Chapter-5

LIGHT

WHAT IS LIGHT?

The devices such as mobile phones, microwave ovens, remote control and scanning machine use electromagnetic radiations (radio waves, microwaves, infrared waves and X-rays) to work.

Light is a form of energy as well as an electromagnetic wave that can be detected.

In a vacuum, light travels in a straight-line path at the speed of 3×10^{8} m. The sunlight takes 8 minutes and 32 seconds to reach the earth.

Importance of Light

Light is the main source of energy for animals and plants.

The sunlight provides natural warmth that creates suitable conditions for the growth and development of life.

The green plants required sunlight to make their food by the process of photosynthesis.

The natural colour of light is white, but this white light has seven different colours: violet, indigo, blue, green, yellow, orange and red.

The objects absorb specific colours of light and reflect the other colours. This reflected colour declare the colour of the object. For example, grass cannot absorb the green colour. So, the green colour is reflected that comes to our eyes.

Sources of Light

The objects that emit light are called sources of light. There are two sources of light: natural and man-made. For example, the sun, stars and fireflies are natural sources, while an electric bulb, a burning lamp and tube light are man-made sources of light.

The objects that become hot when they emit light are called hot sources of light. For example, the sun, a burning candle or lamp and an electric bulb, etc

The objects that emit light without becoming hot are called cold sources of light. For example, fireflies

Bioluminescence: A natural phenomenon of emitting light by the objects. In bioluminescence, the objects covert chemical energy into light energy. Some of the examples are phytoplankton, fireflies, jellyfish and algae, etc.

Luminous objects: The objects that have their own light. For example, the sun, stars and torch, etc.

Non-luminous objects: The objects that do not produce their own light. For example, tables, chairs and books, etc.

Transparent/Translucent/Opaque

Transparent	If we are able to see clearly through an object, it is said to be transparent like water, glass
Translucent	If we are able to see not clearly through an object, it is said to be translucent like butter paper
opaque	If we cannot see through an object at all, it is an opaque object like wood

Formation of shadows

When an opaque object is placed in path of light, a dark portion is formed on the opposite side of object on the screen. This dark portion is shadow.

(1) The size of shadow depends on the distance of source of light and on the angle at which the light rays fall on the object.

(2) If the source of light is closer to the object, a larger shadow is formed than when the source of light is far from the object.

(3) The shadow can be seen only on a screen. The ground, walls of the rooms, a building, or other such surfaces act as a screen for the shadows you observe in everyday life

(4) Shadows sometimes gives lot of information about the object.

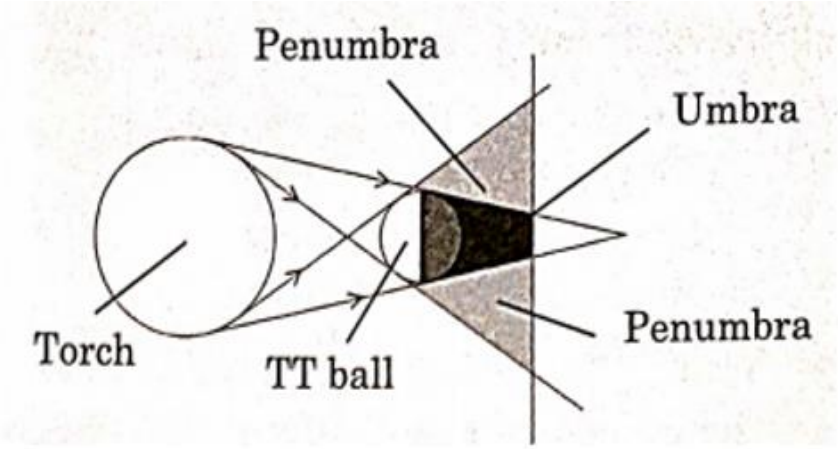
(5) Shadows are in black in colour and this is not changed by the colour of the opaque objects. So a red and yellow rose will have same black shadows.

Nature of a Shadow

The shadow is categorised into two parts based on the brightness of the dark patches:-

i. **Umbra**: It is the darkest part of the shadow present in the middle of it, which forms due to the absence of light.

ii. **Penumbra**: It is the faintest part of the shadow present at the corners of it. It is formed when the light is not completely blocked.



Characteristics of a Shadow

- An opaque screen is required to form a shadow. If there is no screen then no shadow will form.
- The colour of the shadow is always black.
- A shadow casts the shape of the opaque object only.
- The size of the shadow varies according to the presence of light coming from the different angles:-
- If the distance between the source of light and an opaque object is decreased then the size of the shadow forms large dark patches.
- If the distance between the source of light and an opaque object is increased then the shadow is small.
- If the distance between the object and the screen is decreased then the shadow is small.
- If the distance between the object and the screen is increased then the shadow is large.

