

UNIT 6

PROPERTIES AND BEHAVIOUR OF LIGHT



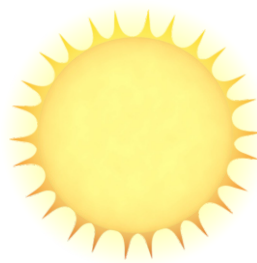
In this unit, we will learn:

- Luminous and non-luminous objects
- Transparent, opaque and translucent objects
- Light travels in straight line
- Shadow formation
- Eclipse formation

Light is a form of energy. The Sun is the biggest source of light. Light bulbs, flames of fire, candles, etc., are also the sources of light. Light travels in a straight line. It can travel through different media like air, glass, water, etc. It can also travel through vacuum. The speed of light in vacuum is 300,000,000 metre per second. Light takes about 8 minutes to reach the Earth from the Sun.

6.1 Luminous and Non-Luminous Objects

It is our daily observation that the objects like the Sun, the flame of a candle and the filament of a lighted bulb, etc., emit their own light (Figure 6.1). Those objects which emit their own light are called



Sun



Lighted bulb

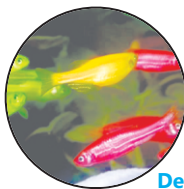


Candle

Figure 6.1

For your information

Living things like deep-sea fish, glow-worm, firefly, etc., emit light to make their bodies glow. Such a light is produced during some chemical reactions in the bodies of the organisms.



Deep-sea fish



Firefly

The objects that do not emit their own light are called non-luminous objects. The book in your hand, the table, the chair, the Moon, the Earth and other planets are the examples of non-luminous objects. We see the non-luminous objects only when the light of some other sources falls on them and they reflect light into our eyes.

Awareness beyond the classroom

Some non-luminous substances become luminous when they are heated at high temperature. For example, coal is non-luminous. It becomes luminous on heating. Such luminous objects are called incandescent objects.

6.2 Transparent, Opaque and Translucent Objects

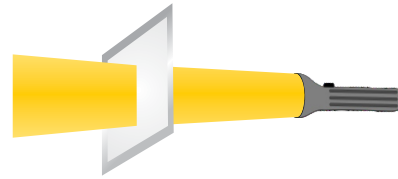
Objects can be classified as transparent, opaque and translucent. The objects through which light can pass are called transparent objects. Glass, water and air are the examples of transparent objects. We can see through transparent objects, because light passes through them.

The objects through which light cannot pass are called opaque objects. Wood, metals, concrete, ceramics and fibres are opaque objects. We cannot see through opaque objects because light does not pass through them.

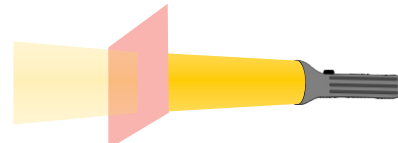
The objects which allow some of the light to pass through them are called translucent objects. Frosted glass, tissue paper, etc., are the examples of translucent objects. Things behind translucent objects cannot be seen clearly, they look blurred. This is because light cannot pass through them completely.

Activity

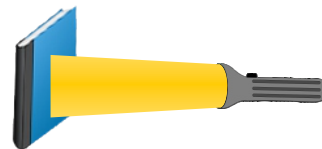
- (a) Place a torch on the table in a dark room and light it. Place a glass plate in front of the torch and see it from the other side.
- Does the glass plate allow light to pass through it?
 - What type of object is the glass plate?
(i) transparent (ii) translucent (iii) opaque.
- (b) Place a tissue paper in front of the torch and see it from the other side.
- Does the tissue paper allow as much light as pass through it as the glass plate?
 - What type of object is the tissue paper?
(i) transparent (ii) translucent (iii) opaque.
- (c) Now place a book in front of the torch and see whether light is passing through the book or not. What type of object is the book?



