MY HEALTH

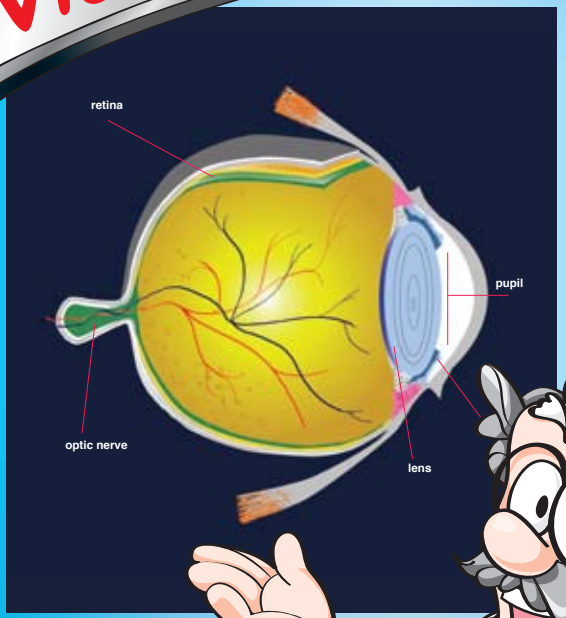
VISION BOOK

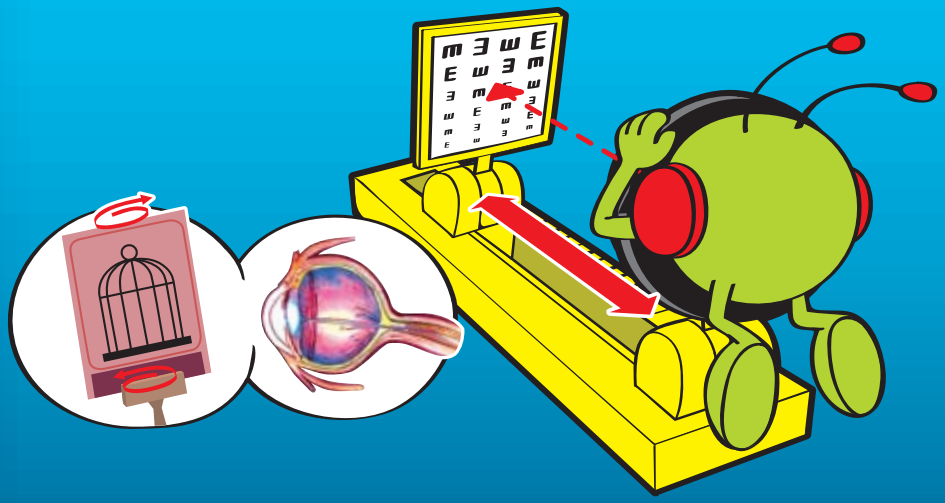
8+

- *The Sense of Sight*
- *Make a pinhole camera*
- *Floating fingers*
- *Binocular Vision*
- *Jumping images*
- *Find your dominate eye*
- *Find your blind spot*

Fun activities

and explanations





All About Your Eyes And Eye Testing

SCIENCE

P38-07094-81001001

Introduction

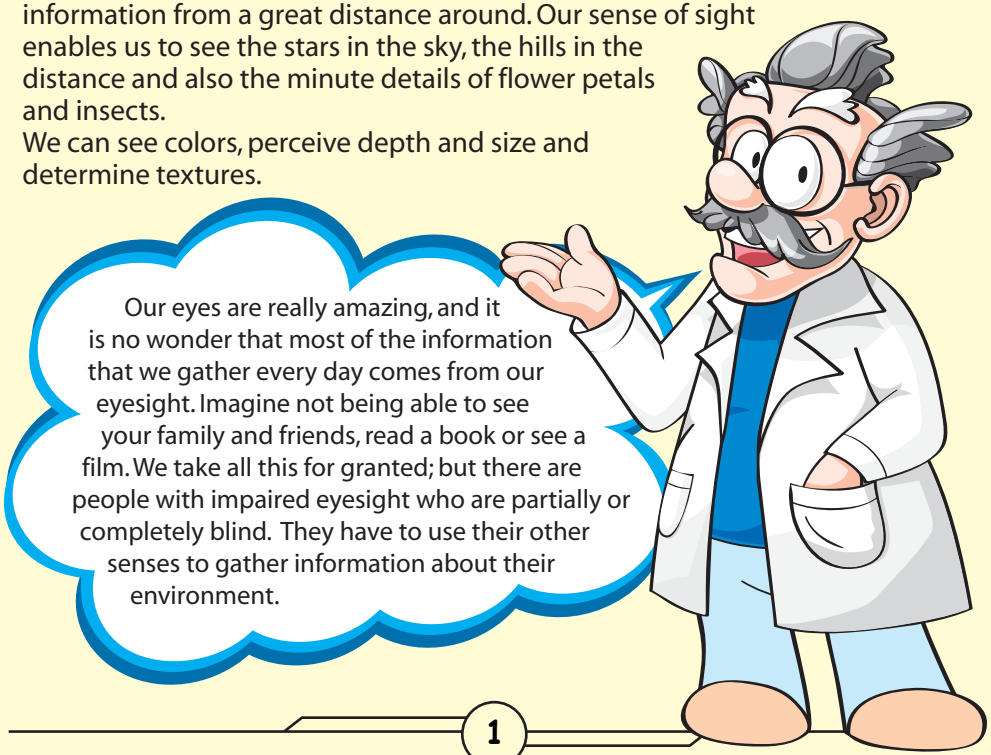
Check your eyes and Eyesight

We are always being told that we should take responsibility for our health and there is no better way of doing this than by learning at a young age how our bodies work and how we can ensure good health both now and in the future.

This series of kits introduces children to their own bodies, and simple activities demonstrate how the various parts of the body work. Each kit contains a specially designed piece of equipment allowing the child to assess his own well being in the framework of each particular kit.

This kit deals with the eyes and the sense of sight. Knowledge of how our eyes work brings with it a greater understanding of how to look after our eyes and protect our sight. The eye gauge offers a simple method of checking for short-sightedness and long-sightedness. This can only give an indication of a possible problem and is in no way an alternative to a professional eye test.

