Sterilising, detecting and treating cancer

Reflection

When light collides with a surface some of the light may be transmitted through, some may be absorbed but some may be reflected back.

- The law of reflection states that the angle of incidence is equal to the angle of reflection
- The normal line is an imaginary line drawn perpendicular to the surface at the point where the ray of light collides with the surface
- Angles of incidence and reflection are measured from the normal line to the ray, not from the mirror to the ray



Wave Properties - Equations

Property	Word Equation	Symbol Equation
Wave speed	Wave speed (m/s) = frequency (Hz) x wavelength (m)	$v = f \times \lambda$
Wave period	Wave period (s) = 1 ÷ frequency (Hz)	$T = 1 / f$
Speed	Speed (m/s) = distance (m) ÷ time (s)	$v = s \div t$

Sound – Longitudinal Waves

- Sound waves transfer energy through vibrating particles and therefore require a medium to travel through – sound waves cannot be transmitted through space as there are no particles.
- The speed of sound can be calculated using the equation speed = distance ÷ time

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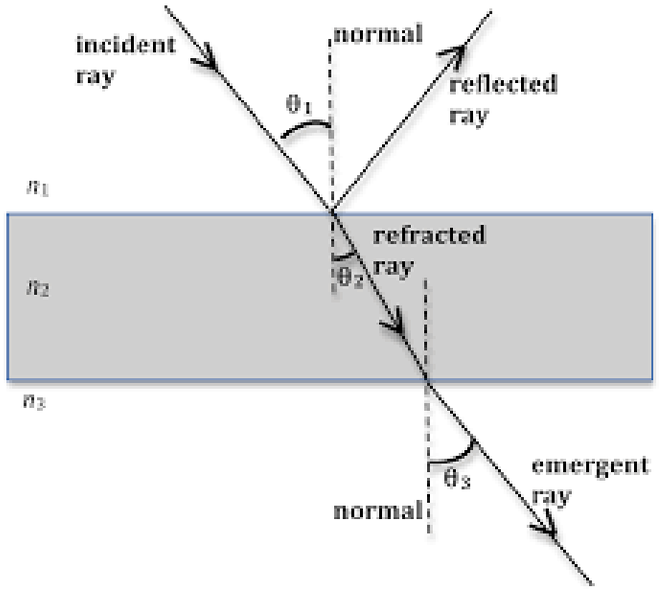
Key Terms

Key word	Definition/description
Reflection	Wave bounces off a surface (a boundary between two mediums)
Refraction	Wave changes direction at a boundary between two mediums
Transmitted	Passes through the object

Refraction

When light collides with a surface and transmission occurs then the speed of the light changes due to the density of the new medium

- If light is entering a more dense medium it slows down
- If light is entering a less dense medium it speeds up
- If light is incident to the medium at a perpendicular angle all the beam of light changes speed at the same time and so it continues in a straight line through the medium
- If light enters the medium at an angle, not all of the beam enters at the same time meaning that some parts speed up/slow down before others. This causes the change in direction.



- When the light enters the block it slows down and bends towards the normal so angle 2 in the diagram is smaller than angle 1
- When the light emerges from the block it speeds up and bends away from the normal so angle 3 is larger than angle 2
- Angle 1 is equal to angle 3