

Light

We need light to see

Sight is one of our senses. Our receptor for light is the eye. The ancients thought that something emerged from our eyes to sense or feel the environment. It is now realised that light **enters** into the eye and is detected there and hence we see. If there is no light, we see nothing – darkness is the absence of light. This seems very obvious to us but it really isn't to children. Have you ever been anywhere where there is no light at all e.g. a deep cave or a tunnel? You can lift your hand in front of your face and you will see nothing – rather scary!

Safety

It is important to stress to children the danger of looking directly at bright lights, especially the Sun. Nobody should look directly at the Sun, not even using filters, smoked glass, sun glasses or whatever. Telescopes and binoculars are especially dangerous in this respect and must **never** ever be pointed at the Sun. Also, be aware that if children are given a convex lens (i.e. a magnifying glass) they may try to start a fire with it by concentrating the Sun's rays of light onto a leaf or a piece of paper

Light needs a source

Light travels from a source. The daylight has travelled to Earth from the Sun but between us and the Sun there is space which is mostly quite empty, i.e. it is a vacuum. This must mean that light can travel through a vacuum, or in scientific jargon, light does not need a medium in which to travel. This is very different to sound which does not travel in a vacuum.

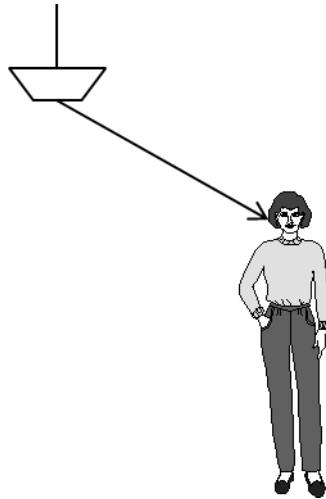
Light travels in straight lines

This can be seen easily by using a safe laser pointer. Point it away from anyone's eyes at, for example, a painted wall (make sure it cannot reflect off anything shiny back into the children's eyes) and sprinkle some baby powder in the path of the light. This shows a beautiful straight line. When we are drawing the path of light, it can be represented by a straight line with an arrow – the arrow shows the direction of travel.

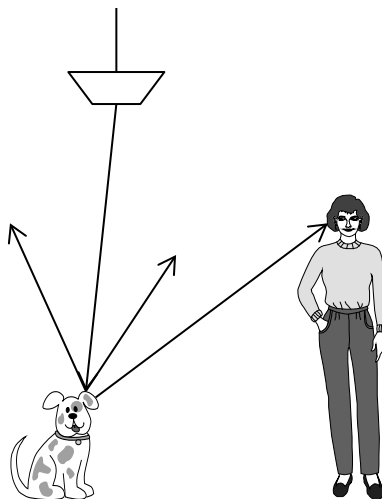


Reflection of light

We can see a room light because it emits light which enters our eyes and is detected there. The path of light is shown by the line with an arrow.



We can see other things, such as a dog, not because a dog emits light but because light from a source, such as the room light reflects off the dog and some of that reflected light enters our eye.



So if the dog is somewhere where there is no light source, such as in a completely darkened room, no light will be reflected off it and so we will not see it and will probably trip over said dog!

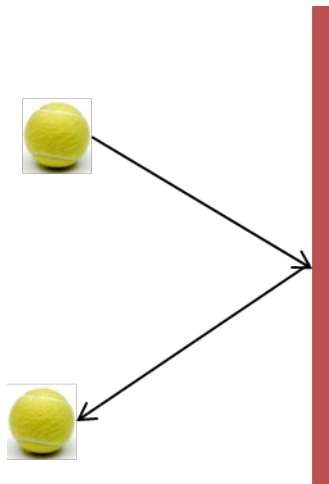
Everything that we see that is not itself a light source is only seen because light from a source has been reflected from its surface.

The light from an uneven surface, such as a dog or a desk, is reflected from the surface in all directions – the scientific term for this is ‘scattering’ but primary children do not need to know this term.

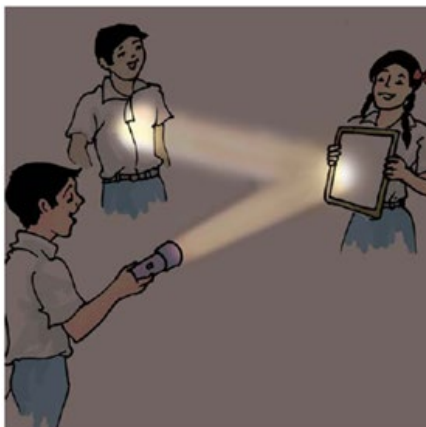
Mirrors

Some surfaces are so smooth that the light reflected from them is not scattered in all directions – it is much more regular and predictable.