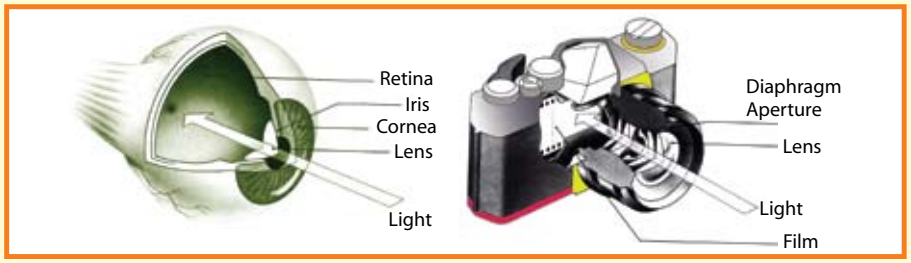
The organs of sight are our eyes, they are capable of taking in detailed information from a great distance around. Our sense of sight enables us to see the stars in the sky, the hills in the distance and also the minute details of flower petals and insects.
We can see colors, perceive depth and size and determine textures.

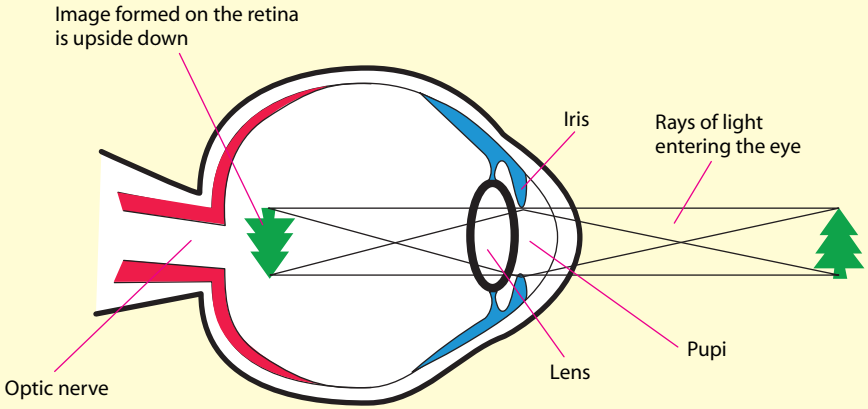


How do our eyes work?

The eyes are very similar to a camera; they collect and focus light onto a light sensitive surface.

Light passes first through the cornea, a transparent protective covering to the eye. Light then passes through the pupil, an opening whose size is determined by the iris.
The iris is like automatic shutters opening and closing in response to changes in the amount of light.
The light rays then pass through the lens, a soft jelly like object which focuses the rays on to the retina, a light sensitive membrane lining the back of the eye. The light receptors in the retina transfer the information to the brain where they are translated in to the images that we see.

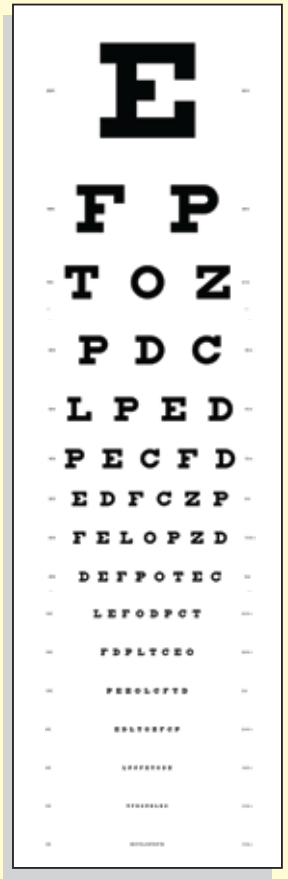




What is perfect vision?

Perfect vision covers several vision skills, some of which are explained in this kit.
These include depth perception, color vision, side vision and clarity of vision.

Clarity of vision (clear, sharp vision) is usually tested with eye charts: most of us know these charts from school or the doctors surgery.



You will probably also be familiar with the terms 20/20 or 6/6 vision, but what do they mean? Both terms are actually the same: the 20 refers to a distance in feet and the 6 refers to the same distance in metres.

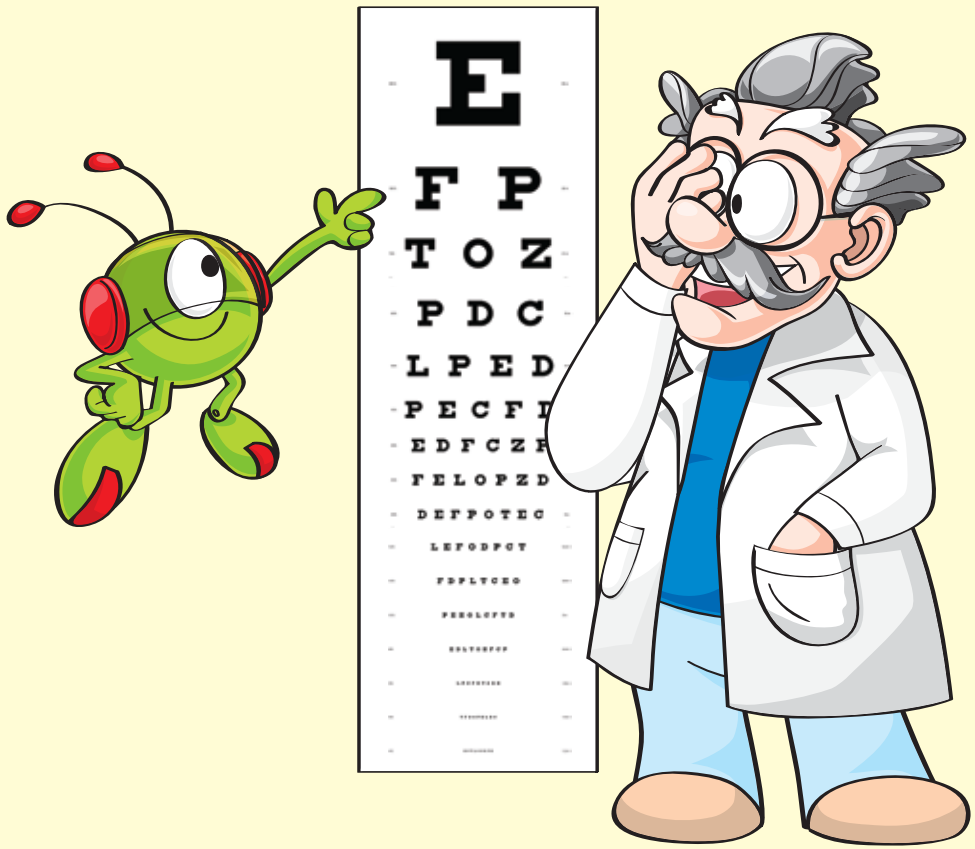
20/20 vision means that you can see clearly what should be seen by someone with normal vision at that distance. 20/40 vision means that you have to stand at a distance of 20 feet to see clearly what someone with normal vision can see at 40 feet.

