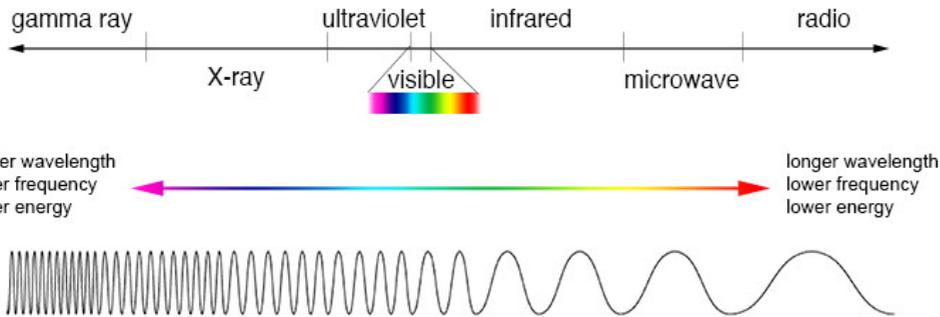
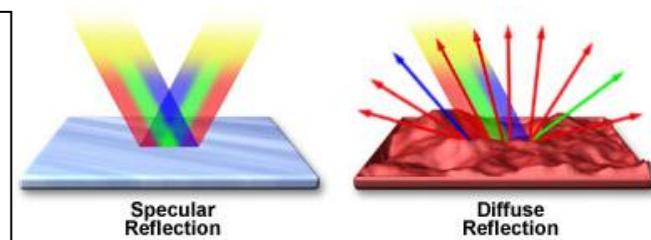


# Topic 5: Light & The Electromagnetic Spectrum



**Specular reflection** is what you see in a mirror - the image is not distorted

**Diffuse reflection** is what happens from most materials - the light is reflected but the image is not preserved



The primary colours of light are red, blue and green

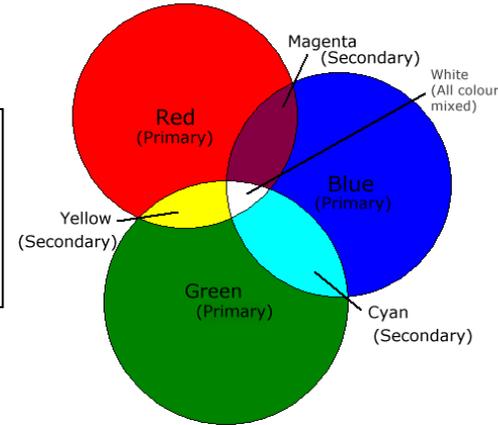
The primary colours of paints and inks are Cyan, Magenta and Yellow

White light is produced by combining the whole spectrum. Our eye sees white when we see red, green and blue

Filters and paints can absorb parts of the spectrum and change the colour of the light that is **transmitted** or **reflected**

A blue filter or blue paint **absorb** all colours except blue. Only blue reaches our eyes

Mixing coloured light

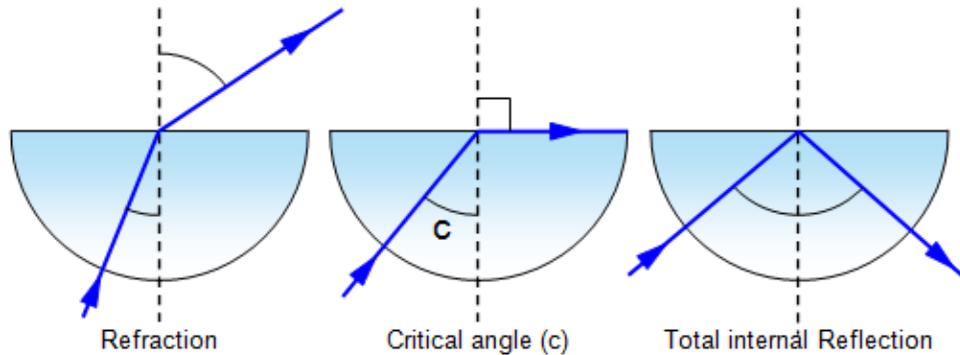


All parts of the e.m. spectrum behave in very similar ways.

