12. LIGHT

When we enter a dark room even with our eyes open, we are not able to see any object, but when the bulb lights up we are able to see the objects in the room. This means we need light to make things visible. When the light scattered from an object enters our eyes, only then we are able to see the object.

12.1 Sources of Light

An object, which emits light, is called a light source. Light sources that we get in nature are known as 'Natural Sources' while those that are made by us are known as 'Man-Made' or 'Artificial sources'. Let us consider the sources from which we get light. Make table 12.1 in your notebook and complete it.

TABLE - 12.1

S. No.	Natural Sources	Artificial Sources
1.	.....	.....
2.	.....	.....
3.	.....	.....

12.2 Does light travel in a straight line?

ACTIVITY 1

Materials required :– A candle, a match box, straw or folded paper to make a straight pipe.

Light a candle and put one end of the straw in front of the flame of the candle (fig.12.2). Now, look at the flame from the other side of the straw. Are you able to see the flame? Now, bend the straw gently (Fig. 12.2). Try to see the flame of the candle again. Can you see the flame in this situation also? Why is it so?

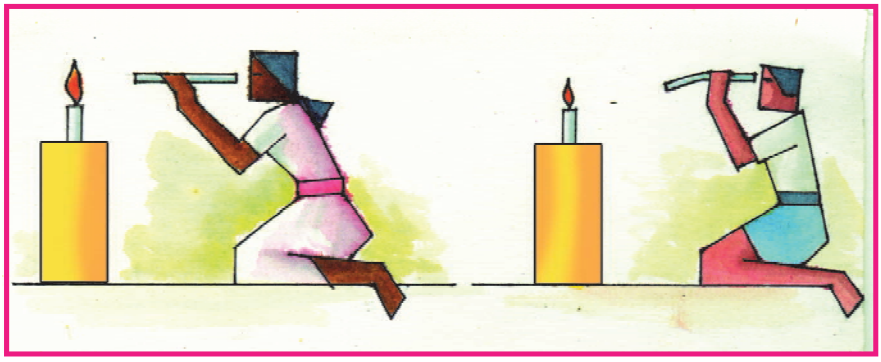


Fig. 12.1 Light moves in a straight line

Fig. 12.2 Light moves in a straight line

ACTIVITY 1

Materials required :– A candle, a long needle, three empty match boxes, four wooden blocks.

First of all take out the inner cases of the match boxes with a needle, pierce each in the middle so as to form a round hole in it. (Fig. 12.3).

Fix these match boxes (with inner case) with the help of wooden blocks, as shown in fig 12.4. Take care that the inner cases of match boxes are not at the same height, keep them at slightly different levels - a little up or down. Now try to see the candle through the hole from the other side. Are you able to see the flame?

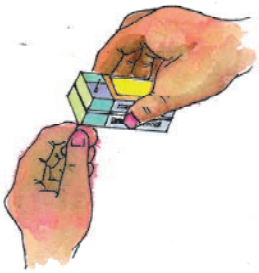


Fig. 12.3

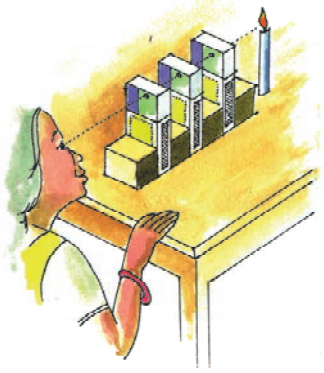


Fig. 12.4

Now, put the inner cases of the match boxes at the same height so that the three holes lie in a straight line. For confirmation gently pass the needle through the holes and check. Now, try to see the flame of the candle from the other side again (fig.12.4)?

What conclusion can you draw from the two activities? Does light travel in a straight line?

Now, you might be curious to know how fast does light travel. Speed of light in air is very high. It is nearly three lakh kilometres per second. Due to this high speed we are not able to notice the time-difference between switching on of a light bulb and seeing its light on the walls. Light takes about 8 minutes to travel from the sun to the Earth.

ANSWER THESE

1. When are we able to see an object?
2. Name any four man-made sources of light.
3. Give an example of an insect that emits light.
4. If sunlight takes 8 minutes to reach the earth (and the speed of light is 3 lakh kilometres per second) calculate the distance of the sun from the earth.

Formation of Shadows :-

ACTIVITY 3

Material required :- Torch, key

Throw the light of the torch on a wall such that it makes a lighted patch. Now, put a key between the torch and the wall. The shadow of the key is formed on the wall. This means if we put an opaque object in the path of light its rays are blocked and do not reach the other side. An un-lighted region is produced on the screen (wall). This region is called the shadow of the object.