ECLIPSES

The eclipses are formed on the basis of rectilinear propagation. They are shadows

formed naturally when the sun, moon and earth aligned in a straight line.
Solar Eclipse

- When the sun, moon and earth align in a straight line and the moon falls between the sun and the earth casts its shadow on earth then this phenomenon is known as solar eclipse.
- During a solar eclipse, the dark side of the moon faces the earth. This phenomenon takes place on a new moon day.

The moon's shadow forms a total solar eclipse on the region of the earth where the umbra of the moon falls on it, while the partial solar eclipse takes place on the regions where the penumbra of the moon's shadow falls

Do not look directly to the sun during a solar eclipse because this will damage your eyes permanently. However, if you really want to look at the sun then you should use eye filters such as X-ray reports.

LUNAR ECLIPSE

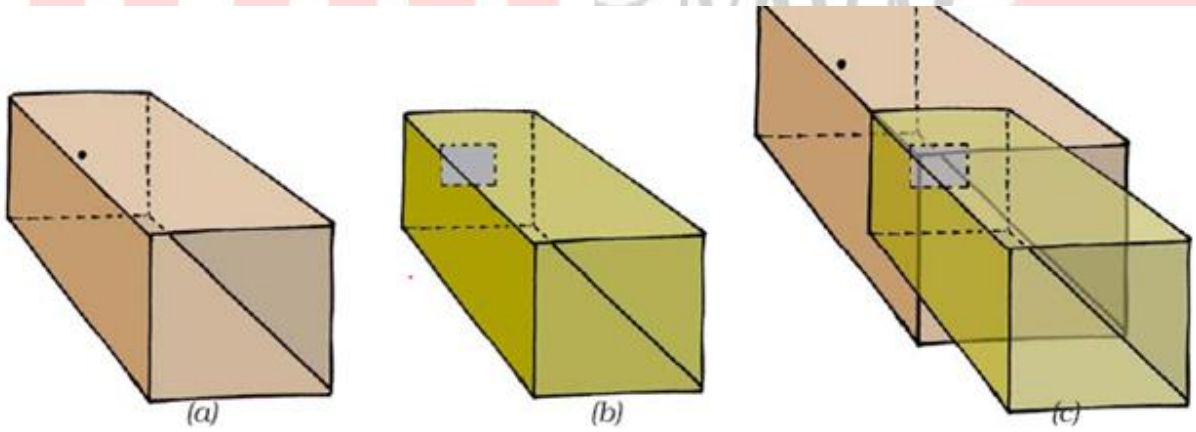
When the sun, moon and earth align in a straight line and the earth is present in the middle of the sun and the moon, casting its shadow on the moon then this phenomenon is called a lunar eclipse.

The total lunar eclipse is formed in the regions of the moon where the earth' umbra falls, whereas the partial lunar eclipse is formed where the earth's penumbra falls.

A Pin-Hole Camera

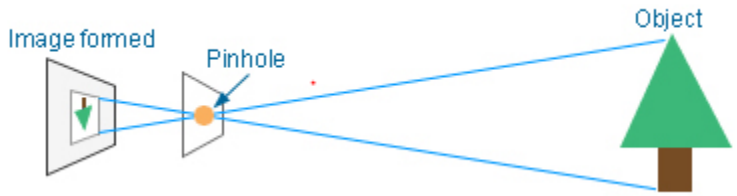
How to prepare it
(1) Take two boxes so that one can slide into another with no gap in between them. Cut open one side of each box.
(2) On the opposite face of the larger box, make a small hole in the middle.
(3) In the smaller box, cut out from the middle a square with a side of about 5 to 6 cm.

(4) Cover this open square in the box with tracing paper (translucent screen).
(5) Slide the smaller box inside the larger one with the hole, in such a way that the side with the tracing paper is inside
Now it is ready to use
How to use it
(1) Hold the pin hole camera look through the open face of the smaller box. You should use a piece of black cloth to cover your head and the pinhole camera.
(2) Now focus on the object you want to capture in the camera. Make sure that the objects you wish to look at through your pinhole camera are in bright sun shine.
(3) Move the smaller box forward or backward till you get a picture on the tracing paper pasted at the other end



How the Images look like pin-hole camera?

Upside down (inverted) images are formed. Image in a pinhole camera is real, inverted and smaller in size.



