



Make your own telescope

Looking at the universe

time

65 minutes

learning outcomes

To:

- know that the invention of the telescope allowed us to find evidence that the Earth is not the centre of the universe
- know that you can use a telescope to see an object in more detail
- know that the shorter the focal length, the higher the magnification

end product

- a telescope for each child

materials needed

- photograph of telescope (Appendix)
- 24 lengths of PVC pipe 18 cm long with a diameter of 40 mm
- 24 lengths of PVC pipe 18 cm long with a diameter of 32 mm
- 24 lenses OM.2
- 24 lenses, OM.8a
- gaffer tape
- thin card
- ruler
- scissors
- A4 paper
- sunlight or electric light
- hollow punch (optional)

Preparation

For the activity **The telescope** you will need the photograph of the telescope from the Appendix.

For the activity **Make your own telescope** you will need the correct lenses.

We are using OptiMedia glass lenses from AstroMediaShop (<http://www.astro-mediashop.co.uk>). Lens OM.2 has a diameter of 16.5mm and a strength of +66.7. Lens OM.8a has a diameter of 40mm and a strength of +5.6.

Good to know.

In lesson 35 the children also make a telescope, but a different one from the one in this lesson.



The telescope 10 min.

The children complete Task 1 on the worksheet. When they are finished, explain that a telescope is an instrument that allows you to see distant objects in more detail. Show the photograph of the telescope. Explain that long ago people thought the Earth was in the centre of the universe. Some early mathematicians made calculations and came to the conclusion that this was not the case. The invention of the telescope enabled them to find proof that the Earth and other planets revolve around the Sun.



The children make a telescope.



Make your own telescope 30 min.

Organise the children into pairs. Each pair of children thinks about drawing the design for their telescope. What requirements does a telescope need to meet?

Discuss the requirements:

- a telescope must allow you to see a distant object in more detail (it needs one or more lenses)
- you must be able to focus a telescope (it must be adjustable)
- the telescope needs to be sturdy

Tip.

The children can decorate their telescope. They may like to add a sticker warning them not to look at the Sun.



Each child makes his or her own telescope. The children complete Task 2 on the worksheet. Help the children as they draw the design for their telescope. When all the drawings are completed, encourage the children to show them to rest of the class. Discuss them together and provide comments. Can anything be improved?

Allow time for children to make improvements where necessary. Make sure they do not spend so much time on their drawing that there is no time left for the actual construction of their telescope. Check that any adapted design drawings are satisfactory. Hand out the materials for making the telescopes.

Help the children where necessary as they make their telescopes. They need to stick the black tape in such a way that the narrower pipe can slide up and down without 'falling out' of the wider PVC tube. Explain to the children that when they are fixing the large lens in place, they must make sure that not too much tape covers the lens.

Using a hole punch enables you to make two holes of exactly the same size in the card. You could also make the holes using a compass and scissors. Make sure the holes are smaller than the lens. The end of the smaller tube is the part you will hold to your eye to look through the telescope.



Does your telescope work? 10 min.

The children complete Task 3. Discuss the answers. When the children look through their telescope, they see objects in more detail. To focus their telescope, they need to slide the narrow tube in or out a little. The telescope contains two convex lenses, so the image they see will be upside down. If necessary the children can make improvements to their telescope so it works better.



How do lenses work? 15 min.

Give each pair of children two lenses and a sheet of A4 paper. The children go outside or use an electric light to see how the lens refracts light. They complete Task 4 on the worksheet.

Lenses bend rays of light that pass through them. When parallel rays pass through the lens, they bend and meet at a spot just beyond the lens known as the focal point. It is possible to see this focal point by shining light through the lens onto a piece of paper. If the spot of light on the paper is small and bright, the focal point of the lens is on the paper. If the point of light is dull and fuzzy, the paper is too close or too far away. This illustrates why we need to be able to adjust a telescope by sliding it in and out.



Make your own telescope



You are going to make a telescope.

1 The telescope



Read the text below.

A telescope is an instrument that enables you to see distant objects in greater detail. The word telescope comes from the Greek. It means 'far-seeing'. A telescope contains at least two lenses. The telescope was invented in 1608. We don't know exactly who made the first telescope. It was either Zacharias Jansen or Johannes Lipperhey. They both lived in the city of Middelburg in the Netherlands. The telescope was seen as a useful instrument in wartime to be able to see your enemy while he was still a long way away. Galileo Galilei was the first person to use a telescope to look into space. He discovered that the Moon has craters and that Saturn has rings. He also proved that the Earth is not at the centre of the universe.

a What can you use a telescope for?

write your answer HERE

b Who invented the telescope?

write the correct answer HERE

c Why was the telescope such an important invention?