ACTIVITY 4

Materials required :-

Light a candle in a dark room. Hold both the hands in ways according to Fig. 12.5 and form different figures. It would be better to make the shadow on a white-washed wall or a screen. Ask your friends to identify the different figures made by the shadow of the hands. To make the play of shadows more interesting you can also produce sounds of the animals whose shapes are formed.

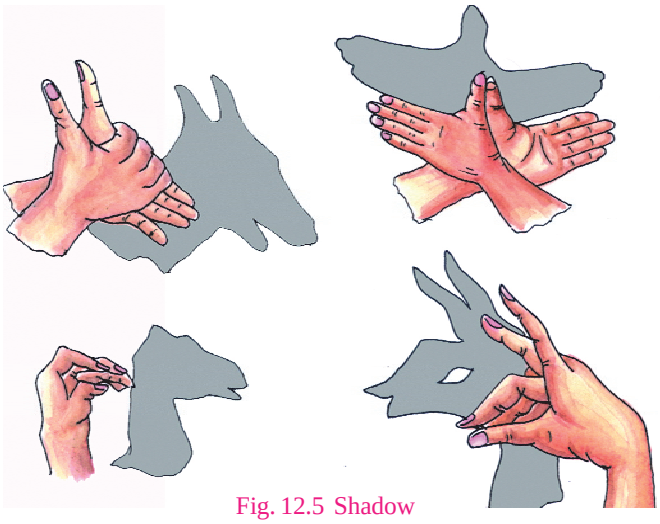


Fig. 12.5 Shadow

ACTIVITY 5

Materials required :– One rod, measuring tape.

At 8 o'clock in the morning put up a rod perpendicular to the ground in an open space near your school or near your house. The place should get full sunlight throughout the day. Mark the tip of the shadow on the ground. Using a measuring tape measure the distance from the base of the rod to the mark. Repeat this experiment at 12 o'clock at 2 p.m. and at 5 o'clock in the evening. Note the results and answer the following questions-

(1) When was the length of the shadow the maximum?

(2) When was the length of shadow the minimum?

(3) On which factors do the length and position of the shadow depend?

12.4 Umbra and Penumbra

In fig. 12.6, S is a big source of light and an object AB is placed between the source S and the screen P. Since no ray reaches the CD portion of the screen therefore there is complete darkness in that

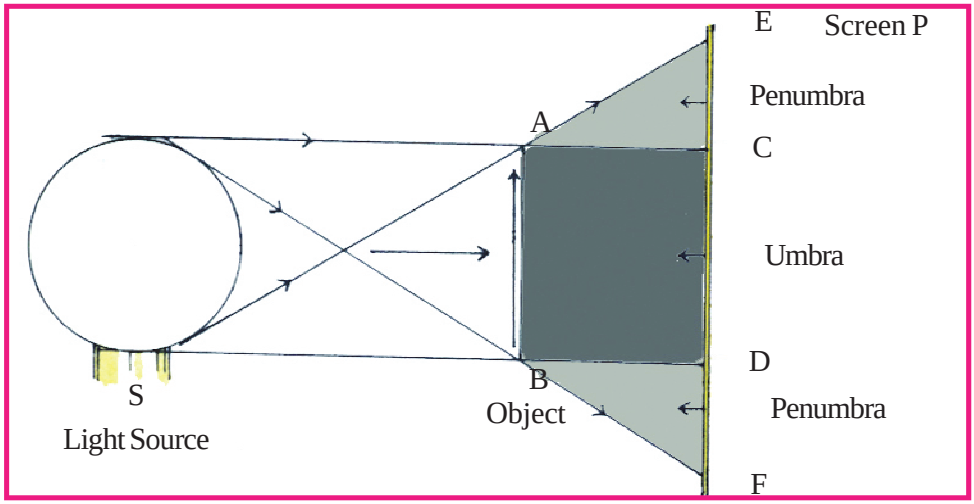


Fig. 12.6 Formation of Umbra and Penumbra

region. This region is called umbra. However, some rays are able to reach the CE and DF regions so a diffused shadow is formed in these regions. These regions are called penumbra. (Fig. 12.6)

12.5 Eclipse

We notice the shadow of several objects on the surface of the earth everyday. Likewise the shadows of earth, moon and other planets are formed somewhere in space. We can see the shadows only when they fall on a screen. We cannot see the shadows of birds on the earth, if they fly very high becuase the shadow in formed at sufficient height in space so that even penumbra does not fall on earth. But if they fly at low altitudes their shadow can be seen on the surface of the earth.