Light through a glass



Light through a tissue paper



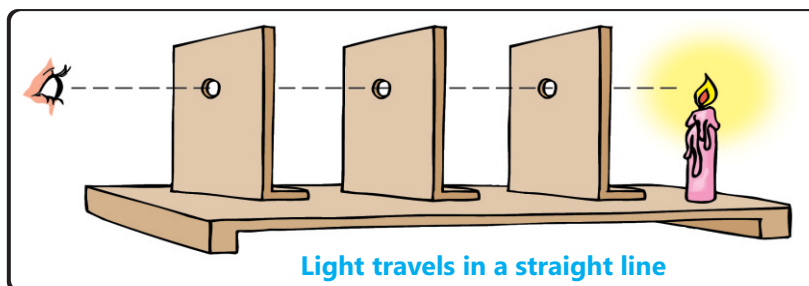
Light cannot pass through a book

6.3 Light Travels in a Straight Line

We can prove that light travels in a straight line. Let us perform an experiment as follows:

Experiment

Take three similar cardboards and make holes in them at the same height. Place them on a table in a straight line. Now light a candle and place it on one side of the cardboards in such a way that the flame is exactly in front of the holes in the cardboards as shown in Figure 6.2 given below.



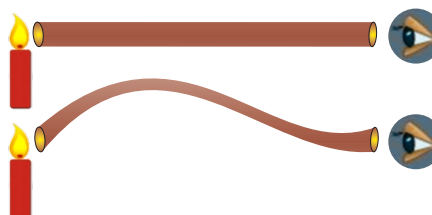
Light travels in a straight line

Figure 6.2

See through the hole in the cardboard placed opposite to the candle. Do you see the flame? Now move any one of the cardboards slightly so that the holes are not in line and again see the flame through the hole in the same cardboard. Do you still see the flame? You will notice that the eye will not be able to see the flame. What does it mean? It means that light travels in a straight line. It cannot pass through the holes which are not in line.

Activity

- Take a plastic tube and see the flame of a candle through it.
- Now slightly bend the tube and again see the flame through it.
- Can you see the flame through a bent tube? Why does it happen?

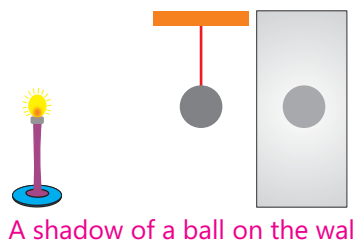


6.4 Shadow Formation

Light travels in a straight line. When an opaque object is placed in the path of the light, it cannot pass through the object. Hence, shadow is formed behind the opaque object. Shadow is a region of darkness behind an opaque object facing the source of light.

Activity

- Switch on a table lamp in a dark room. It will light up the walls of the room.
- Hang a small ball between the lamp and a wall. A dark circle (shadow) will appear on the wall.
- This is because the ball stops the light from reaching the wall in the region of the dark circle.



Location, size and shape of shadow

The type of the shadow depends on the size of the light source, shape and size of the object and its position from the light source.

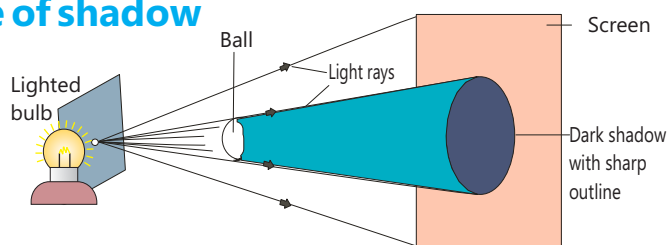
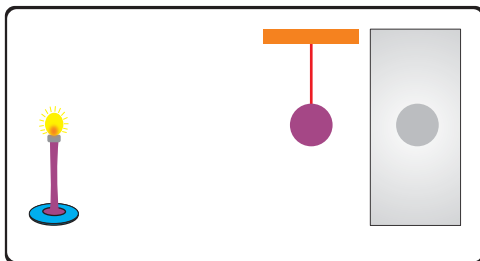


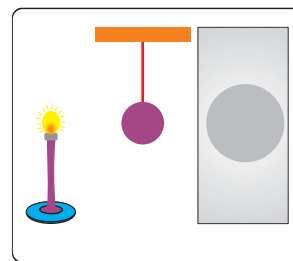
Figure 6.3 Shadow formed by a point source of light

The shadow formed by a point source (a very small source) of light is totally dark with sharp outline (Figure 6.3).