The main differences between them are their **wavelength**, **frequency** and **energy**

They all travel at the same **speed in a vacuum:  $3 \times 10^8 \text{ m/s}$** . Nothing can go faster

They can all reflect and refract

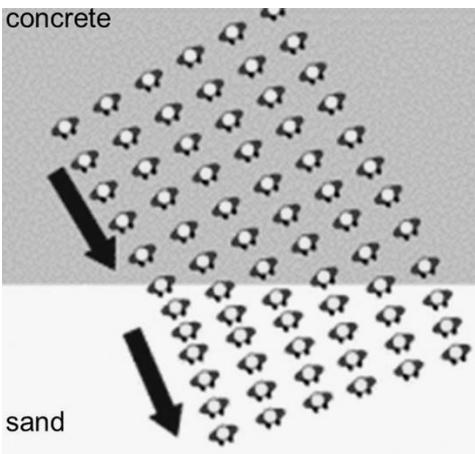
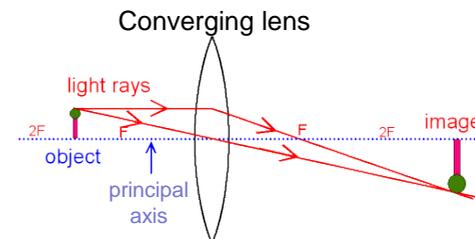
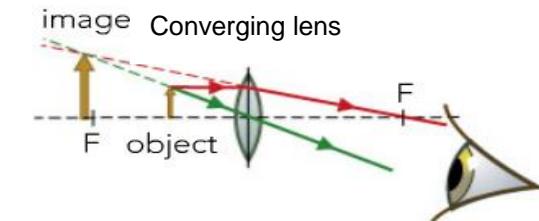
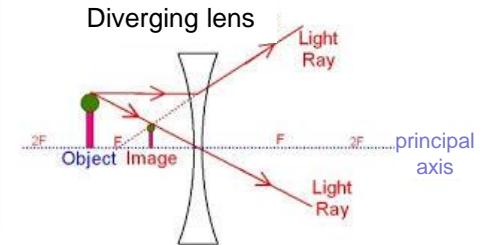
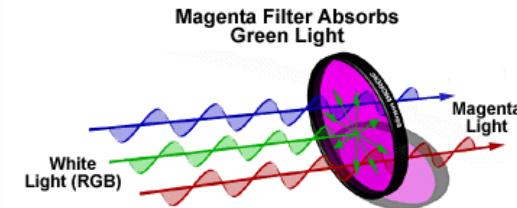


Lenses can be **converging** (the light is bent inwards to a central point) or **diverging** (the light is bent outwards)

The **more curved** the surface of the lens the more **powerful** it is

The image produced can be **real** or **virtual**. Real images appear in front of the lens and can be shown on a screen. Virtual images appear behind the lens and cannot be shown on a screen

The image can also be **magnified** (larger) or **diminished** (smaller) and it can be the correct way up or **inverted** (upside down)



Waves **refract** when they cross into a new material at an angle. This is because they change speed

At the **critical angle** they travel along the surface instead of escaping

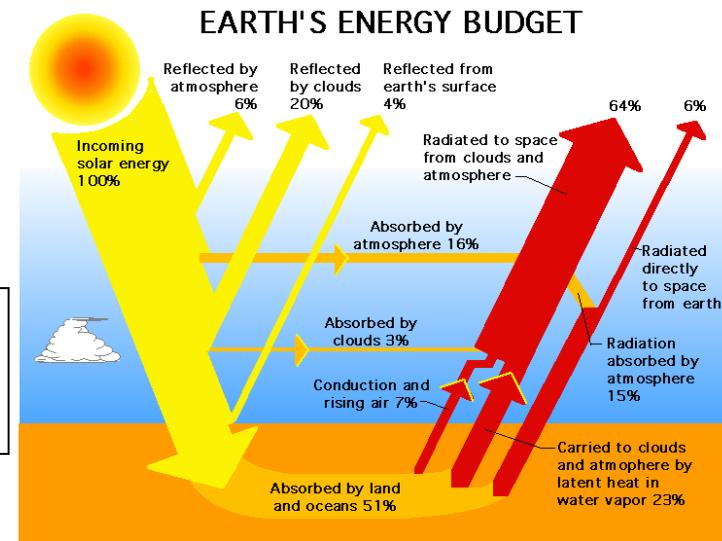
Beyond the critical angle they reflect - called **total internal reflection**

# Topic 5: Light & The Electromagnetic Spectrum (part 2)



Objects can absorb one frequency of radiation and then re-emit it at a different frequency.