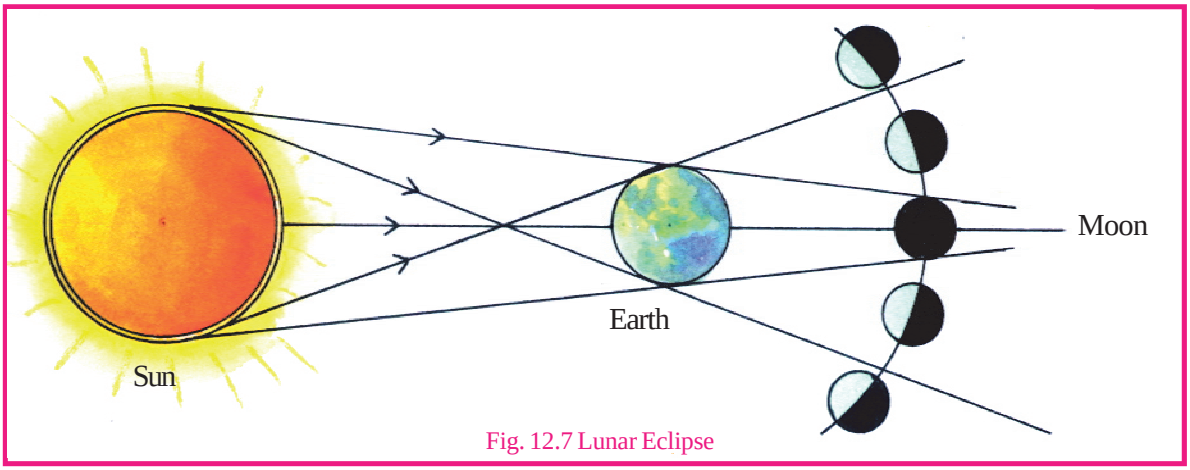


Fig. 12.7 Lunar Eclipse

On a full – moon night (Poornima) the earth is in between the sun and the moon. Sometimes when these three are in a straight line in the same plane then the moon passes through the umbra made by the earth (fig. 12.7). In this position, we cannot see the part of the moon, that lies in the umbra from any position on the earth. This phenomenon is called the lunar eclipse.

When the moon enters the umbra completely and is not visible from the earth, then we have the total lunar eclipse. When the moon passes only partially through the umbra cast by the earth then it is called a partial lunar eclipse.

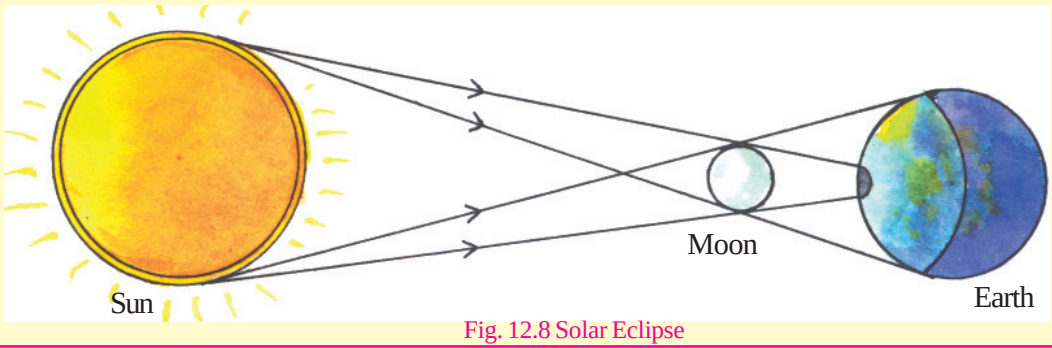


Fig. 12.8 Solar Eclipse

On a no moon (amavasya) day, the moon lies in between the earth and the sun. Sometimes, their centres may lie in the same plane on the same straight line. This event occurs only on certain no-moon days, and not on all no-moon days. As the size of the moon is small compared to that of earth, the moon's shadow falls only on a limited region of the earth. In these regions on the Earth, SOLAR ECLIPSE occurs (fig. 12.8)

The small region of the earth which is in the umbra of moon and where sunlight is completely blocked has TOTAL SOLAR ECLIPSE. The region where you can see the sun partially, has partial solar eclipse.

