

5

Light



What

you will learn

Light

Playing with shadows

Light bounces

Rainbow colours

Light

No one can see anything in a completely darkened room. There has to be light before you can see! You see when light enters your eye.



✦ What is light?

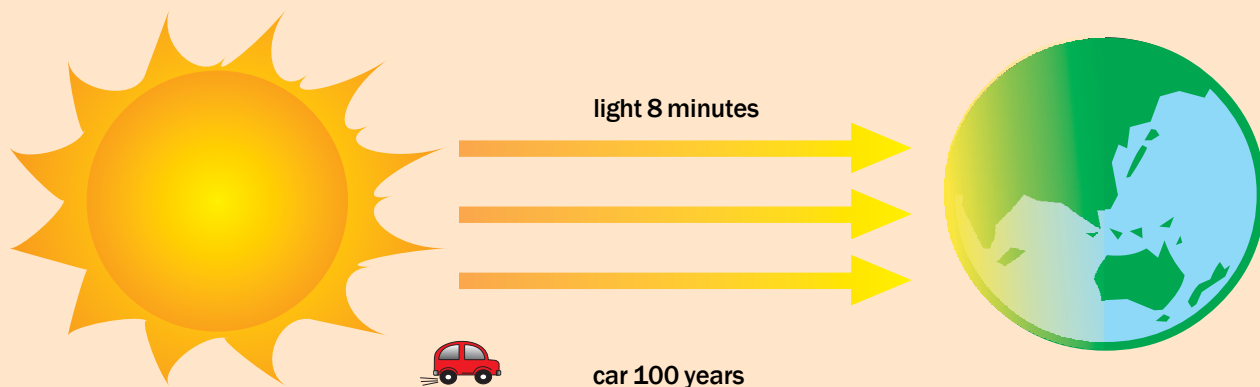
Light is a type of energy. Light energy is given off by the Sun, by electric light bulbs, by candles and other light sources.

Light energy travels from one place to another. The light which allows you to see during the day has travelled so many km to the Earth from the Sun!



✦ The speed of light

Light travels at a very high speed. In one second, light can travel a distance of 300,000km. This means that the speed of light is 300,000,000 metres per second. This is about a million times faster than the speed of sound.



Light travels

We can often see the sun shining during the day. In the picture, you can see the Sun's rays shining down on to the Earth, lighting everything up.

How does light travel? Are the rays in straight lines?

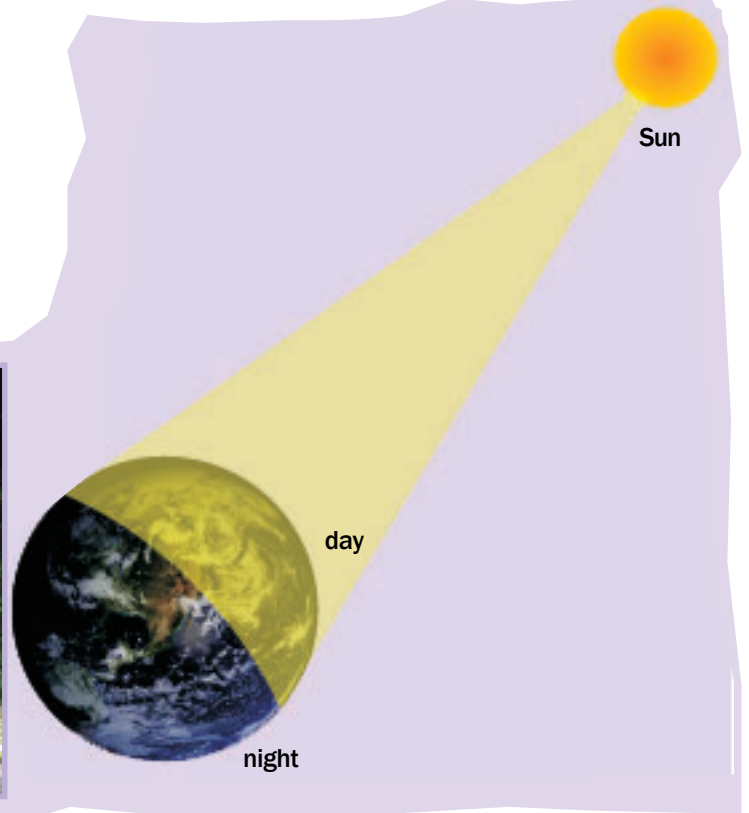
Where else have you seen light travelling in straight lines like this?



Day and night

At night, our side of the Earth is facing away from the Sun and we can no longer see its rays. Everything is dark.