If you have 20/100 vision you have to stand at a distance of 20 feet to see clearly what someone with normal vision can see at 100 feet. In your kit you will find a traditional Snellen eye chart. Herman Snellen was a Dutch ophthalmologist who developed the chart in the 19th century. The chart has eleven rows of block letters starting at the top with one large letter. Each following descending row has more letters that decrease in size. Each row is marked with the corresponding ratio according to the 20/20 or 6/6 systems.

How to use the eye chart

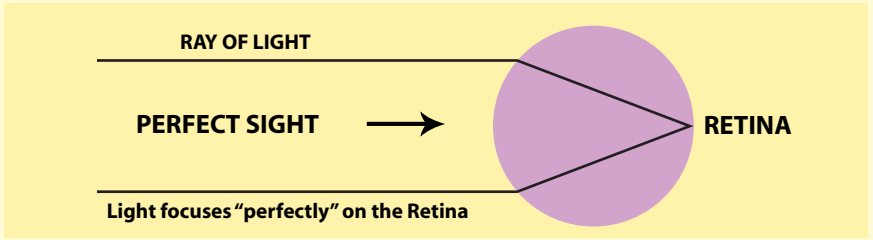
Attach the eye chart to a door or wall so that you can stand 20 feet or 6 metres from the chart. Make sure there is good light in the room. Now cover one eye lightly with the palm of your hand and starting from the top of the chart read the letters out loud in each line. It is a good idea to ask a friend to check the letters as you call them out and to note to which row you can read clearly.

Now cover the other eye and test again.

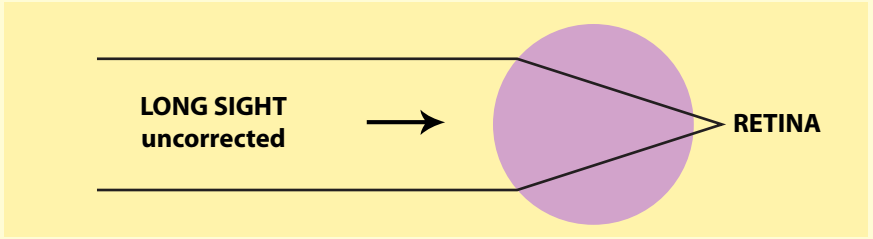


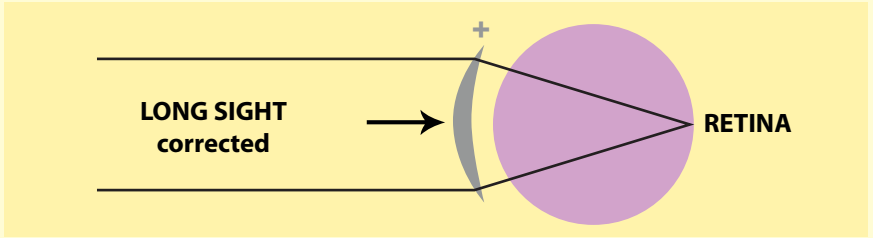
What is long sightedness?

Another name for long-sightedness is hyperopia.
This happens when light entering the eye focuses behind the retina instead of on the retina. Someone with long-sightedness can usually see the close environment and into the distance very clearly; but has difficulty in focusing on close objects. This will cause blurred vision and maybe tired eyes and headaches. Children with long-sightedness may have difficulty in focusing on book work and computers.



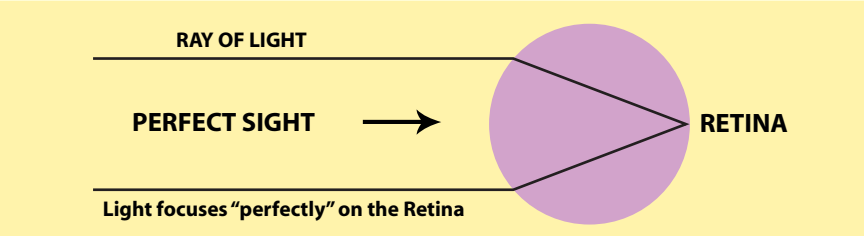
Long-sightedness can be corrected easily with glasses or contact lenses. By using a convex lens (plus lens) the rays of light entering the eye are bent inwards and the image lands on the retina.



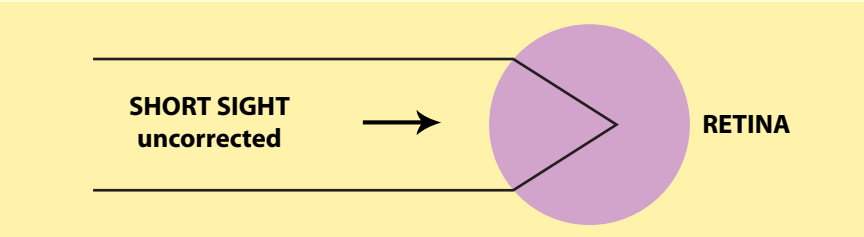


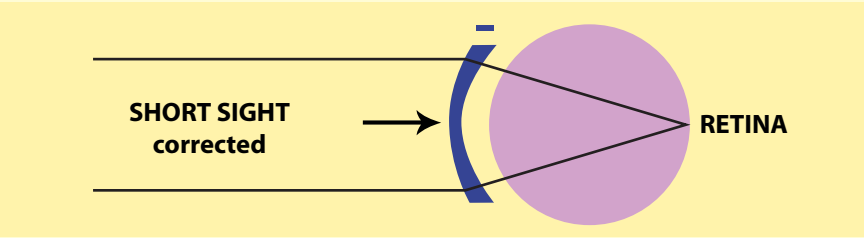
What is short sightedness?

Another name for short-sightedness is myopia.
This happens when light entering the eye focuses in front of the retina instead of on the retina.
This means that you see close objects clearly but distant objects are blurred.



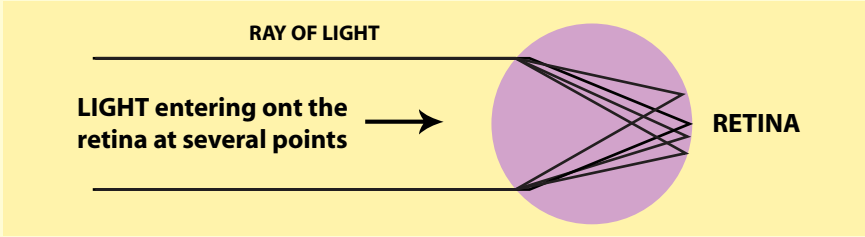
Short sightedness can be corrected by using a concave (minus lens).
The lens causes the rays of light entering the eye to be bent outwards so that the image lands on the retina.





What is Astigmatism?

