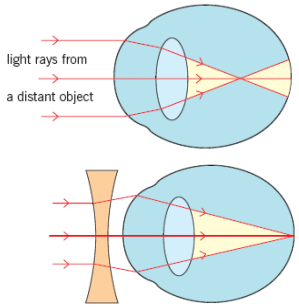
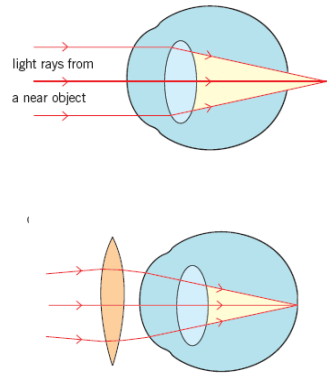
Eye sight problems:

A **nearsighted** person can see nearby things clearly, but distant objects are blurred. The eyeball is too long, so the lens focuses the image in front of the retina. To correct this, a concave lens in front of the eye spreads out light rays before they enter the eye.

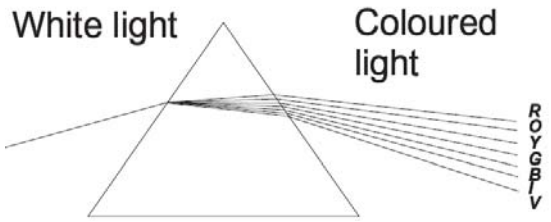


A **farsighted** person can see distant objects clearly, but nearby objects appear blurry. The eyeball is too short, so the image that falls on the retina is out of focus. A convex lens corrects this by bending light rays toward each other before they enter the eye.



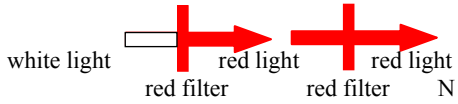
Colour.

White light is a mixture of coloured lights. The colours can be dispersed (separated) into a spectrum using a prism: red orange yellow green blue indigo violet



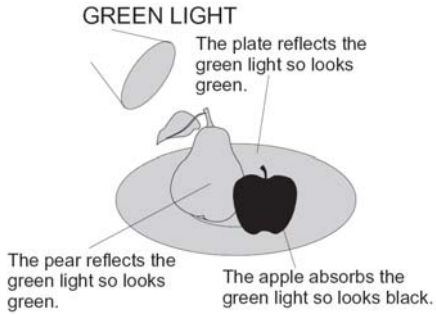
Red light is bent the least; Violet light is the most violently bent. Get it? Raindrops can disperse sunlight, which is why we see rainbows.

Coloured filters. Coloured filters are transparent materials that only let light of one colour pass through. All other colours are absorbed. Eg pass white light through a red filter, the filter allows red light to pass through and absorbs all others.

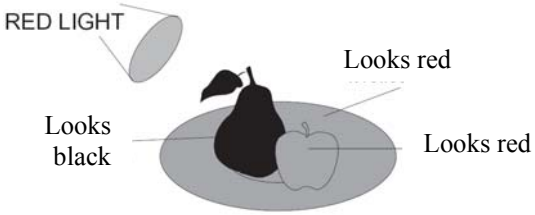


Coloured objects. White objects reflect all the colours of light. Coloured objects reflect only their own colour; all other colours are absorbed by the object.

A green pear and a red apple are put on a white plate, and a green light is shone on them

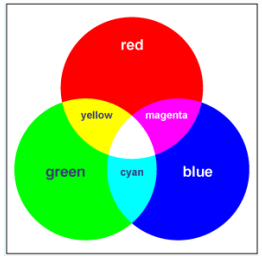


Under a red light the apple would look red, the pear would look black & the plate would appear red.



Black objects absorb all of the visible frequencies, so our eyes see no colour - we see black.

The primary light colours are red, blue and green. They can be mixed, as follows, to form secondary light colours: red + green = yellow, red + blue = magenta, blue + green = cyan.



LIGHT REVISION

Light is a type of energy which travels as a wave from a luminous source (eg the Sun, a flame, or a torch). Not everything is a light source. Paper reflects light from a light source towards your eyes, making you able to see it.

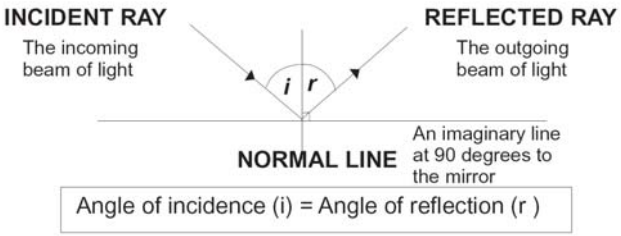
Light travels at a speed of $3x10^8$ m/s. Light travels faster than sound which is why you see a flash of lightning before you hear thunder! It takes 8 minutes for light from the Sun to reach Earth.

Light travels in straight lines. It can't bend itself around objects if they are in its path. Shadows occur where light has been blocked by an object

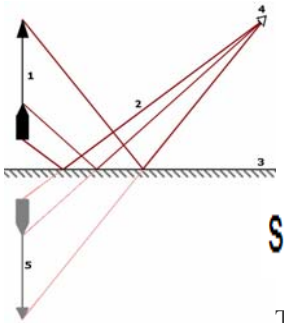
Transparent, translucent & opaque

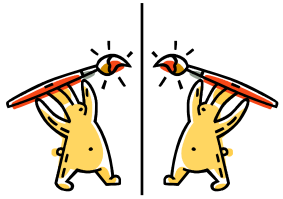
Transparent objects are clear. Most light shines through them. Eg windows and glasses. Some light passes through translucent objects, but you can't really see through them. Eg frosted glass, thin paper, cloth, milk. Opaque objects don't let light go through them. Eg a brick.