Both lunar and solar eclipses are natural events and when they occur you must look at them, using appropriate devices. It is dangerous to view the solar eclipse with naked eyes. It is always safe to observe a solar eclipse by looking at the image of the Sun on a screen. To obtain the image, you can punch a neat circular hole in a piece of cardboard and place it perpendicular to the sun rays. You can get an image of the eclipsed sun through this pinhole on a screen or on a wall. It is safe to view this image with naked eyes, keeping your back to the sun. Eclipse can also be seen on live telecast made by Doordarshan.

12.6 Reflection of Light

You know that light travels along a straight line. Can we change the direction or path of light? Think, what happens when light falls on a polished or shiny surface?

We all use mirrors at home. Since the surface of mirror is shiny, it changes the path of light when it falls on it. Due to the change of direction of light we can see our face in the mirror.

So, we can say that when a ray of light falls on a shiny surface, direction of light changes. This phenomenon is called reflection of light. Think why are you able to see your face in still water? The surface of water can also act as a mirror and can change the direction of light.

ACTIVITY 6

Material Required:- Two strips of plane mirror, black and white paper, gum and blade

Take a plane mirror. Wrap a piece of black paper having three slits on it as shown in fig.12.9 a. Put the white paper on a plane surface chosen at such a place where there is both light and shadow. Keep the mirror (having slits) in your hand in such a way that the slits are towards the sun. Place another plane mirror in the path of these rays. Ensure that the rays coming from the slits are falling on the mirror (fig.12.9 b).

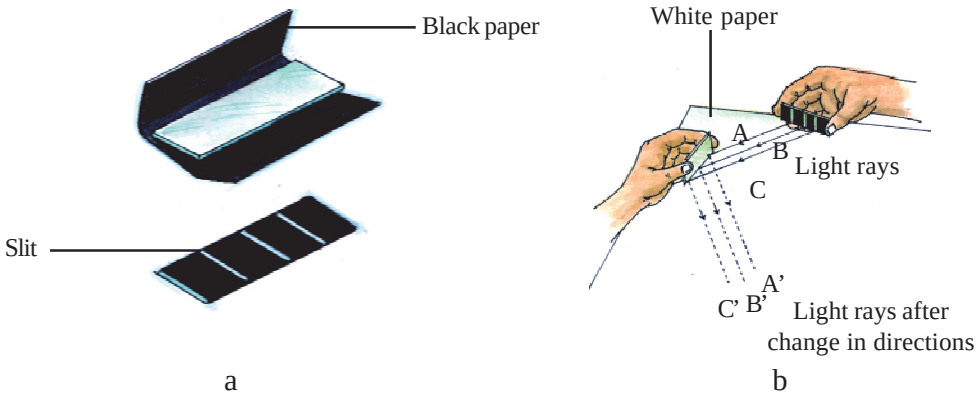


Fig.12.9. Reflection of Light

What do you see? Does the mirror change the direction of light falling on it? This activity shows that when a ray of light falls on a shiny surface, direction of light is changed. This is known as reflection of light.

ANSWER THESE

1. State the difference between umbra and penumbra.
2. Why do total and partial lunar eclipses occur?
3. Why does lunar eclipse not occur on every full-moon day?
4. State the precautions to be taken for viewing partial or total solar eclipses.
5. Which type of surface is necessary for the phenomenon of reflection?

WE HAVE LEARNT

- An object, that has its own light and gives it out, is called a source of light. Sources of light are natural as well as man-made.
- To see objects we need light. This light scatters from the objects and reaches our eyes. This makes the objects visible to us.
- Light travels in a straight line
- Speed of light is 300,000 km/sec
- By placing, opaque objects in the path of light, the path of light is blocked. The Region, where no light can reach is called umbra and where light reaches partially is called perumbra.
- Eclipses of the Moon and the Sun occur due to the shadows cast by the Earth and Moon respectively.
- When a ray of light falls on a shiny surface, direction of light is changed. This is known as reflection of light.

EXERCISE

1. Choose the correct option-

I. Time taken by light to travel from the Sun to the Earth is

(a) 5 minutes (b) 6 minutes (c) 7 minutes (d) 8 minutes

II. When moon passes through the middle of the umbra of the earth then

(a) Total lunar eclipse occurs (b) Partial lunar eclipse occurs

(c) Solar eclipse occurs (d) None of these

III. When the sun is at the top of the head, then the length of the shadow of a man will be –

(a) Maximum (b) Minimum (c) Twice the height of man (d) None of these

2. Fill in the blanks –

1. An object, which has its own light, is called _____.
2. Light travels in a _____ line.
3. Eclipses of the Moon and the Sun occur due to the shadows cast by the Earth and _____ respectively.
4. Change in direction of light rays by a shiny surface is known as ---------- of light.