When a light source is away from the object, the shadow formed is smaller (Figure 6.4a). Moving the light source closer to the object makes the shadow much bigger than the object (Figure 6.4b). The shadow resembles the object in shape.



Shadow formation when light source is away from the object
Figure 6.4 (a)



Shadow formation when light source is close to the object
(b)

6.5 Eclipse

The Earth moves around the Sun and the Moon moves around the Earth. When the Moon, the Earth and the Sun come in a straight line, an eclipse takes place (Figure 6.5a, b).

Solar Eclipse

When the Moon comes between the Sun and the Earth, it throws its shadow on the Earth, which results into solar eclipse (Figure 6.5b).

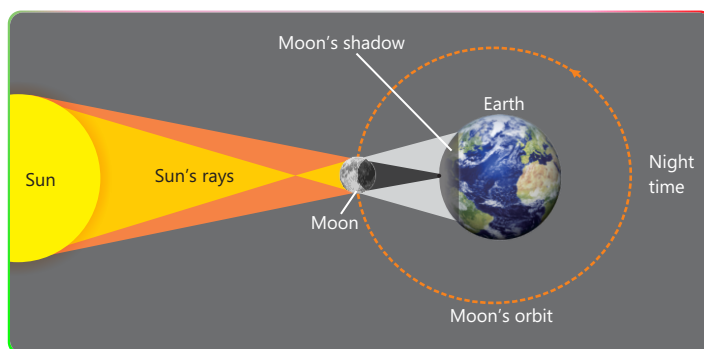
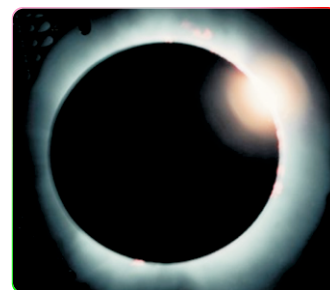


Figure 6.5 (a) Solar eclipse



A solar eclipse
Figure 6.5 (b)

Lunar Eclipse

When the Earth comes between the Sun and the Moon, it throws its shadow on the Moon, which results into lunar eclipse (Figure 6.6a).



Figure 6.6 (a) A lunar eclipse

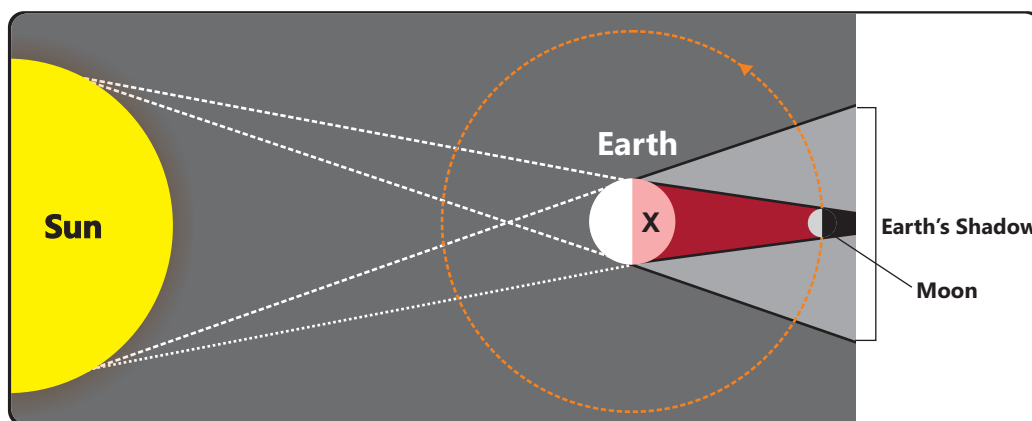


Figure 6.6 (b) A lunar eclipse

The shadow of the Earth on the Moon is so large that it covers the full Moon. When the Moon is in the dark region of the Earth's shadow, the people on the Earth at position X (as shown in the Figure 6.6(b) cannot see the Moon for sometime as no light falls from the Sun.