The greenhouse effect is caused by radiation from the sun being absorbed by the Earth, and reemitted as a frequency that cannot escape the atmosphere

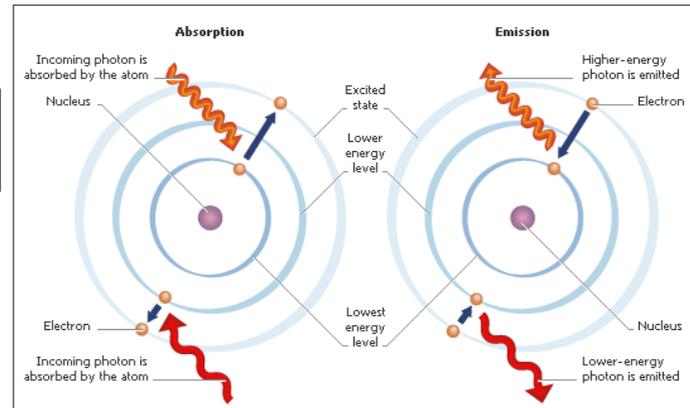


All objects **emit radiation** all the time. Most of this is around the infrared range.

Objects emit radiation faster when hot than when cool

Black objects **emit** radiation faster than white or silver objects. Black objects also **absorb** radiation faster than white or silver objects.

White and silver objects **reflect** more radiation. Houses in hot countries are painted white to reflect the radiation from the sun



Atoms can absorb and emit electromagnetic radiation. The frequency they absorb is related to the shells of the electrons.

This can produce absorption spectra (astronomy topic)

The spectrum can be split by **refraction**.

Red light is refracted **less** than violet light.

Radio waves are refracted less than gamma rays

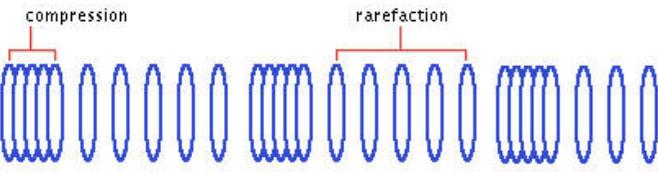


Figure 1: Longitudinal Wave

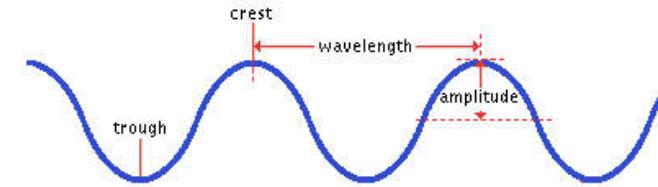
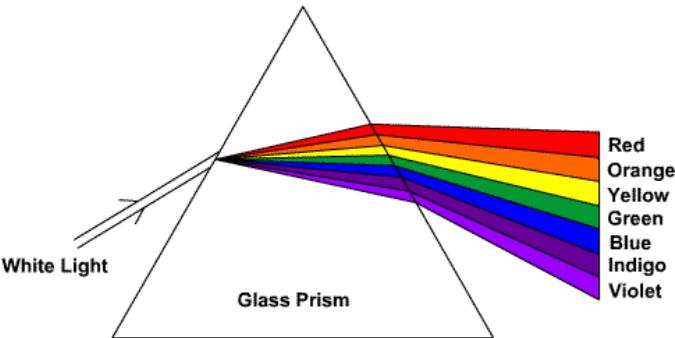


Figure 2: Transverse Wave

All parts of the e.m. spectrum are **transverse** waves

Sound is a **longitudinal** wave



Type	Use	Danger
radio	Communication	Normally none
microwave	Communication, Cooking	Heating can cause burns
infrared	Heat lamps, Night vision, Remote controls	Skin burns
light	Seeing, lasers, communication	Eye damage
ultraviolet	Security – e.g. with bank notes. Sterilising water	Skin cancer
X-Rays	Imaging bones	Cancer
Gamma	Tracers, treating cancer, Sterilising	Cancer and cell death