The reason is the Sun's rays cannot bend round and light up the back of the Earth.



1 Fill in the blanks using the words below.

rays lines light bend

We see when enters our eye.
Light travels in straight
called Light cannot



Ideas

- Light is a type of energy.
- Light travels at a very high speed.
- Light travels in straight lines.

Playing with Shadows

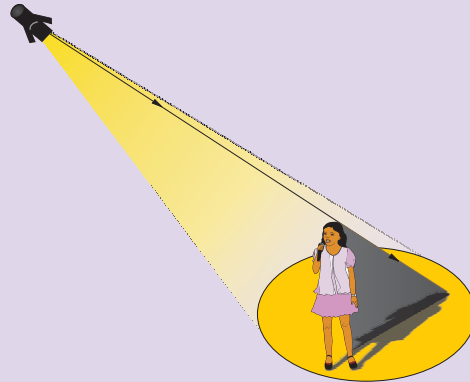
Shadows are made when an object blocks light rays from reaching an object. The shape of the shadow is the same as the shape of the object.

This is because light travels in straight lines.

People on stage often make very clear **shadows**. The light comes from a spotlight. Its rays shine down on the singer to light her up.

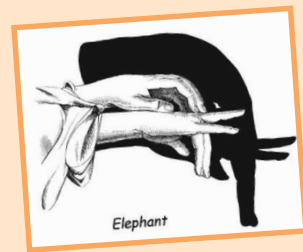
There is a dark shadow on the stage where the rays do not reach.

Because light travels in straight rays, we can draw a straight line to show where the singer's shadow will be.