2 Make your own telescope

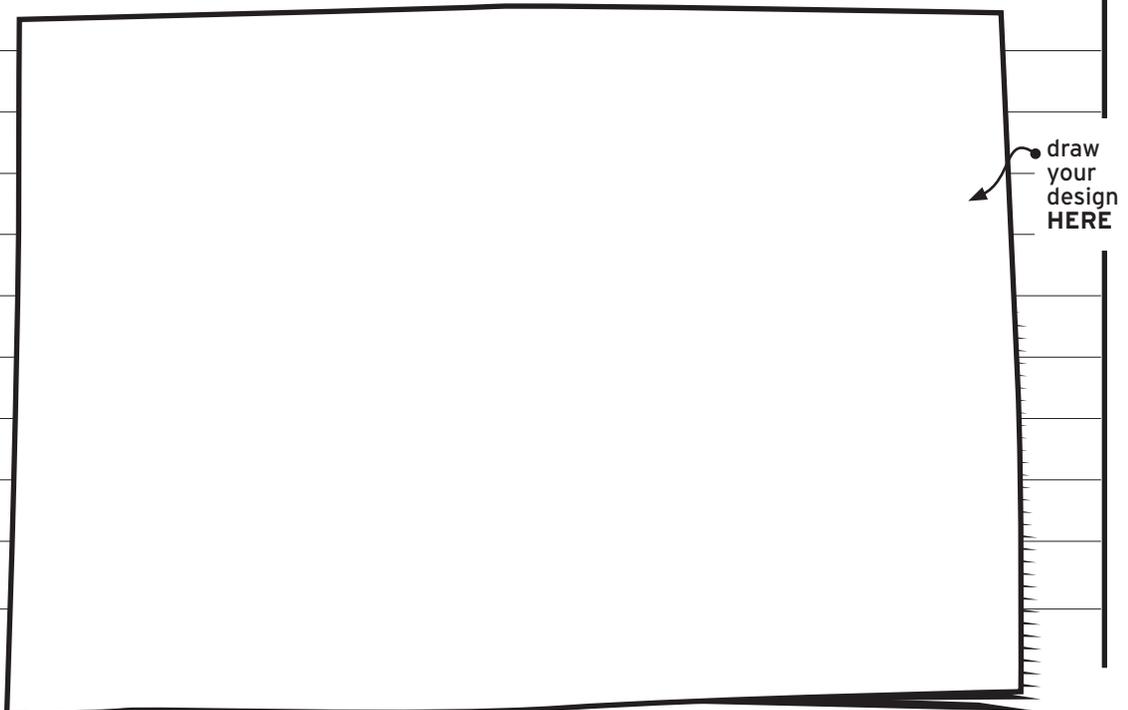


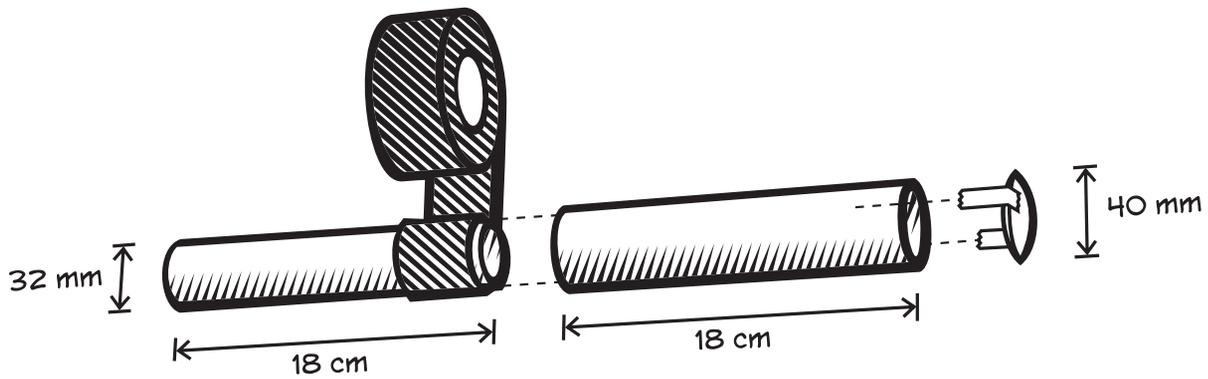
What do you need?

- 2 PVC tubes, 1 wider and 1 narrower
- ruler
- 2 lenses (2 and 8a)
- pencil
- gaffer tape
- scissors
- thin card
- hollow punch (optional)

What do you need to do?

- 1 Make a design drawing, showing how you are going to make your telescope.
Before you start, read carefully the instructions on the next page from step 2 onwards and look at the drawings. Use a pencil and ruler to make your design drawing. Label the drawing to show what materials you are using to make your telescope.





