INVESTIGATING MIRRORS

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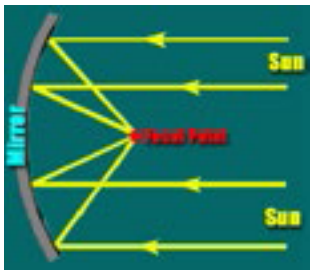


Strands/Strand Units

Energy and Forces: Light

Class Level

3rd - 6th

Learning Objective

The child shall be enabled to:

"Investigate how mirrors and other shiny surfaces are good reflectors of light ... effects of flat shiny surface, curved shiny surface" (3rd/4th, 5th/6th class).

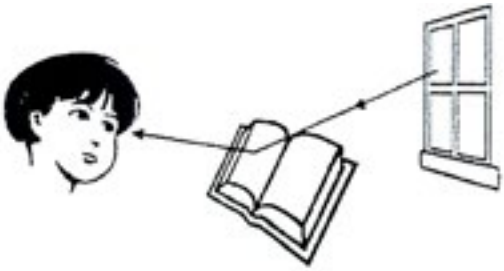
Equipment

A selection of mirrors: Plane (i.e. flat) and curved (convex and concave), dessert spoons, tape (to tape two mirrors together), small object (e.g. pencil), sheet of paper.

Preparation See under 'Safety' to ensure mirrors have no rough edges.

Background information

We see objects because light rays enter our eyes after bouncing off the objects. This bouncing of light off objects is known as **REFLECTION.**



Most objects have a rough surface, and we cannot see ourselves in them. But if an object is very smooth and shiny then we can see a very clear image of ourselves in it. A mirror is usually made from a smooth piece of glass with a silvery coat at the back of it.

Types of Mirror: There are plane (flat) and curved mirrors.

In a plane mirror the image is the same size as the object and the same way up. But it is inverted, i.e. 'back-to-front' (see activity 1).

There are two types of curved mirror (convex and concave).

A mirror that bulges outwards is called a convex mirror. Convex mirrors show things the right way up and usually smaller.

Convex mirror

A mirror that bulges inwards is called a concave mirror. (Remember you go into a cave!). How you appear in a concave mirror depends on how close you are to it. From close up you look bigger and right way up. Further away you look smaller and upside down.

Concave mirror

An object placed between two mirrors can generate many images.

(See DPSM activities 'Mirror Writing' and 'Satellites and Reflection' for other activities with mirrors.)

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Trigger questions

What do you know about light?

Where does it come from? What things give us light? Name some sources (Natural/artificial).

The sun: What does it give us? (Light and heat, without which people and animals could not survive).

Does light travel? (Yes, but very fast; faster than sound; e.g. in a thunderstorm when the clouds 'crash together' – you see the lightning before you hear the thunder).

What is 'seeing'? (light coming into your eyes; rather than something that your eyes actually do).

What is reflection? (The bouncing back of light off a shiny surface).

What sort of things reflect light? (Mirrors).

Anything else? (Other smooth shiny things e.g. smooth kitchen foil, calm water, clean glass window).

Skills

Experimenting, Observing, Analysing.

Cross-curricular links

MATHS: Shape and Space: 2-D shapes, Lines and Angles
Measures: Length.

ART: Symmetry (Patterns, cutting or painting and folding over paper, e.g. butterflies, snowflakes).

Activities

1. PLANE MIRRORS – 1 MIRROR PER CHILD IF POSSIBLE

A. **CHILDREN WORKING INDIVIDUALLY**

Hold up a plane mirror in front of you – what do you see? (Yourself!)

Close (wink with) your left eye? Which eye seems to be winking back at you? (Your right eye).

Hold up your right hand. Which hand is being held up in the mirror? (Your left hand).

(Reflections are always the 'wrong' way around).

REVERSAL OF IMAGE - <u>MIRROR IMAGES</u>

(e.g. semi-detached houses are often mirror images of each other).

"Are both your feet the same? Yes? Then does it matter which shoe goes on which foot?"

"And your hands. Put one on top of the other, the same way up. Are they both exactly the same (apart from scratches, etc.!)?"

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'SAME BUT DIFFERENT' – MIRROR IMAGES again.

What way does the word 'AMBULANCE' appear on the front of an ambulance? Why?

Can you write your own name 'back-to-front' so that it appears right way round when you look at it in a mirror?

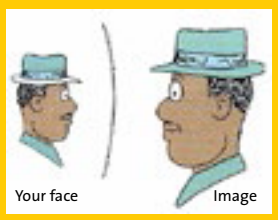
B. **CHILDREN JOIN UP IN PAIRS**

i. <u>Tape two plane mirrors together at the back, so that the tape acts like a hinge, and stand them upright.</u>
Put something small (e.g. upright pencil, Lego man...) between the mirrors. " What do you see?"
"What happens when you make the angle between the mirrors greater or smaller?"
"When do you see the most images?"
(The number of reflections increases as the angle between the mirrors decreases).

ii. <u>Put 2 plane mirrors standing up parallel to, and facing, each other</u>
Put a small object between them. "What do you see?"
(An endless number of reflections as the light is bounced backwards and forwards between the mirrors).