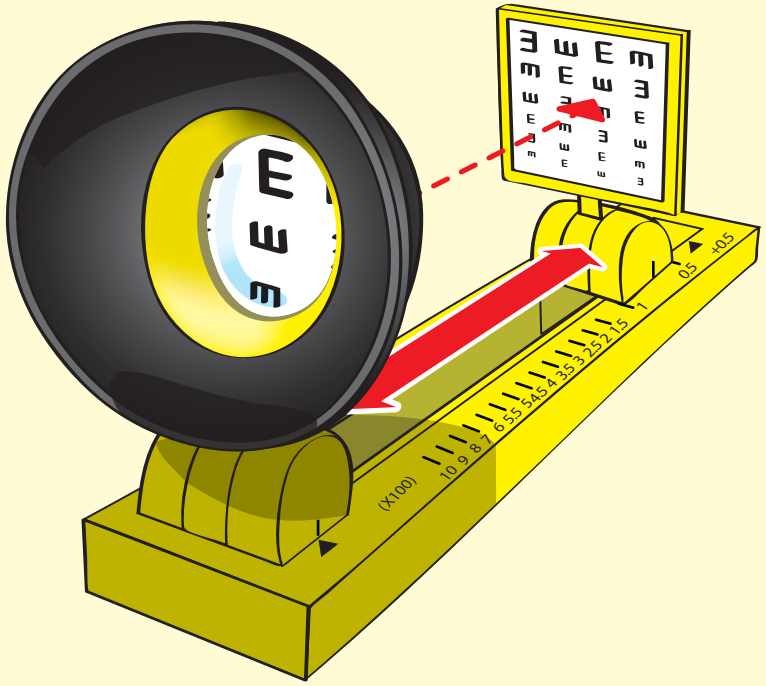
Astigmatism occurs when the cornea of the eye has an irregular shape.
The cornea is usually spherical, like a round ball, but in astigmatism it has an oval shape like the back of a spoon. The front of the cornea is nearly flat but the sides are curved This discrepancy causes light entering the eye to focus on the retina at several points instead of focusing at one point.
The result is blurred vision.



Astigmatism can be treated with glasses or contact lenses.

How to use the Eyesight Gauge

IMPORTANT. This gauge can only give an approximate indication of short-sightedness and long-sightedness and is in no way an alternative to a professional eye test.



The eyesight gauge is used to give an approximate indication of short-sightedness and long-sightedness. Hold the gauge to one of your eyes and look through the lens. You will see the small chart at the other end of the gauge. Move the chart backwards and forwards until you see a sharp image of the markings on the chart. Take your time until you are sure that you have the sharpest image possible. Now check the position of the chart.

How to use the Eyesight Gauge

The base of the eyesight gauge is marked with numbers.

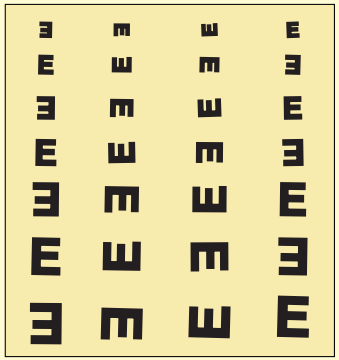
To explain the numbers more clearly we have colour coded the following diagram to help you understand and read the gauge correctly.

If the chart fall in the yellow area, eyesight is normal.

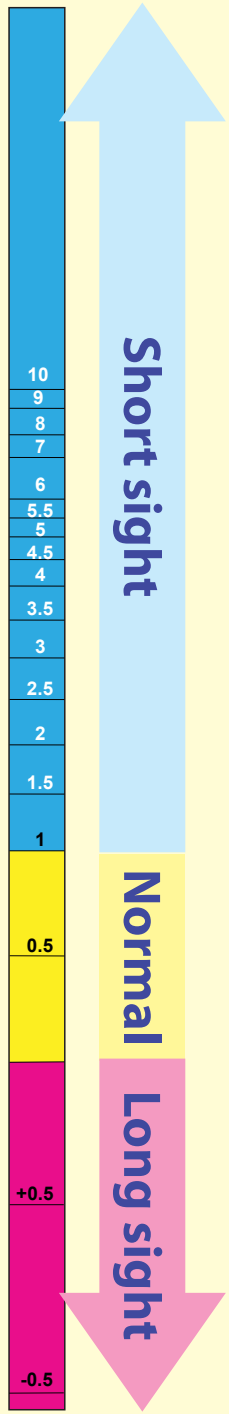
If the chart falls in the blue area, this is an indication of short-sightedness. The higher the number on the gauge, the greater the degree of short-sightedness.

If the chart falls in the red area this indicates long-sightedness.

The higher the number on the gauge, the greater the degree of long-sightedness.



If the gauge indicates short-sightedness or long-sightedness, a professional eye test should be arranged as soon as possible.

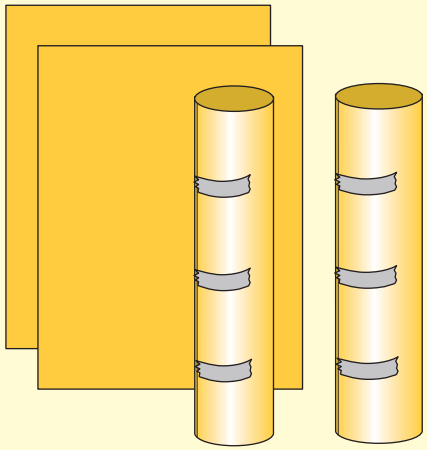


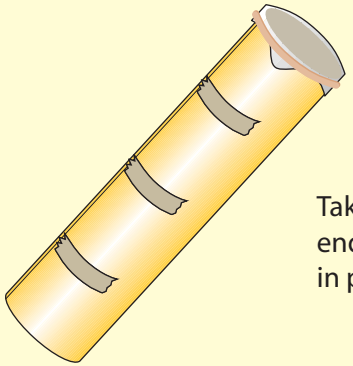
Make a Pinhole Camera

The pinhole camera shows what happens to light when it enters your eye.

You will need to collect a few things from home first:
An empty breakfast cereal box.
A piece of aluminum foil 10 x 10 cms (4 x 4 inches)
A piece of parchment paper 7.5 x 7.5 cms (3 x 3 inches).
This paper is used for cooking and is sometimes called greaseproof paper.
It is semi transparent.
2 rubber bands
A pin – to make the pinhole.
Tape.