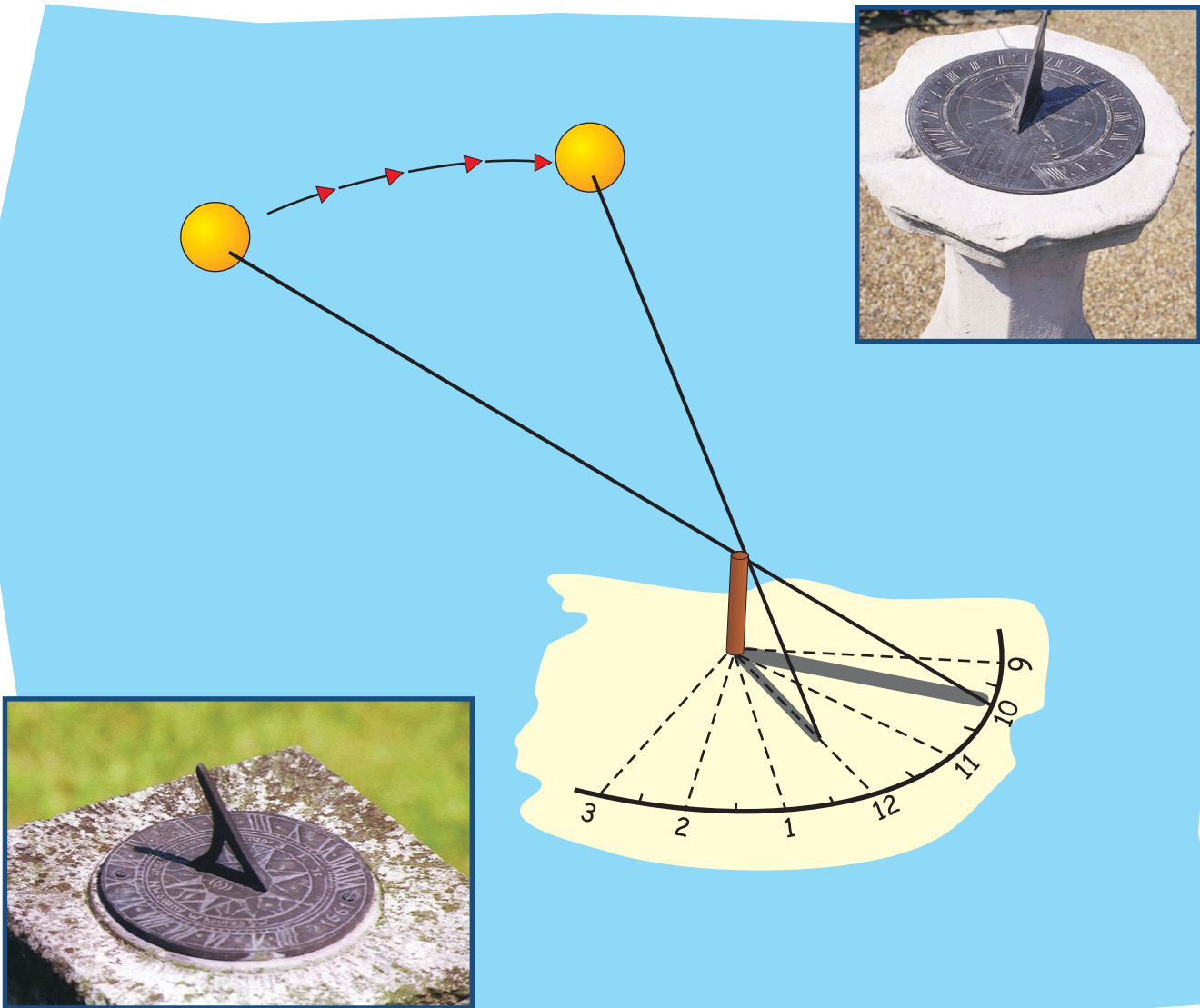
✦ Light and shade

You can make interesting shadows using your hands.



✦ A sundial

When the Sun's rays hit a sundial, a shadow is made. During the day, the Sun moves across the sky. The shadow moves around, and we can use this to tell the time.



- 1 How does shadow form?
- 2 You can create stage shows using a toy person for the actor, and two or three torches for the lights. Draw a diagram to show how three shadows would be formed.



Ideas

⇨ A shadow is formed when light rays are blocked by an object. This idea is used in a sundial.

Light bounces

Look at the pictures opposite.
What do you understand from the pictures?

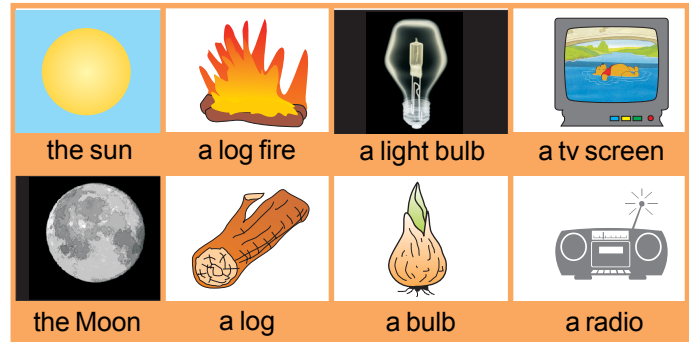
People use mirrors to see things by looking indirectly.



✦ Sources of light

We can see the Sun because it gives out light which shines into our eyes.
The sun is a source of light. Here are some other things that are sources of light.

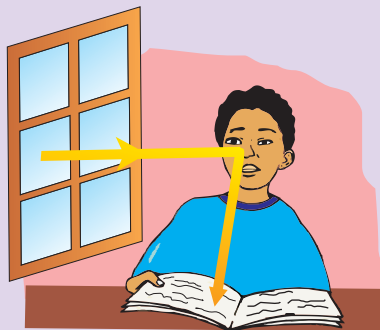
Here are some other things that we can see. They are not sources of light. We need to shine light on these things to see them. The light is reflected back into our eyes.



✦ How do you see?



You just look at things to see them.



Light goes into my eye and onto the book, so that I can see it.



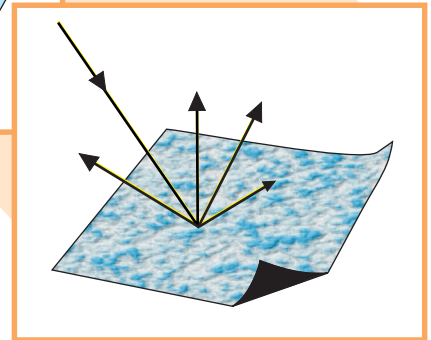
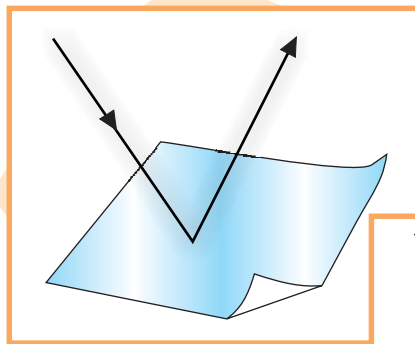
Light goes from the window onto the book, and then into my eye.

The last one is the correct one. Light rays from the Sun shine on the book. They are scattered, and some go into your eye.

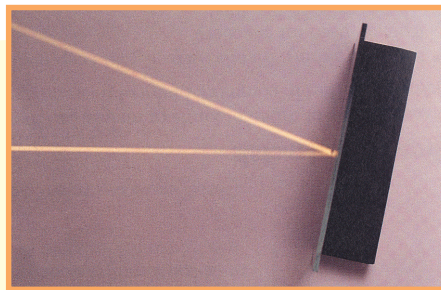
✦ Light change direction

Light travels in straight lines.
You can make a ray of light change direction using a mirror. The mirror **reflects** the light.

