How we see

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SCIENCE

1 Experiment: pin-hole camera

Reading, Speaking, Writing

Work in small groups. Complete the experiment, and write a description of what you observe.

AIM To understand how an image appears on the retina.

HYPOTHESIS Light beams travel in straight lines, and can cross one another.

METHOD Equipment:

- one small cardboard box
- a sharp pencil
- a room with a window
- a large object for covering part of the window
- an assistant

PROCEDURE:

1) Open one side of the box so that when you hold it up to your eye, your face covers the box and the inside is as dark as possible.
2) Turn the box so that the open side is facing up. Now find the middle point of one of the sides of the box - the left or right side.Turn the box so that the open side is facing up. Now find the middle point of one of the sides of the box - the left or right side.
3) Then, make a very small hole in that mid-point with the pencil.
4) Point the hole towards the window.
5) Now, hold the box against your face and look in again. Look at the opposite side of the side with the hole.
6) Move the box until you can see an image of the window (do not stand between the box and the window!).
7) Ask your assistant to cover first the top, then the bottom of the window. What do you see?

RESULTS

CONCLUSION

2 How do we see?

Reading

Fill in the gaps.

How do we see?

Light (1)_____ off the things around us. Different surfaces reflect different wavelengths of light. Our eyes focus the light into images in the same way as a pin-hole camera.

Light beams enter the eye through the (2) _____, the (3) _____ and the (4) _____ body. Each of these refracts the beams in a different way as they have different refractive indices – they are all made of different matter.

An image of the object appears on the (5) _____, inverted (upside-down) and reduced (much smaller than the object it represents). The retina is really part of the brain, and it contains two kinds of cells that are sensitive to (6) _____ – rods and cones. Rods are very sensitive even to weak light, and cones are sensitive to different (7) _____ of light, allowing us to see colours.

The neurons in the retina lead to the optic (8) _____, and on to a series of processing centres in the (9) _____. We see objects because our brains have learned to interpret the information from our retinas about the shapes and colours around us.

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Teacher's Notes and Answer Key

This worksheet is suitable for secondary school students of general science, biology or physics. For the experiment you will need a number of small cardboard boxes, one for each group.

5 Experiment: pin-hole camera

Reading, Speaking, Writing

Aims:

- **To conduct and write up a simple experiment**
- **To understand clearly why the retinal image is inverted**
- **To use language in a practical group context to achieve a goal**
- **To practise formal scientific reporting of findings**

Groups can be of any size, depending on the number of boxes available. Too many groups may lead to problems with the window: it may be better to have one person in charge of obscuring parts of the window on behalf of all of the groups who are observing.

Make sure all the students have a chance to observe the inverted image.

The writing up of observations and conclusions may be carried out collaboratively by the groups.

Sample answer:

RESULTS

A small image of the window was seen on the back of the box. When an object was held in front of the bottom of the classroom window, it could be seen at the top of the image in the box. When the object covered the top of the window, it could be seen at the bottom of the image.

CONCLUSION

The image of the window appeared upside-down on the back of the box. This must be because all the light beams from the window pass through the small hole, so that the beams from the top arrive at the bottom of the image and vice versa. Therefore the light beams travel in straight lines and can cross one another.

Aims:

- **To understand the fundamentals of visual perception**
- **To apply vocabulary and knowledge from the lesson to detailed understanding of a short text**

Students can work alone, then check in pairs or groups before giving feedback to the whole class.

K ey:

1 reflects (is reflected)

2 cornea (conjunctiva)

3 lens

4 vitreous

5 retina

6 light

7 wavelengths

8 nerve

9 brain