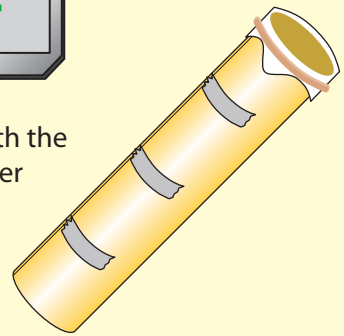
Cut out the 2 large sides of the cereal box.
Roll 1 piece into a tube with a diameter of 4 cms (1.6 inches) and close firmly with tape.
Roll the 2nd piece into a tube with a diameter of 3 cms (1.2 inches) and close with tape.





Take the larger tube and cover one end with the aluminum foil: hold it in place with a rubber band.

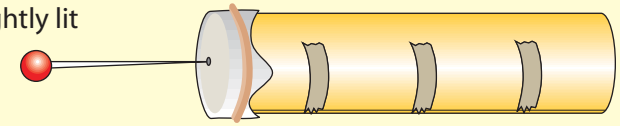
Make a Pinhole Camera 2



Take the smaller tube and cover one end with the parchment paper: hold in place with a rubber band and make sure that the overlapping edges are flat against the sides of the tube.

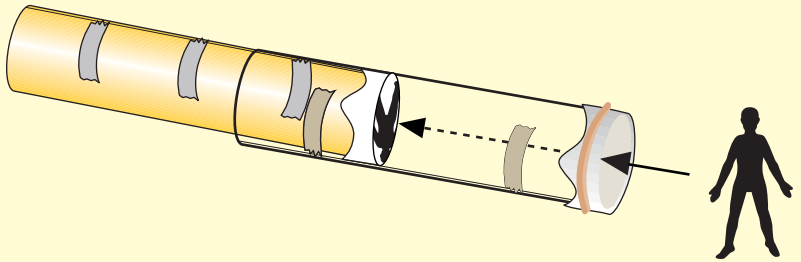
Make a small hole with the pin in the centre of the aluminum foil. Insert the smaller tube inside the larger tube so that the parchment paper touches the foil.

Use your camera in a brightly lit room or even better, outside on a sunny day.



Look at objects through the pinhole and you will see upside down images on the parchment
paper: this is your screen. Move the inside tube backwards and forwards to focus on the object and to get as clear an image as possible.

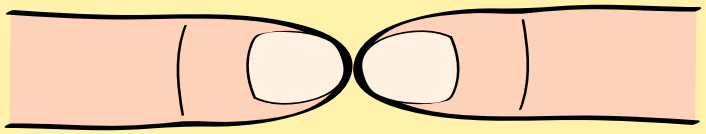
You have made a simple camera. The images will not be sharp but this is how the early cameras worked. It is also how the eye works: an upside down image is formed on the retina of our eyes; we need our brains to turn the image the right way up!



Floating fingers

The lens of the eye focuses light rays onto the retina but cannot focus divergent rays from a close object and parallel rays from a distant object at the same time. This activity shows you what happens.

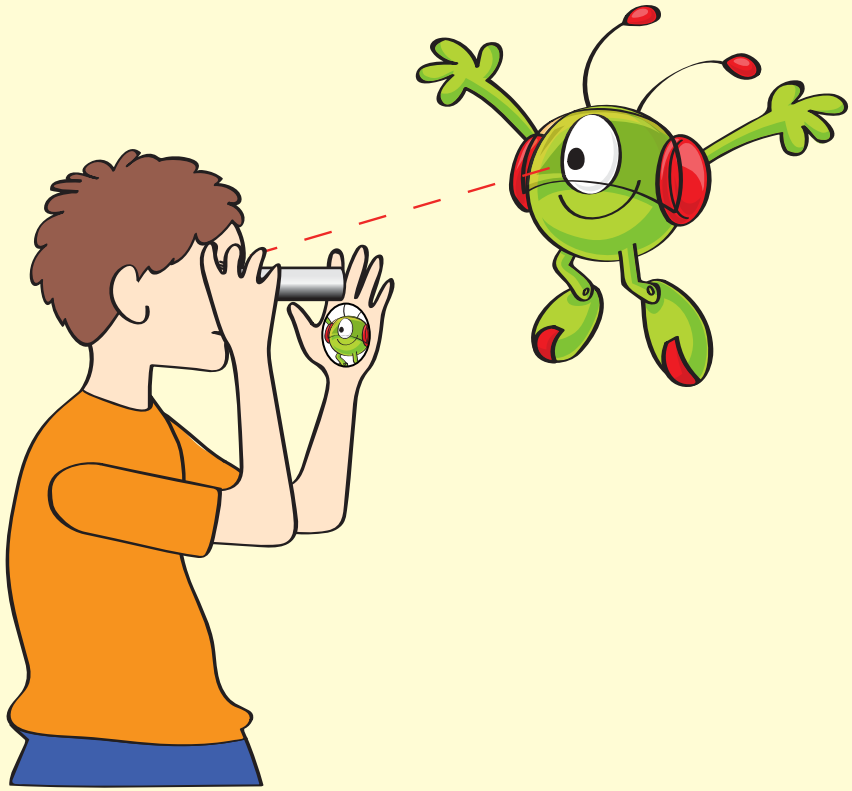
1. Put the ends of each forefinger together and hold them in front of you at eye level.



2. Now look under your fingers at some object in the distance.
You will see three pieces of finger. Separate your fingers just a little and you will see a finger with two fingernails floating between your fingers.

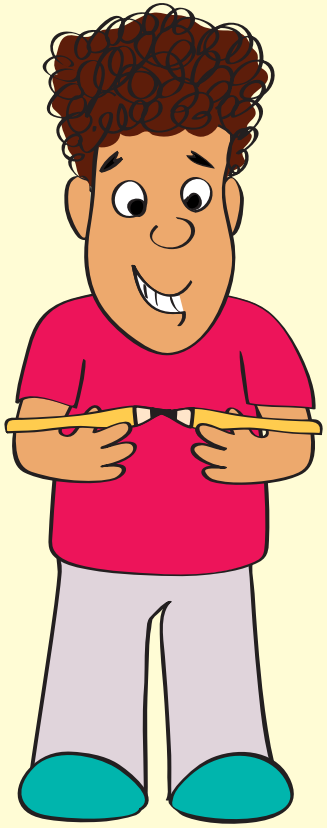
Hole in the Hand

Here is another illusion trick to show the same effect.
Roll a piece of paper (about 20 cms square /8 inches square) into a tube; the diameter ofthe tube should be about 2.5 cms /1 inch.
Hold the tube up to your right eye and place your hand about 15 cms / 6 inches from your face with your palm facing you.
Let the side of your hand rest on the tube. Now, keeping both eyes open, focus on a distant object. You will see the object through a hole in your hand!