We can see objects because they reflect light into our eyes. When light hit a surface some of it bounces back. This bouncing back is called **reflection**.
Smooth surfaces reflect light in a regular way. Rough surfaces scatter light in different directions.

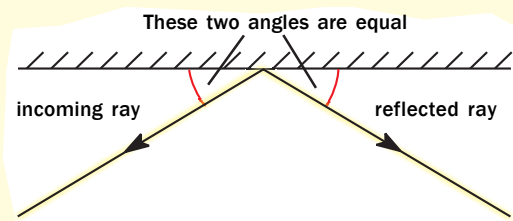


A ray box produces a single, narrow ray of light. You can use a ray box to investigate how a mirror reflects light. The ray shows up on the white paper.



You can see how the ray of light reflects off the mirror. The mirror must be smooth and flat. Then you can see a clear reflected ray.

The diagram shows a plan view of the ray of light reflecting off the mirror. It hits the mirror and bounces off at the same angle.



1 Fill in the blanks using the following words.

smooth narrow rough flat
straight bumpy

A ray of light is and
To reflect light well, a surface must be
and
A surface will scatter light if it is
and.....



Ideas

☞ Light travels in straight lines.

☞ When light is reflected by a flat, smooth surface, it bounces off at the same angle at which it hit the surface.

☞ When light hits a rough surface, it scatters in many directions.

Rainbow colours

If the Sun is shining and it is raining at the same time, you may be able to see a rainbow. Light from the Sun shines on drops of water in the air, and the light is split up into all the colours of the rainbow.

The colours are red, orange yellow, green, blue, indigo, violet.

Different people use different ways of remembering the colours of the rainbow.

Some people say “Vibgyor”.

How does this help you to remember the colours?



✦ Splitting white light

The Sun is a very hot source of light. It is almost white-hot. We say that light from the Sun is **white light**.

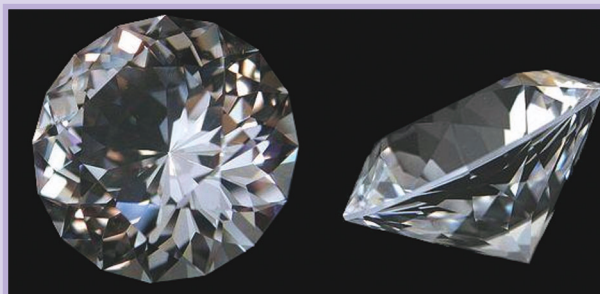
You may have noticed white light getting split up when it shines on certain objects.



Photographers have special filters which can split up white light to give interesting effects.



A compact disc reflects white light. It splits it up into the colours of the rainbow.



