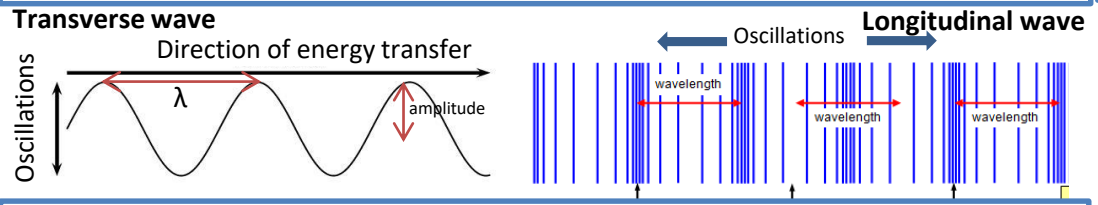
Year 11 – Paper 2 - Physics Knowledge Organiser - Waves

Types of wave

One way of defining types of wave is whether they are **longitudinal** or **transverse**. Which one they are depends on the direction of the oscillations compared to the direction of energy transfer by the wave.

- In **transverse waves**, the oscillations are **perpendicular** to the direction of energy transfer.
- In **longitudinal waves**, the oscillations are **parallel** to the direction of energy transfer. They show areas of compression and rarefaction – see diagram.



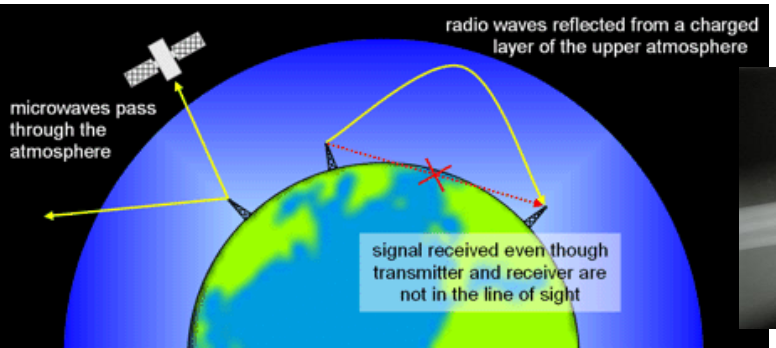
Electromagnetic waves (EM waves)

EM waves are always **transverse waves**. They transfer energy from the source of the waves to an **absorber** – object that absorbs the wave. EM waves occur all over the universe naturally, and we can produce them ourselves for all sorts of uses. You need to know the order of these. Try remembering **R**ees **M**ight **I**nvite **V**ery **U**gly e**X** **G**irlfriend.

Long wavelength → Short wavelength

Radio waves	Microwaves	Infrared	Visible light	Ultraviolet	X-rays	Gamma rays

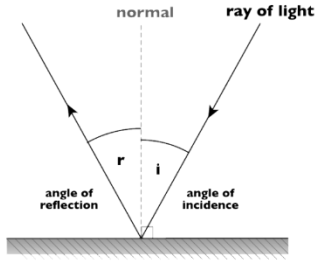
Low frequency → High frequency



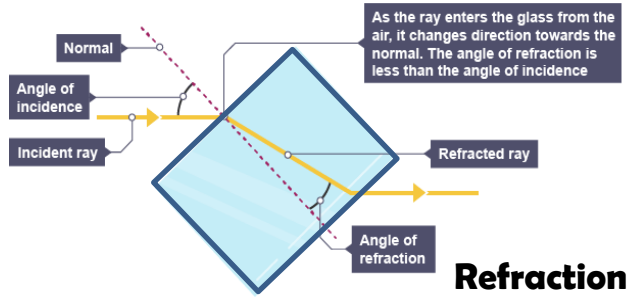
Properties of EM waves

All EM waves can be reflected, refracted, absorbed or transmitted *depending* on the wavelength of the EM wave and the medium they are travelling through, or surface they are reaching.

Refraction occurs when a wave changes the medium it is travelling through. Refraction is a change in direction of the wave, and it happens at the boundary, or junction, between the media – for instance, the surface of a sheet of glass would be the boundary between the glass and the air. You need to be able to draw diagrams to show refraction, like the example opposite.



Reflection



Refraction

Applications using EM waves

It is not exaggerating to say that EM waves dominate our technology and our lives. Here are some examples of the practical applications of EM waves:

- **Radio waves**: used for *television*, *radio* and Bluetooth.
- **Microwaves**: obviously, cooking food, but also communication with *satellites* and *mobile phones*.
- **Infrared**: electrical heaters, cooking food, infrared cameras.
- **Visible light**: *fibre optic communication* (like the best broadband). **Ultraviolet**: *sun tanning* beds… however, look at the dangers of UV in the other box.
- **X-rays**: both medical imaging for *diagnosis* (like broken bones) and medical *treatments*.
- **Gamma rays**: used in medical treatments such as radiotherapy.

Dangers of EM waves

Ultraviolet waves, X-rays and gamma rays are potentially dangerous types of EM waves, since they can have hazardous effects on human tissues. How severe the effects are depends on the type of radiation and the size of the **dose** received.