This can be compared to throwing a ball at a wall. If the wall has a smooth surface, then the ball will bounce off the wall in a predictable direction. This will be true of all balls thrown at this wall:



Similarly, light that is reflected from a **very smooth** or polished surface such as a mirror or still water is reflected in predictable directions:



The fact that rays of light are reflected from a very smooth surface regularly is the reason why we can ‘see ourselves’ in a mirror or in a still pool of water. If you look in a mirror, you appear to be behind the mirror but, of course, you are not so what you see is called an image. Children quickly understand this - when we clean our teeth and look in the bathroom mirror, we appear to be behind the mirror but if we excavate the wall we are not there!

Transparency

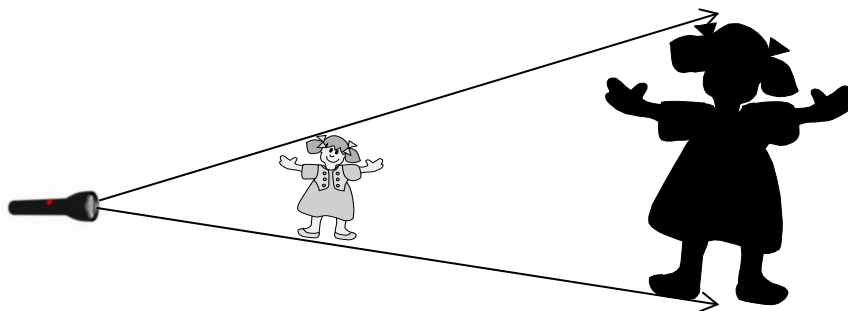
Light can travel through certain materials, such as glass, water, clear plastic and such materials are called transparent.

Translucent materials, like greaseproof paper and frosted glass let some but not all light through. They diffuse the light.

Opaque materials and shadows

Most materials do not allow light through at all and these are called opaque. When light from a source cannot travel through a material then a shadow can be formed.

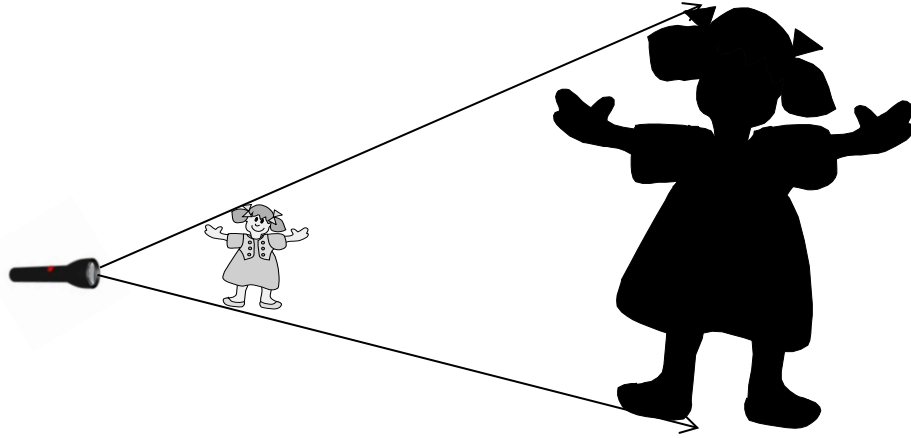
This is shown in the following diagrams where the path of the light is shown by a straight line with an arrow. The rays shown are sample rays from the edges of the girl causing the shadow. The formation of shadows in this way shows that **light travels in straight lines** – otherwise we would not have sharp shadows like this.



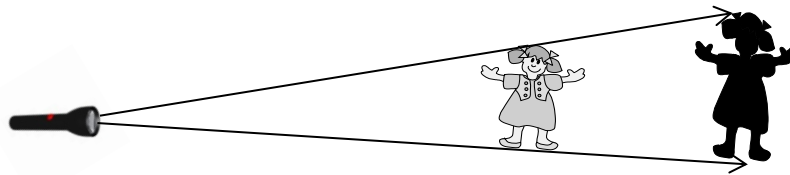
The girl is opaque – light cannot pass through her so all the light inside the rays shown is blocked and her shadow is where the light cannot reach.

N.B. Children commonly think that shadows have features (eyes, etc.) rather than just being dark.