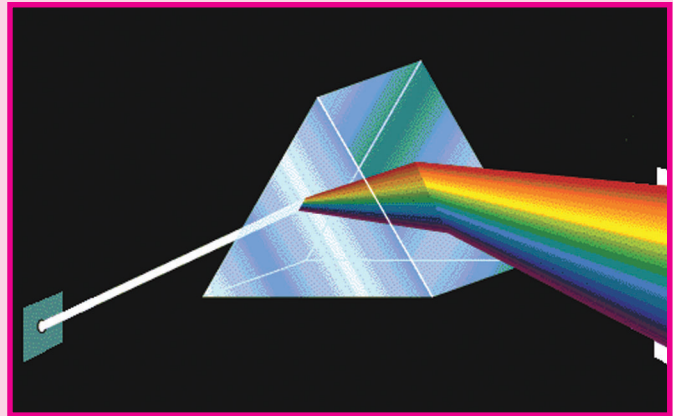
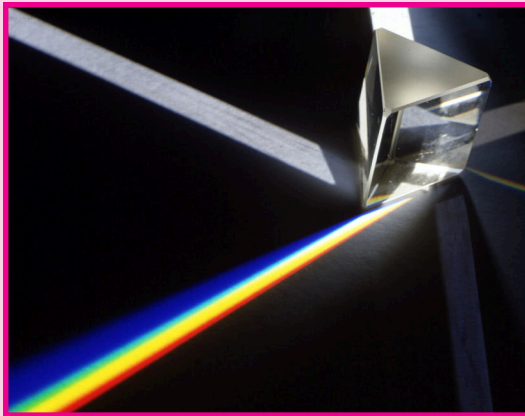
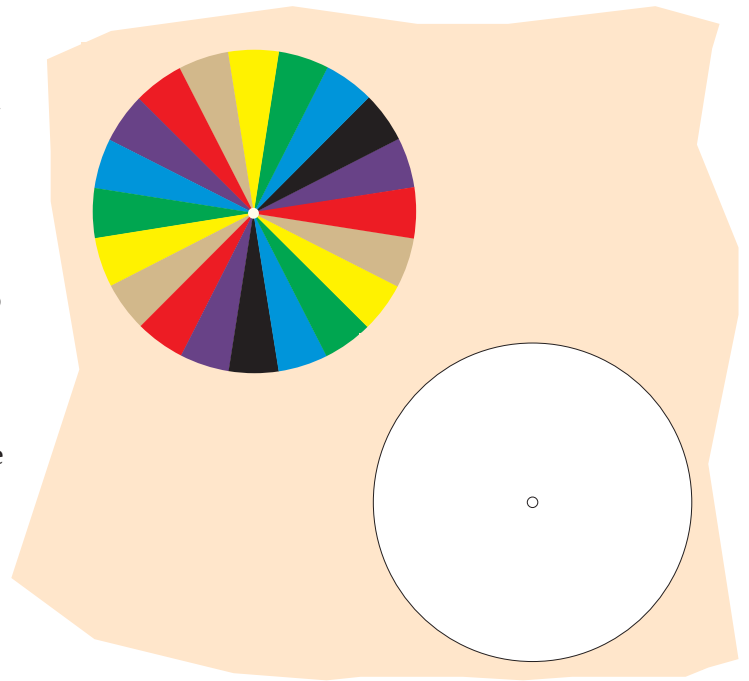
A diamond is clear and colourless. When light shines on it, you can see all the colours of the rainbow.

✦ The Spectrum

If white light can be split into many colours, can these colours make white again?

It was Isaac Newton who first showed that white light is a mixture of all the colours of the spectrum. He invented an experiment to show that you could make white light by mixing the colours together again.

What he did was, he made a colour disc like the one opposite with all the colours. When it spins round, all the colours blur together. It looks almost white.



- 1 Fill in the blanks using the words below.

prism mixture spectrum

White light is a of all the colours of the It can be split up using a



Ideas

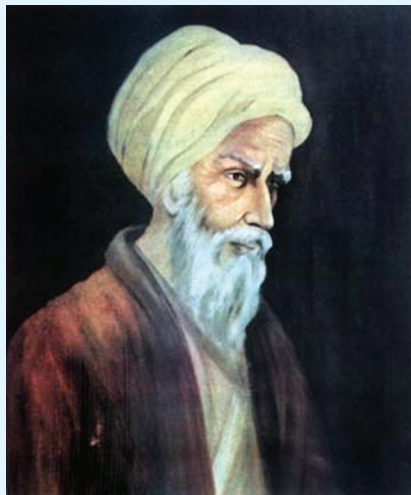
↪ **White light** is a mixture of all the colours of the **spectrum**.

↪ White light can be made by spinning a coloured disc.

ABU ALI HASAN IBN AL-HAITHAM

965 - 1040 C.E.

*Father of
modern optics*



Abu Ali Hasan Ibn al-Haitham was one of the most eminent physicists, whose contributions to optics and the scientific methods are outstanding. He is known in the West as Alhazen, Ibn al-Haitham. He was born in 965 C.E. in Basrah, and was educated in Basrah and Baghdad.

He made a thorough examination of the passage of light through various media and discovered the laws of refraction. He also carried out the first experiments on the dispersion of light into its constituent colours. His book *Kitab-al-Manadhir* was translated into Latin in the Middle Ages, as also his book dealing with the colours of sunset.

He dealt at length with the theory of various physical phenomena like shadows, eclipses, the rainbow, and speculated on the physical nature of light.

He is the first to describe accurately the various parts of the eye and give a scientific explanation of the process of vision.

He contradicted Ptolemy's and Euclid's theory of vision that objects are seen by rays of light emanating from the eyes; according to him the rays originate in the object of vision and not in the eye. Through these extensive researches on optics, he has been considered as the **father of modern Optics**.

His contribution to mathematics and physics was extensive. In mathematics, he developed analytical geometry by establishing linkage between algebra and geometry. He studied the mechanics of motion of a body and was the first to maintain that a body moves perpetually unless an external force stops it or changes its direction of motion. This would seem equivalent to the first law of motion. Ibn al-Haitham's influence on physical sciences in general, and optics in particular, has been held in high esteem and, in fact, it ushered in a new era in optical research, both in theory and practice.