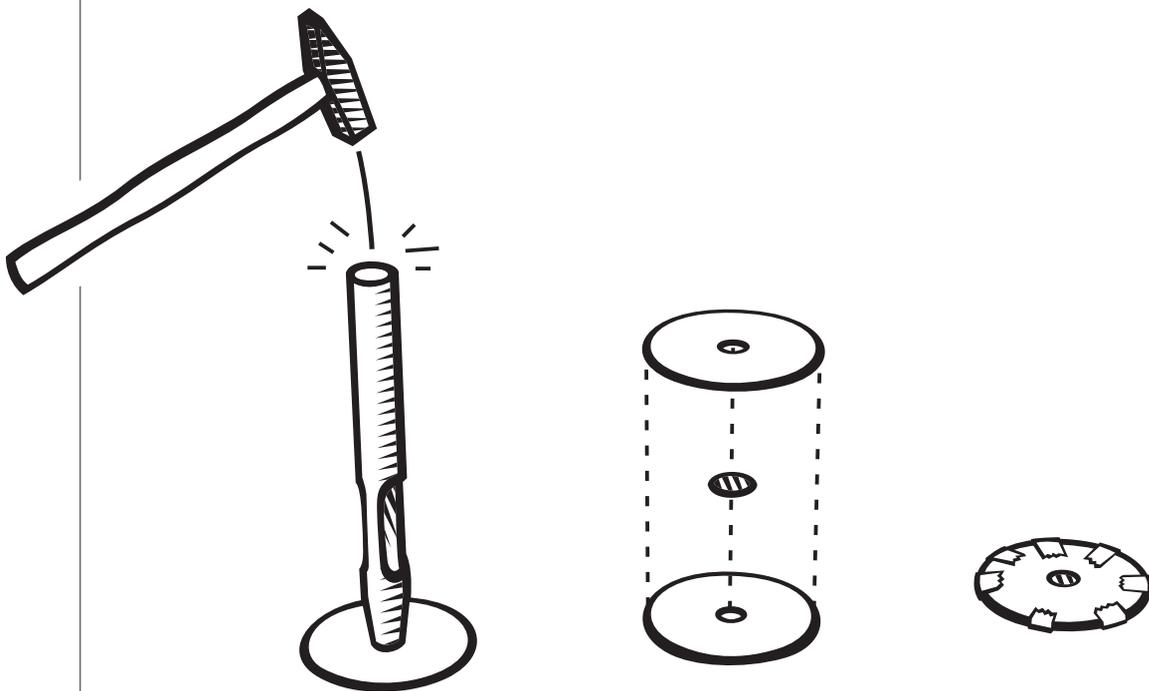
- 2 Wrap tape around the narrow PVC tube so that it fits snugly into the wider tube. Important: you need to be able to slide the narrower tube in and out but it must not fall out of the wider tube when you hold it at an angle!

Look carefully at the drawing above.

- 3 Attach the larger lens to the end of the larger tube using gaffer tape.

Make sure the tape only covers the edge of the lens.

- 4 Stand the narrower PVC tube upright on the card and draw around it with the pencil. Do this twice.



- 5 Cut out the two circles. Place the circles on top of each other. Use the hollow punch to punch a hole in the middle of the two circles. Or cut two equal sized circles out, as shown in the drawing on the previous page.
- 6 Take the smaller lens. Place it in between the two card circles, in the middle where the holes are. Tape the card circles together so that the lens is held in place between the holes.
- 7 Tape the card with the lens to the end of the narrower PVC tube.
- 8 Slide the narrower tube into the wider one. Make sure that the lenses are on the outer ends. Your telescope is ready!

3 Does your telescope work?

a Look at an object through your telescope.



Is your object in focus? **yes / no**

CIRCLE the correct answer

b Look at the object again.

Slide the narrow tube of your telescope in and out.

Is your object in focus now? **yes / no**

CIRCLE the correct answer

Keep trying until your object is in focus.

c What do you notice about the image that you see?

d Does the object look closer, or farther away?

Important!

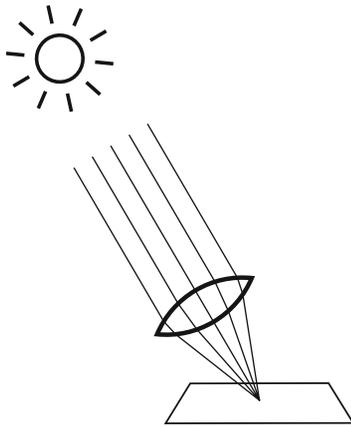
You must NEVER use your telescope to look at the Sun.

If you do that you will damage your eyes.

4 How do lenses work?



You have just used two lenses in your telescope. Some people use lenses for their eyes every day by wearing glasses or contact lenses. Lenses bend rays of light that pass through them. When parallel rays pass through the lens, they bend and meet at a spot just beyond the lens known as the focal point.



You are going to find out where the focal points of your lenses are.

What do you need?

- 2 lenses (2 and 8a)
- A4 paper
- Sunlight or an electric light

What do you need to do?

- 1 If the Sun is shining you can go outside. If the Sun is not shining, you can use an electric light.
- 2 Place a sheet of A4 paper on the ground under the lens
- 3 Move the lens up and down until you see a small and bright point of light on the paper. The bright light means it is in focus, so the distance you can measure between the paper and the lens is the focal distance.
- 4 Do this for both lenses.

Tip.

Think about the height you held each lens from the paper. Was it the same?

a Is the focal point for each lens the same?

yes / no

CIRCLE the correct answer

b The shorter the distance between the lens and its focal point, the higher the magnification. Which lens makes things appear larger?

lens 2 / lens 8a

CIRCLE the correct answer