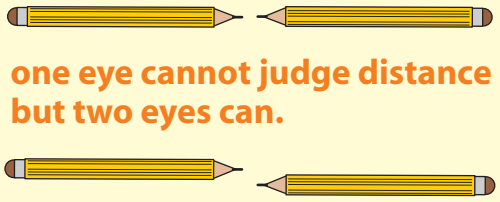


Binocular Vision

We have two eyes to see with; this is called binocular vision.
When we look at an object, different images are formed on the retina of each eye because each eye sees the object at a slightly different angle.
The brain learns how to interpret these images and enables us to judge distance. This ability is called depth perception; with two eyes working together we can judge if an object is nearer or further away from others.



You can see this with a very simple experiment. Hold a pencil horizontally in each hand about 30 cms (12 inches) apart.
Hold them at eye level at arms length from your body.
Now slowly try to bring the ends of the two pencils together.
This is easy, but now try with one eye closed. This time it is more difficult: one eye cannot judge distance but two eyes can.



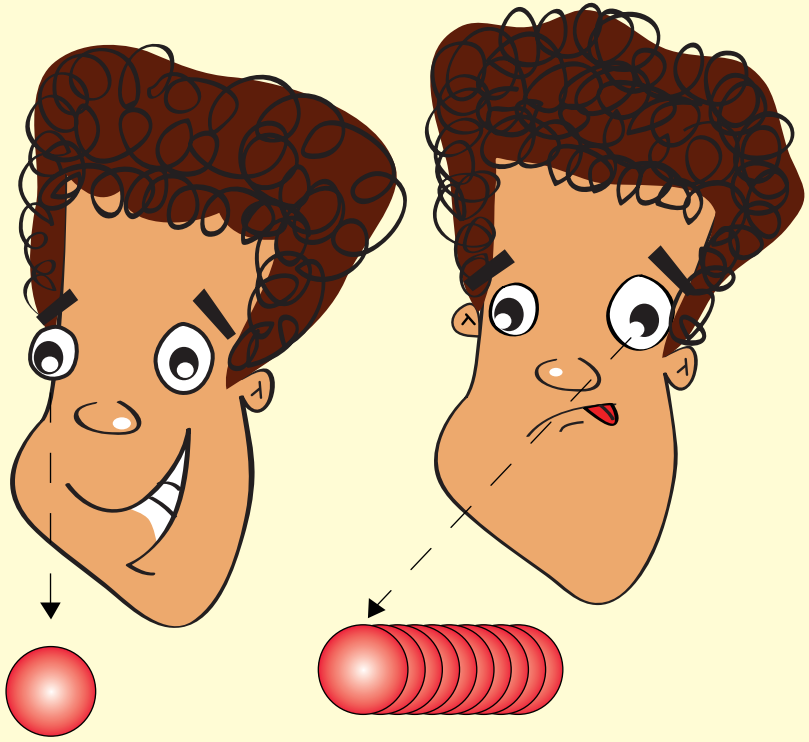
one eye cannot judge distance but two eyes can.

Jumping Images

Here is another simple experiment to show that each eye receives a different image.

Close one eye and point at an object about 10 meters (30 feet) away. Still pointing at the object, open this eye and close the other eye.

The object will jump to the side. Alternate opening and closing each eye: the object will jump from side to side.



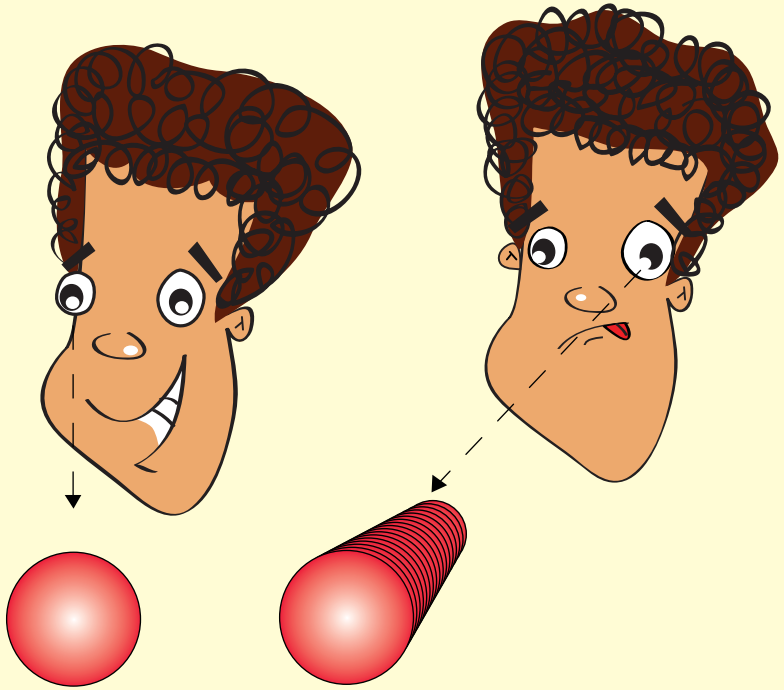
Find your dominant eye

We all have a dominant eye, just as we all have a dominant hand or leg.

This eye is probably stronger and we feel more comfortable using it if only one eye is needed, such as when looking through a telescope or microscope.

You can determine your dominant eye very easily. Point at an object about 10 meters (30 feet) away with both eyes open. Now close your right eye: does the object jump? If it does, your dominant eye is your right eye. Now check by closing your left eye and still pointing at the object. This time the object will not jump because you are looking at it with your dominant eye.

People that play sports such as archery and billiards have to know which is their dominant eye as they have to use this eye to take a correct aim.



Find your blind spot

There is an area on the retina which is called the blind spot. This is where the optic nerve leaves the eye to connect with the brain, and any image that falls on this spot will not be seen.