The size of the shadow changes depending on the distance between the torch and the object causing the shadow. The following diagrams show why this is the case – as she is closer to the torch, more light is blocked and the shadow is bigger:

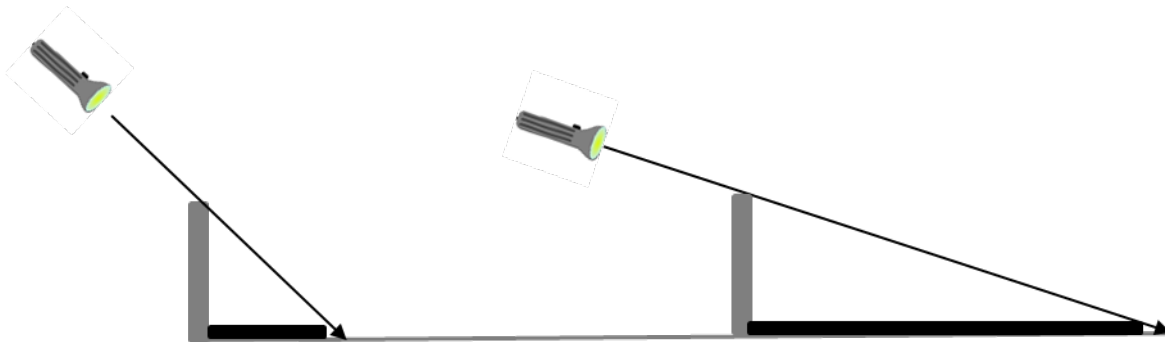


When she is further from the torch, less light is blocked and the shadow is smaller:

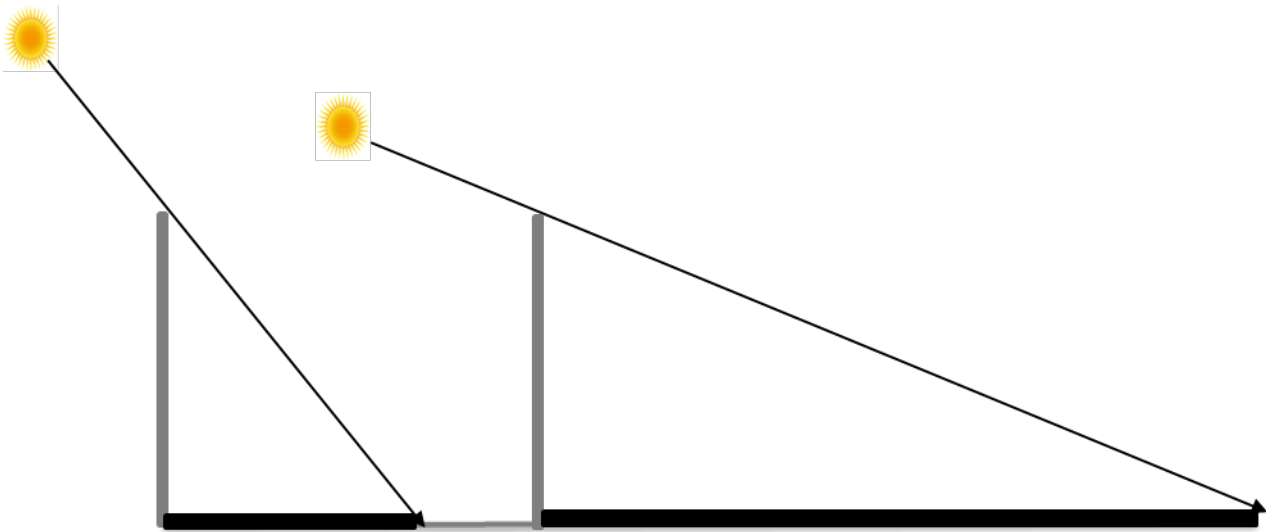


So children can investigate how the distance between the torch and the object blocking the light influences the size of the shadow.

Children can also investigate how the length of the shadow will also change when the angle of the torch is altered.



This relates to the length of the shadow formed as the height of the Sun varies during the day, as shown in the diagram below:



This also explains why the shadow at midday in the summer is shorter than at midday in winter – the Sun is much higher in the sky at midday in the summer than in the winter. The Sun is never directly overhead in the summer in the UK though so there is always a shadow at midday!

Health & Safety:

Teachers always need to risk assess practical activities for their children and defer to their health and safety advisor for the most up-to-date source of health and safety guidance.

This training cannot be relied upon as source of health & safety guidance.