3. Short answer questions –

1. Name any four light sources.
2. How does light travel from one point to the other?
3. Explain the following using ray-diagrams-

(i) Lunar Eclipse (ii) Solar Eclipse

4. Calculate the time taken by light to travel from the Moon to the Earth, if the distance between them is 4,00,000 kms.

5. Explain by experiment that light travel in a straight line ?

6. If the moon becomes bigger in size what will be its effect on solar eclipse ?

THINGS TO DO

1. Make your own pinhole camera -

Take two old post cards and fold them in the form of a tubes such that the radius of one tube is less than the other, and the former can be fitted into the later easily. Use gum to make the tubes. Paste black paper on one side of the tube with the smaller radius. Make a neat pin hole in the middle of the black paper. Exactly in the same manner paste a white paper on one side of the other tube, apply some oil on this paper so that it becomes translucent.

Place the tube having black paper inside the other tube. Your pinhole camera is ready with butter / oil paper acting as a screen.

Light a candle and keep it in front of the pinhole of the camera and look at the screen carefully. What do you observe? Move the outer tube forward and backward and observe the image of lighted candle in every position, see the effect of this movement on the image.

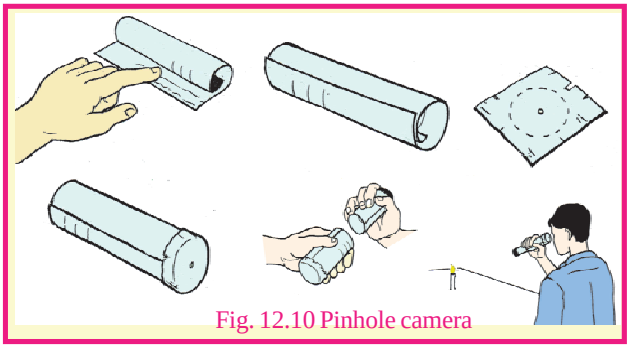


Fig. 12.10 Pinhole camera

Now see brightly lit objects like trees, house etc. using the camera.

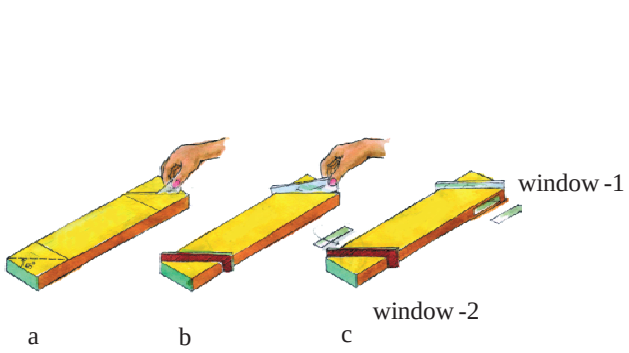
2. With the help of posters, charts, models or plays explain the concept of solar and lunar eclipse to the community.

3. Make your own periscope

Materials required: - Empty incense sticks box (agarbatti), two plane mirror strips, candle, blade, match box, scale, and gum.

Close the agarbatti box on both the sides. On both the corners of the box make a square with side equal to the breadth of the box (fig.12.11a). Join the diagonals of both squares. Make a cut with the help of blade along the diagonals having thickness equal to thickness of mirror and place the mirror strips such that the shining sides are facing each other (fig. 12.11b).Ensure that the mirror strips are parallel to each other. On both sides of the strip drop melted wax using a lighted candle, such that, the strips stick to the box and are fixed. To stick them we can also use gum laden paper.

Now cut out two windows in the box as shown in fig. 12.11c. Ensure that the windows made in the narrow side strip of the box are facing the silvery side of the mirrors. They should also be at the same height, so that reflected light from one reaches the other. Now your 'periscope' is ready, you can use it to see objects on the other side of the wall. For this put window-1 of periscope above the wall and use the window-2 to see the objects opposite to the window-1 (fig. 12.11d). Periscope is used to see the ships on the surface of the sea from submarines.



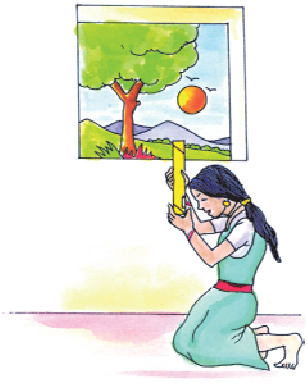


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Fig 12.12 a b c d Periscope