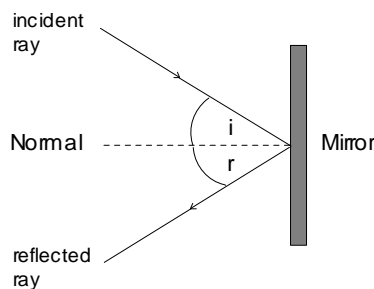


## How light travels

Light travels in straight lines at a very high speed. Light does not need particles to pass it on, so it can travel through a vacuum. Light is a form of energy.

## Reflection

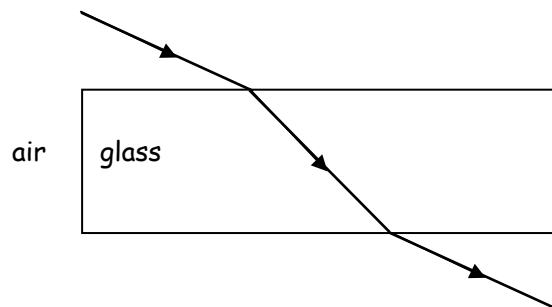
When light shines on a mirror, it reflects. It bounces back at the same angle. The angles are measured from a line at right angles to the mirror, called a **normal**.



The ray that shines on the mirror is called the incident ray. The angle it makes to the normal is called the angle of incidence ( $i$ ). The angle of incidence equals the angle of reflection ( $r$ ).

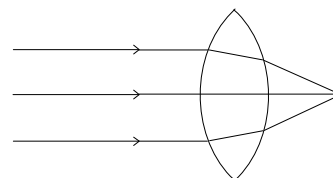
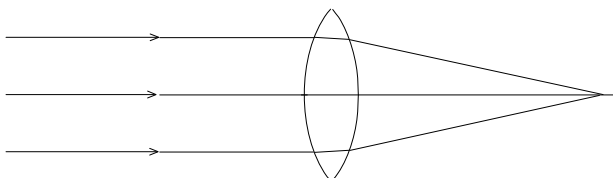
## Refraction of Light

Light changes direction when it passes from one material into another. This is called refraction.

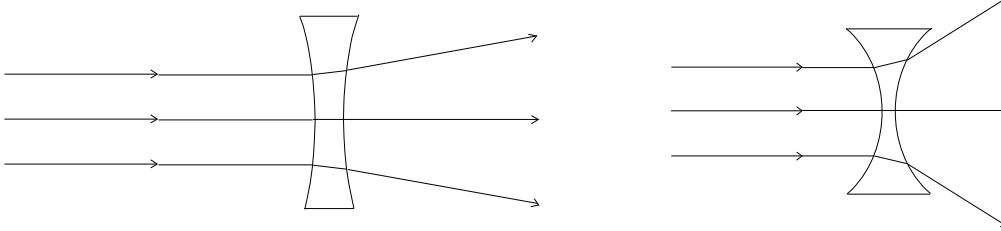


## Lenses

Lenses refract light in different ways. **Convex** lenses make light rays converge (come together).



**Concave** lenses cause light rays to diverge (spread out).



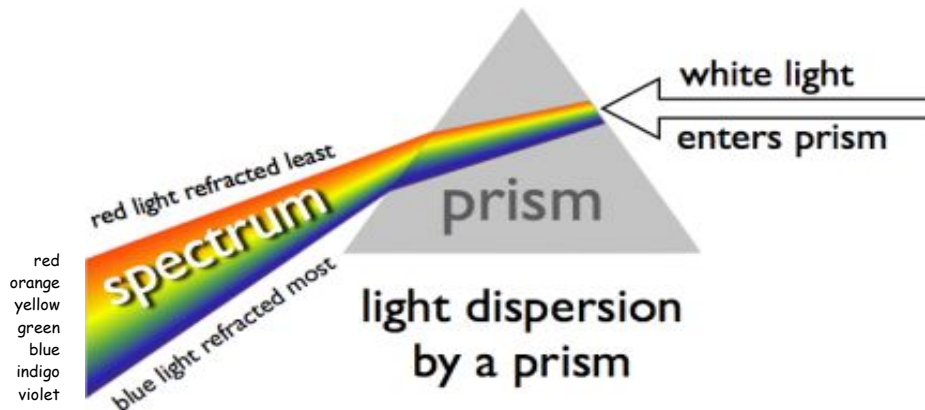
The more curved the lens, the greater the change in the direction of the light ray.

### **What lenses are used for**

Lenses are used for bending light in spectacles, contact lenses, cameras, binoculars, projectors and magnifying glasses.

### **Prisms**

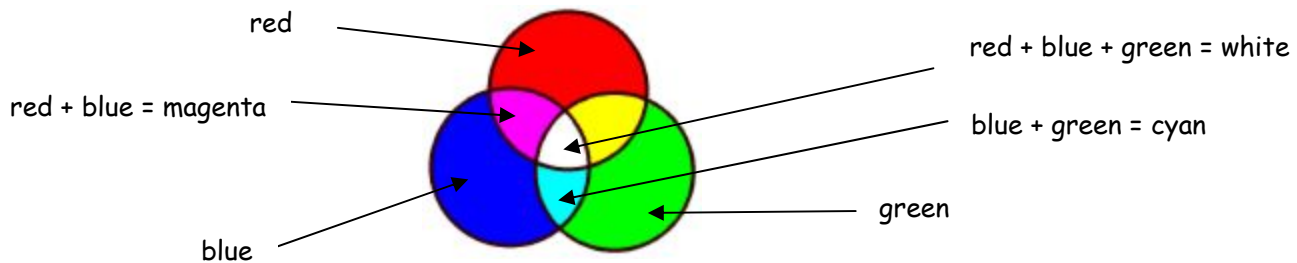
A prism can be used to refract light. When white light passes through a prism, the following pattern is produced:



This happens because white light contains a range of colours: red, orange, yellow, green, blue, indigo and violet. The different colours are refracted by different amounts by the prism, causing them to separate into a spectrum. A rainbow is caused like this, by sunlight being refracted by water droplets in the air.

## Mixing colours

The three primary colours of light are red, green and blue. These colours can be mixed to produce all other colours. (The primary colours of light are different from the primary colours of paints.)



## Coloured filters

A filter is a coloured object that lets only certain colours of light pass through it. For example, a red filter only lets red light through, and absorbs (stops) other colours. Filters can be used to make coloured light from white light bulbs, for example in traffic lights, car brake lights, and in theatres.

## How we see

We see objects because of the light that comes from them. Some objects, like the sun or a candle, give out their own light. We can still see objects which **don't** give out their own light, because light from the sun reflects off them.

A white object appears white because it reflects all colours of light.

A red object appears red because it reflects only red light. It absorbs (takes in) the other colours.

A yellow object absorbs blue light, but reflects red and green. The red and green mix to produce yellow.

## Looking at things using coloured light

We normally see things in sunlight, which is white. If we look at things in coloured light, they look different. A blue object reflects blue light, and absorbs the other colours. When we see it in white light, it looks blue. But if you shine red light on it, the red is absorbed. No light is reflected to your eyes, and so the blue object appears to be black.