P1 Chapter 3: Light

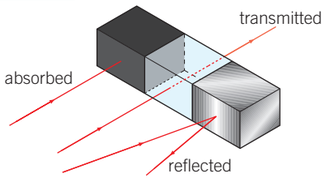
Knowledge organiser

How does light travel?

Luminous objects are sources of light, e.g., the Sun.

Non-luminous objects do not produce their own light, e.g., the Moon.

When light hits an object it can be **absorbed**, **reflected**, or **transmitted**.



If an object is:

transparent – most light is transmitted

translucent – light is scattered

opaque – no light is transmitted so a shadow is produced.

Light can travel through gases, some solids and liquids, and completely empty space (a vacuum).

The speed of light in a **vacuum** is about 300 000 km/s.

Distances in space are measured in **light-time**. Remember that light-time is a distance (not a measure of time).

A light-minute is the distance light travels in one minute.

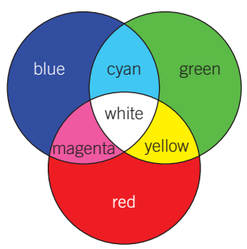
A light-year is the distance light travels in one year.

Colours of light

A **prism** refracts different colours of light by different amounts. This disperses light into a continuous **spectrum** of colours.

The **primary colours** of light are **red**, **green**, and **blue**.

Secondary colours are produced when any two primary colours are mixed.



Filters subtract colours from white light, so that only one colour of light is transmitted.

Objects appear to be different colours because they reflect some colours of light and absorb others.

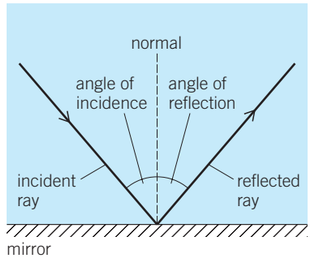
Black objects absorb all colours and white objects reflect all colours.

Reflection and refraction of light

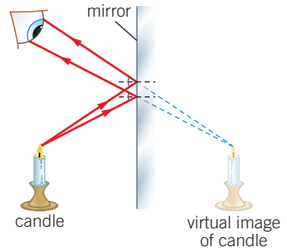
The **law of reflection** states that:

The **angle of incidence** is equal to the **angle of reflection**.

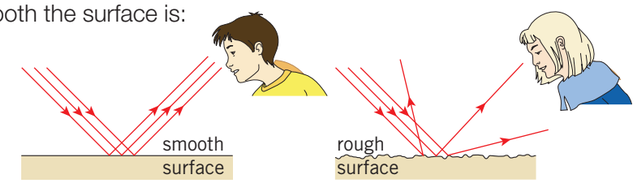
The **normal** is an imaginary line at 90° to the mirror.



Images in mirrors are **virtual** – they look like they are behind the mirror.



Whether or not you can see a clear reflected image depends on how smooth the surface is:



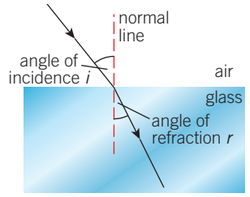
specular reflection **diffuse scattering**

Refraction is when light changes direction when it travels from one **medium** (material, such as air or water) to another.

Refraction happens because light travels at different speeds in different materials.

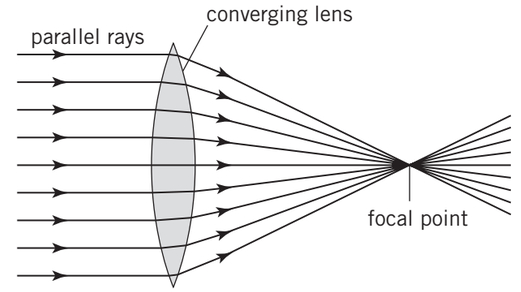
Rays of light will be refracted:

- towards the normal if they slow down, such as going from air to glass
- away from the normal if they speed up, such as going from water to air.



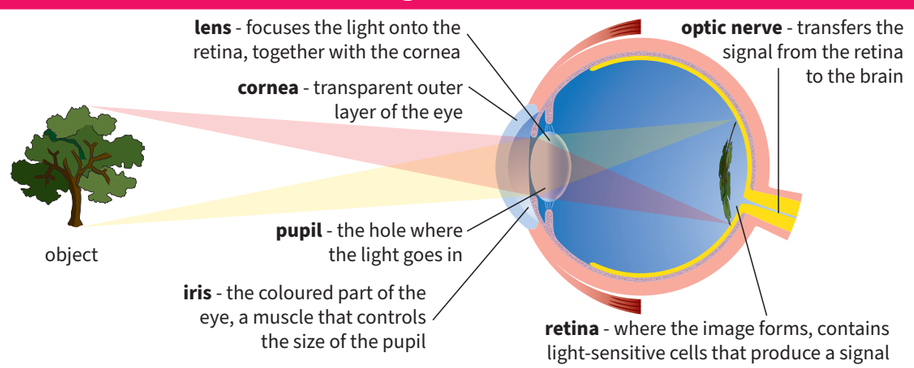
Lenses use refraction to spread out or **focus** light.

Convex (or **converging**) lenses (like the ones in your eyes) are shaped to focus the light to a point – called the **focal point**.



How do eyes and cameras work?

Light entering your eye is refracted by the **lens**, focusing it on the **retina** and creating an inverted image. **Photoreceptors** detect the light hitting your retina and send an electrical impulse to your brain.



Cameras work in the same way as your eye – light passes through an opening and a **real image** is formed on a screen or film.

Digital cameras now have a **charge-coupled device** (**CCD**) instead of film – when light hits a **pixel** it produces an electrical charge.

Key Words

Make sure you can write a definition for these key terms. ***absorb*** ***angle of incidence*** ***angle of reflection*** ***aperture*** ***camera*** ***charge-coupled device*** ***continuous*** ***converging*** ***convex*** ***cornea*** ***diffuse scattering*** ***dispersion*** ***emit*** ***eye*** ***filter*** ***focal point*** ***focus*** ***image*** ***incident ray*** ***inverted*** ***iris*** ***law of reflection*** ***lens*** ***light-time*** ***luminous*** ***medium*** ***non-luminous*** ***normal*** ***opaque*** ***optic nerve*** ***photoreceptors*** ***pixel*** ***plane*** ***primary colour*** ***prism*** ***pupil*** ***ray*** ***real image*** ***reflect*** ***reflected ray*** ***refraction*** ***retina*** ***secondary colour*** ***source*** ***spectrum*** ***specular reflection*** ***translucent*** ***transmit*** ***transparent*** ***virtual image***