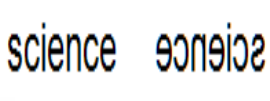
Reflection Light can be made to change direction with mirrors - this is called reflection. When light is reflected off a mirror, the angle at which it hits the mirror (angle of incidence) is the same as the angle at which it is reflected off the mirror (angle of reflection). The rays of light which hit the mirror are called the incident rays; those reflected off the mirror are called the reflected rays. The angles are always measured from the ray to the "normal". The normal is a line at right angles to the mirror.



The image is always the same distance behind the mirror as the object is in front. The image is always the same size as the object.

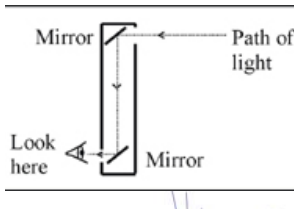




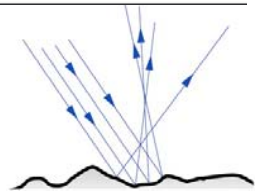


The image is laterally inverted (left becomes right & right becomes left), which is why writing is back to front in a mirror.

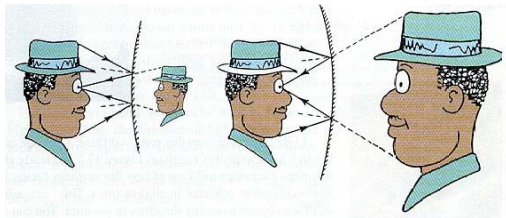
Two plane mirrors set at a 45° angle can be used in a periscope.



Reflection from smooth surfaces (eg mirrors or calm water) leads to **regular reflection**. Bumpy or rough surfaces do not reflect light evenly. The light is **scattered** in all directions, and usually we cannot see an image. This is known as **diffuse reflection**.



Curved mirrors

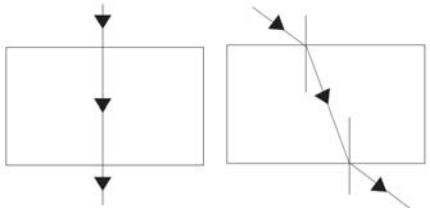


Images in **convex** mirrors are always smaller & the right way up. Uses - shop-lifting mirror, mirror at a road corner.

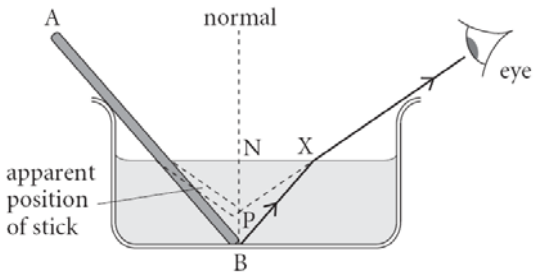
Images in **concave** mirrors can be: larger and the right way up, if eye is very close to the mirror OR smaller and upside down if eye is away from mirror. Uses - shaving mirror, dentist mirror.

Refraction Light can change direction when it passes from one transparent medium (material) to another (e.g from air to glass), this is called refraction.

If a ray of light enters a glass block at 90° it passes through the block without changing direction. If a ray of light enters a glass or Perspex block at an angle it is bent towards the normal as it goes in and away from the normal as it leaves.



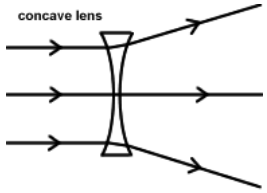
The bent stick: The brain thinks light from B has come from P in a straight line to the eye. The light has changed direction – been refracted – at the surface of the water at X.



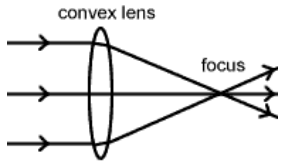
The apparent position of the stick is at P so the stick appears to be bent. A object on the bottom of a swimming pool always looks closer than it really is.

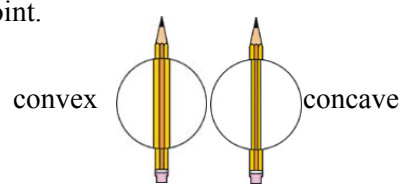
Curved lenses

Concave lenses are thin in the middle and make light rays spread out, or diverge. If the rays of light are traced back they all intersect at the focus, or focal point, behind the lens.

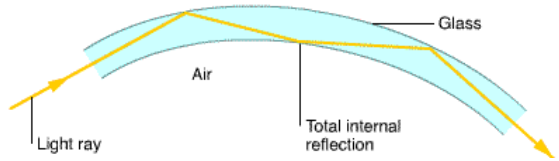


Convex lenses however, are thicker in the middle, and focus light rays to a point in front of the lens (the rays 'converge'). This point is called the focus or focal point.





Total internal reflection is when a wave reflects off the inside of a block, rather than refracting out of it. The **critical angle** for perspex is about 43°. This principle is used in **fibre optics** (e.g. endoscopes in medicine). Optical fibres can also carry enormous amounts of information as pulses of light.



The Eye