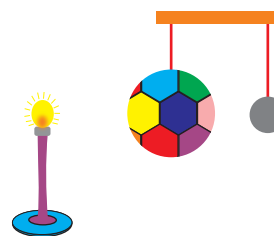
Warning

Never look directly at Solar eclipse, even through sunglasses. Special type of dark blue glasses should be used to see the Solar eclipse. Such glasses are used by the welders.

Activity

- Suspend a football and a small toy ball with the help of strings in front of a table lamp in the dark room as shown in the figure.
- Switch on the lamp and observe the shadow of the football on the toy ball. Has the shadow of the football covered the toy ball fully?

Consider the football as the Earth and toy ball as the Moon and explain the lunar eclipse from this model.



Science, Technology, Society and Environment

The property of light that it travels in a straight line and casts shadow of the objects has been used by the scientists in developing the vast field of photography. The concept of pinhole camera became the basis of the inventions of variety of instruments like lens, camera, microscope and telescope etc.

KEY POINTS

- The objects that give out their own light are called luminous objects.
- The objects that do not give out their own light are called non-luminous objects.
- The objects which allow almost all the light to pass through them are called transparent objects.
- The objects which do not allow light to pass through them are called opaque objects.
- The objects which allow some of the light to pass through them are called translucent objects. Frosted glass, tissue paper, etc., are the examples of translucent objects.
- Light travels in a straight line. When it is blocked by an object, shadow is formed.
- A shadow is a region of darkness behind an opaque object facing the source of light.
- Shadows are formed and eclipses occur because light travelling in a straight line is blocked.
- The shadow formed by a point source of light is totally dark with sharp outline.
- A solar eclipse occurs when the Sun, the Moon and the Earth are in a straight line and the Moon is between the Sun and the Earth.
- A lunar eclipse occurs when the Sun, the Moon and the Earth are in a straight line and the Earth is between the Sun and the Moon.

QUESTIONS

6.1 Encircle the correct option.

- i. The light from the Sun reaches the Earth in about:
 - a. 5 minutes.
 - b. 8 minutes.
 - c. 10 minutes.
 - d. 15 minutes.
- ii. Lunar eclipse occurs when:
 - a. the Moon comes between the Sun and the Earth.
 - b. the Earth comes between the Sun and the Moon.
 - c. the Sun comes between the Earth and the Moon.
 - d. the Mars comes between the Sun and the Moon.
- iii. The objects which do not allow light to pass through them are:
 - a. transparent
 - b. translucent
 - c. luminous
 - d. opaque
- iv. The objects which allow some of the light to pass through them are:
 - a. transparent
 - b. translucent
 - c. luminous
 - d. opaque
- v. A shadow of an object is formed because the:
 - a. object is luminous
 - b. object is opaque
 - c. object is too big
 - d. object is transparent
- vi. When light source is far away from the object, the shadow formed is:
 - a. equal in size to the object.
 - b. smaller in size than the object.
 - c. bigger in size than the object.
 - d. double in size than the object.

6.2 Identify transparent, translucent and opaque objects from the following:



Glasses



Door



Sun hat



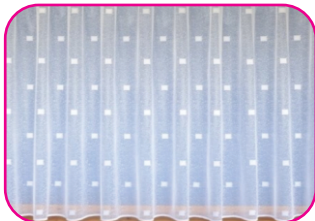
Black card



Stain-glass window



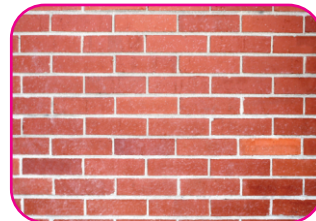
Plane glass window



Net curtain



Magnifying glass



Brick wall



Tissue paper



Water



Sellotape

Transparent:	
Translucent:	
Opaque:	

- 6.3 Name three examples of:
- i. luminous objects
 - ii. non-luminous objects
 - iii. transparent objects
 - iv. translucent objects
 - v. opaque objects.
- 6.4 The Moon is non-luminous. How do we see it?
- 6.5 What is shadow? Describe the location, size and shape of the shadow.
- 6.6 Why are the shadows of the objects in open place formed in different directions at different times of the day?
- 6.7 How can you prove that light travels in a straight line?
- 6.8 Explain with the help of diagrams:
- a) Solar eclipse
 - b) Lunar eclipse