It is very simple to find your blind spot using the icons:

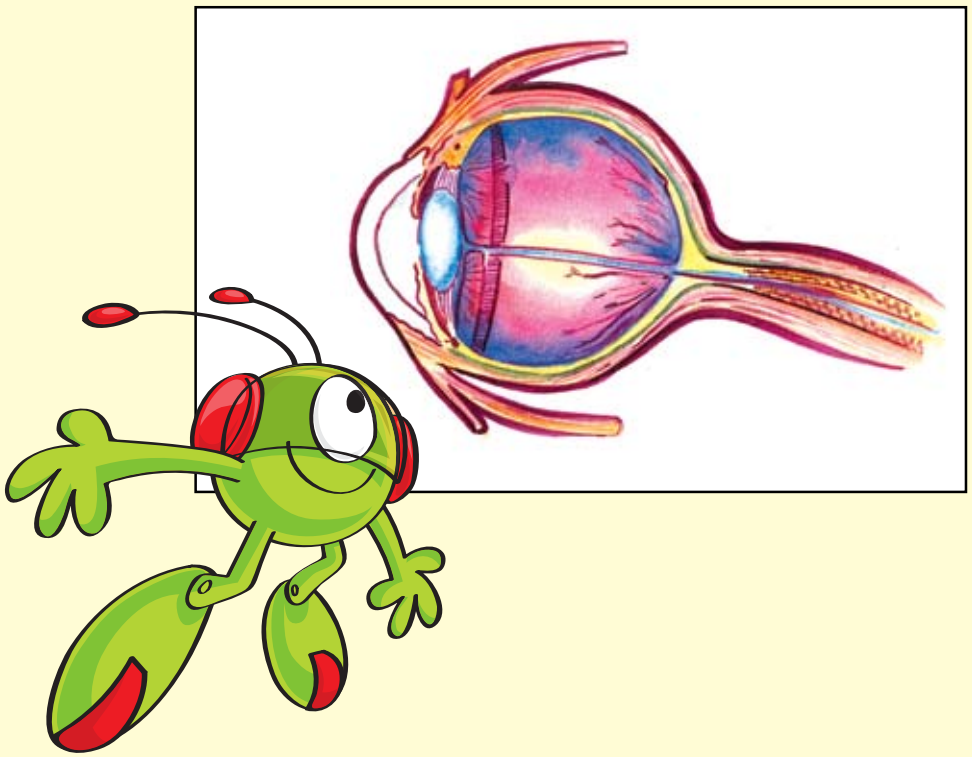
Place your hand over your right eye or close it .Holding your manual at about arms length, look at the ■ icon with your left eye and slowly bring the page closer. At a certain point, the ● icon will disappear. Now close your left eye and look at the ● icon and again slowly bring the page closer. This time the ■ icon will disappear. The point at which the icons disappear is your blind spot. The image of the icon falls on the small area of your retina where there are no light receptors.

How do we see colour?

The retina (the membrane at the back of the eye) contains millions of light receptors: these are cells which are sensitive to light. Some of these cells are called cones; they are situated mainly in the centre of the retina and there are 3 types. Some of the cones detect red colour, some blue and some green. These three colours are the primary colours of light.

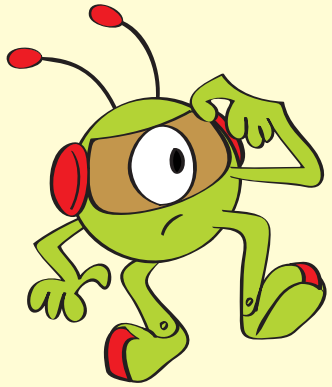
The cones send messages to the brain where they are translated into an amazing variety of colours, hues and textures for us to see.

Also in the retina are light sensitive cells called rods. These cells detect shapes and shadowsand respond to low level light.



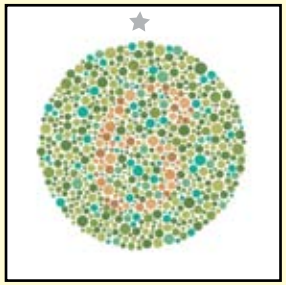
Colour Blindness

Most people who are colour-blind can see colours: they just have difficulty in seeing the difference between certain colours. The cone cells in the retina do not work exactly as they should and there is a problem with the three main colours: red, blue and green.

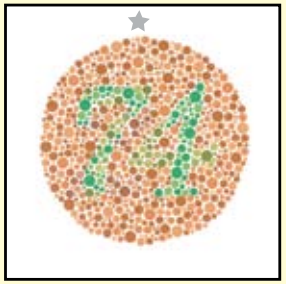


The most common form of colour-blindness is with red and green; these colours are usually seen as grey or beige.

Colour-blindness is inherited and is more common in boys than in girls. Ask your friends to tell you what number they see on the first disc. If you have normal colour sight, you will see the number "6". If you are colour blind you will see only spots.



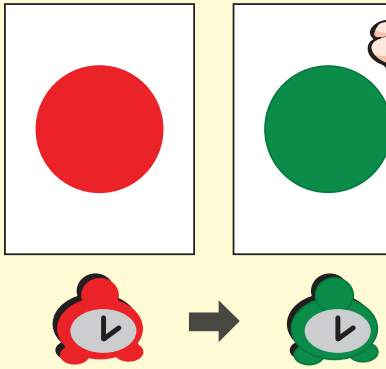
Now look at the second disc.
If you see the number "74" you have normal colour sight. If you see the number "21" or just spots, you are colour blind. This shows you that there are different types of colour blindness. Statistics show that 1 in 12 boys is colour blind, so if you check the boys in your class you should find at least one who sees the number "21" or just spots.



Look at the discs with the star at the top.

What is an after image?

For a moment you cannot see: the white light has blinded you.



Stare at the red circle for 30 seconds

Your first reaction is to blink and you see black spots wherever you look. The black spot is the afterimage of the white light from the flash.
Now experiment with a coloured afterimage. Draw a bright red circle on a piece of white paper; fill the circle completely with the red colour. Now stare at the circle for 30 seconds, then blink and look at a white wall or a piece of white paper.

You should see the circle but not red; it will be a green colour.
What has happened? Remember the cones in the retina that detect 3 main colours, red, blue and green. By staring at a red image, the red detector cones are overworked and become very tired.
The blue and green detector cones take over and produce a green image.

Persistence of Vision

When you look at something and then look elsewhere, your brain remembers the previous image for a fraction of a second.

If the image was brightly coloured the brain remembers it for a little longer.

This is the basis of animation: if you see 10 bright images, one after the other, in one second, they appear as moving images.

Use the coloured cards supplied in the kit to try this out.
You have three cards: a bride and groom, a bird and a cage, and an acrobat and a horse.