2. CONCAVE MIRRORS
(Mirrors that bulge in - or cave in).

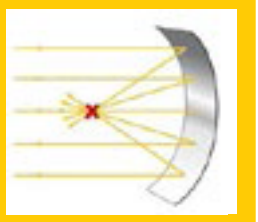
A. Hold the mirror <u>close</u> in front of you. What do you see? Compare the size of this image with the image in the plane mirror. (Larger image, right way up).



Examples are make-up mirrors, dentist's mirrors.

B. Now hold the mirror as far away <u>far</u> you as you can, i.e. with your arm fully stretched. What do you see? (The image is upside down).

C. <u>'Collecting' Light:</u> Using a concave mirror, can you get a beam of light to focus on a sheet of white paper? (You may need to move the paper and the mirror around in order to 'catch' a beam of light from a window or an electric light).



Approximately how far is the sheet of paper from the mirror? Now measure the distance.

(When you get to Second Level, you will find that this distance is called the 'focal length' of the mirror. The focal length tells you how curved the mirror is).

Telescopes use concave mirrors to collect light from distant objects like stars, and trap the light in a tube so that people can study it.

Isaac Newton was the first person to make a telescope using a concave mirror, in 1688. (Galileo made the first telescope of all, using a convex lens which also collects up light, in 1609).

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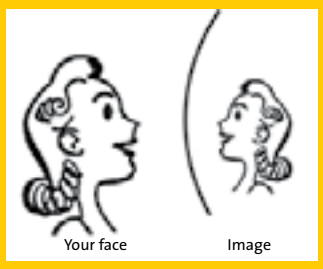
3. CONVEX MIRRORS (Mirrors that bulge out)

A. Hold a convex mirror close in front of you. What do you see? Compare the size of this image with the size of the image in the plane and concave mirrors.
(Your image is small and right way up).

B. Now hold the convex mirror further away. What do you see? (The image is still small and right way up).

Because convex mirrors produce a smaller image a lot more can be fitted into them than into a plane mirror, so they give a wider view of things behind.

Mirrors on car doors are convex in order to give drivers a wide view of the road and traffic behind them. This is more important than seeing the colour of the eyes of the driver behind you!



Supermarket mirrors are also convex to give a wide view.

Where else do you find convex mirrors? (Opposite 'blind' entrances to help cars see out onto a busy road).

Mirrors and Maths

- Tape two plane mirrors together so that the tape acts as a hinge. Place them vertically on a sheet of paper.
- Draw a horizontal line in front of the two mirrors.
- What happens when you make the angle between the mirrors greater or smaller?

- Can you make the shapes below? What are they called?
- Can you make a six-sided figure? What is it called?
- Can you make shapes with more sides?

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Safety

If using glass mirrors the edges may need to be taped in order to avoid cuts or scrapes.

When investigating topics on 'Light' children should be warned of the dangers of looking directly into the sun. They could damage their eyes.

Follow-up Activities

1. Can you use two plane mirrors to 'turn' 20 cents into €1?
2. **Symmetry**:
   a. Teachers could cut out the following shapes (ideally in coloured card), and ask the children to lay each piece (separately) flat up against a vertical plane mirror so that the card and its reflection make a letter.

   If it does then that letter is symmetrical.
   b. Are any letters of your name symmetrical?
   c. Are any of the numbers 0 - 9 symmetrical?

(Note: Letters and numbers are symmetrical if you cut them from side to side or from top to bottom).

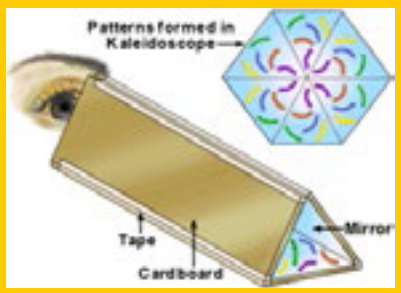
Children Can:

Look into both sides of a spoon or other curved shiny surface, e.g. Christmas tree baubles.
What kind of images do they see?

Make and see lots of interesting patterns by making a **kaleidoscope** from an empty kitchen towel tube and plastic mirrors (or plastic report covers).

See http://kids.nationalgeographic.com/kids/activities/funscience/be-dazzled/

A poet called Michael Rosen wrote fun poems about various science things including a kaleidoscope. See if you can find it online or in the library.



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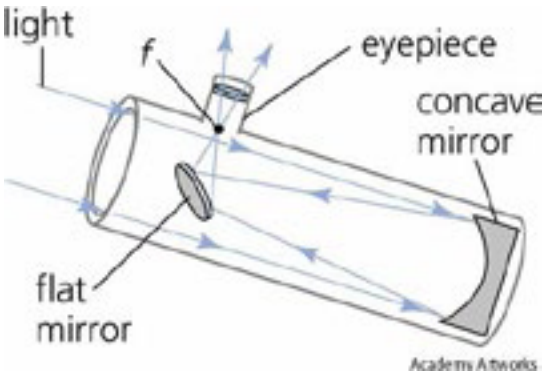
Did You Know?

Funfairs often have 'Halls of Mirrors' which have lots of curved mirrors. Have a look next time and see what shape you are!

The giant telescope at Birr Castle, the Leviathan, which was once the largest telescope in the world, has a concave mirror with diameter 180cms.(72") to collect light from the stars.



Useful Websites:

- Eight useful lessons on mirrors can be seen at: http://www.nsta.org/elementaryschool/connections/200912TeacherGuide.pdf
- For more details on the Leviathan at Birr Castle, see www.birrcastle.com