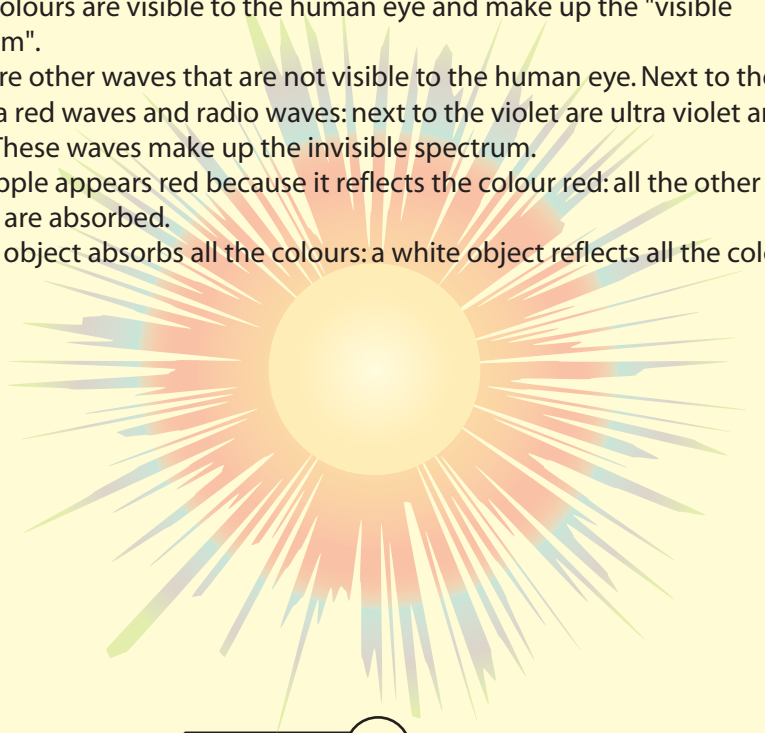
Fold one of the cards in half and attach it to the plastic holder. Hold the handle between your thumband forefinger and twist it rapidly back and forth. The two images on the card will merge together. The bride and groom are together, the acrobat sits on the horse and the bird is in the cage! If you prefer, you can hold the handle between your two hands and twist it. Movies are also based on "persistence of vision"; but they show more images in one second, giving a much more natural effect.

Light and Colour

Light from the sun is white light, but actually it consists of several different colours. Light travels in the form of a wave and each colour in white light has a different wavelength. You probably know these colours: they are thecolours of the rainbow.

RED
ORANGE
YELLOW
GREEN
BLUE
INDIGO
VIOLET

These colours are visible to the human eye and make up the "visible spectrum".
There are other waves that are not visible to the human eye. Next to the red are infra red waves and radio waves: next to the violet are ultra violet and x-rays. These waves make up the invisible spectrum.
A red apple appears red because it reflects the colour red: all the other colours are absorbed.
A black object absorbs all the colours: a white object reflects all the colours.



Make a rainbow

Place a full glass of water on the edge of a table and a piece of white paper on a chair next to the table.

You will need a flashlight and some masking tape. Use the masking tape to cover the bulb of the flashlight so as to leave a narrow slit for the light to come through. Turn off all the main lights in the room, hold the flashlight above the glass of water and direct the beam down onto the edge of the glass and onto the white paper.

You should see a rainbow of colors on the white paper. If you don't, move the flashlight around a bit till you see the rainbow.

Make a telescope

There are several tools available to help us see better. Many people wear glasses to correct their eyesight. We use microscopes to see very small things and binoculars to see distance objects or bring them closer. The telescope is used to see distant objects and uses several lenses to give you a clear picture of things many miles away.

You can make a simple telescope using the two lenses supplied in the kit.
You will need a few things from home first.

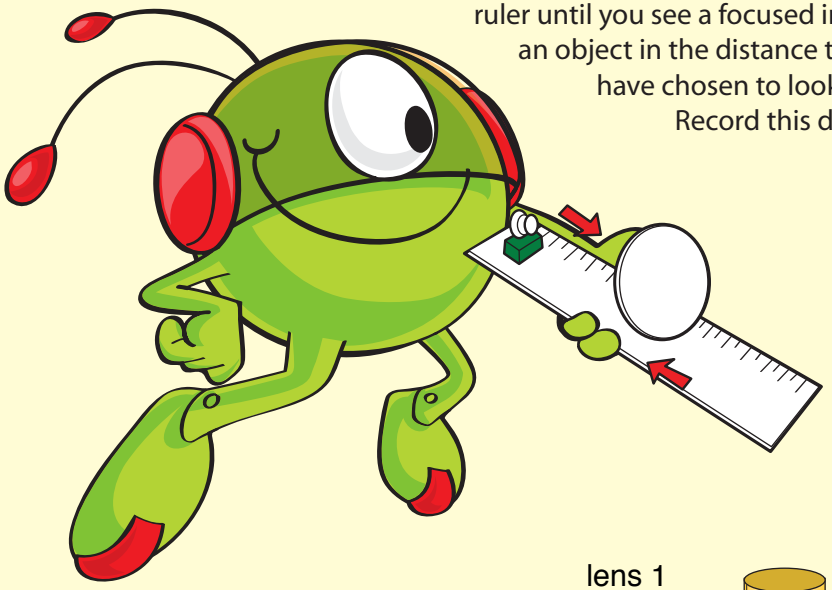
An empty breakfast cereal box / A ruler / Thick tape
A piece of modelling clay from the kit / 2 lenses from the kit

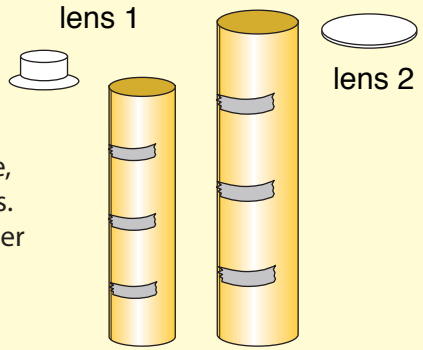
Make a telescope 2

First you must measure the difference between the lenses that gives you a focused image. Place a piece of modelling clay on the ruler at zero cms and insert the small lens into the clay with the flat end of the lenses facing you.

Now bring the ruler up to eye level and move the large lens up and down the ruler until you see a focused image of an object in the distance that you have chosen to look at.

Record this distance.





Cut out the 2 large sides of the cereal box and make 2 tubes, securing them with tape, each with the diameter of one of the lenses. Make the wider tube longer than the thinner tube by the distance you recorded before plus 5 cms.

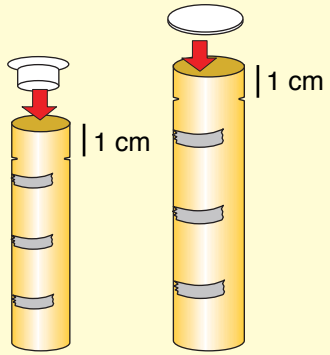
Make a telescope

To insert the lens into the tube, make 4 small cuts in the cardboard about 1 cm from the end of the tube.

Insert your fingernail into each cut and gently press the cardboard backwards.

You can now insert the lens and it will be held firm by these small folds.

Remember that the small lens should be inserted with the flat side towards the back of the tube.



Your telescope is nearly ready; you just have to wrap some thick tape around the top end of the small tube (1 cm from the end) until you feel that the small tube touches the inside of the large tube, but can move easily backwards and forwards.