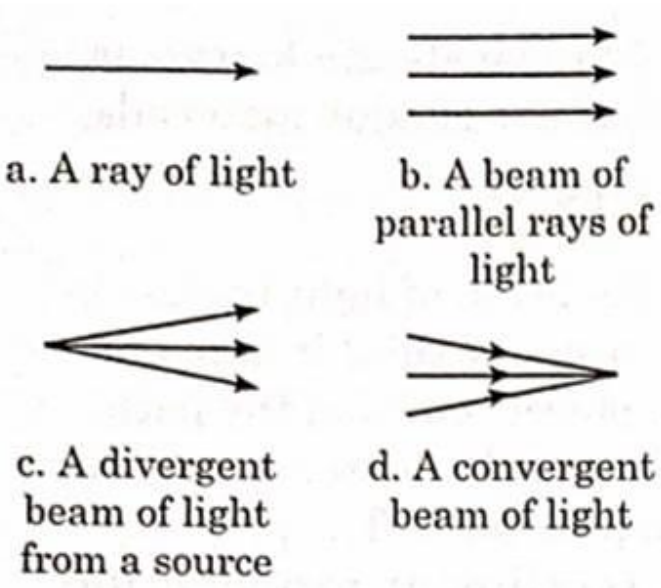
A pinhole camera that is used to capture the images of the sun is called solar graphy.

Natural Pin-hole Camera

When we pass under a tree covered with large number of leaves, we notice that small patches of sun light under it. These circular images are, in fact, pin hole images of the Sun. The gaps between the leaves, act as the pin holes. These gaps are all kinds of irregular shapes, but, we can see circular images of the Sun. This is called Natural Pin-Hole Camera

Rectilinear Propagation of Light

- The property by which the light travels in a straight line is called rectilinear propagation of light.
- The path travelled by a light in a straight line is identified with the help of a ray of light. The arrow head shows the direction of light
- A narrow group of light rays called a beam
- When beam of light moving away from each other is called divergent rays
- When beam of light moving towards each other and meet at a common point then it is called convergent rays

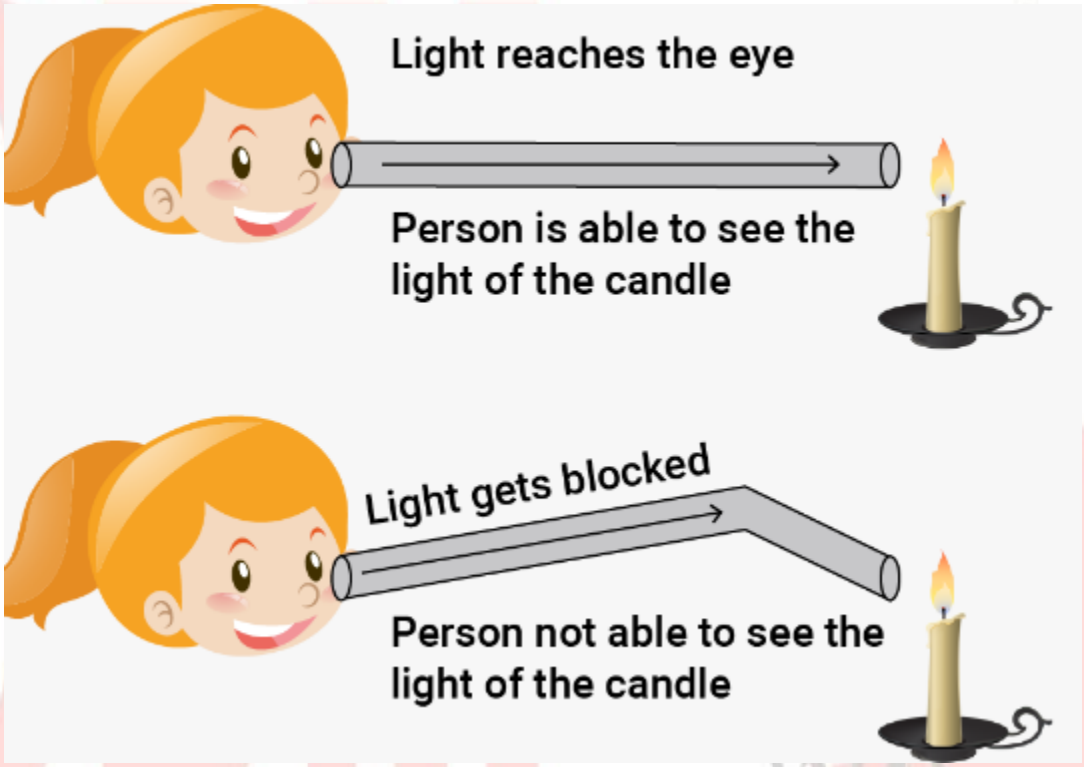


Producing a Beam of Light

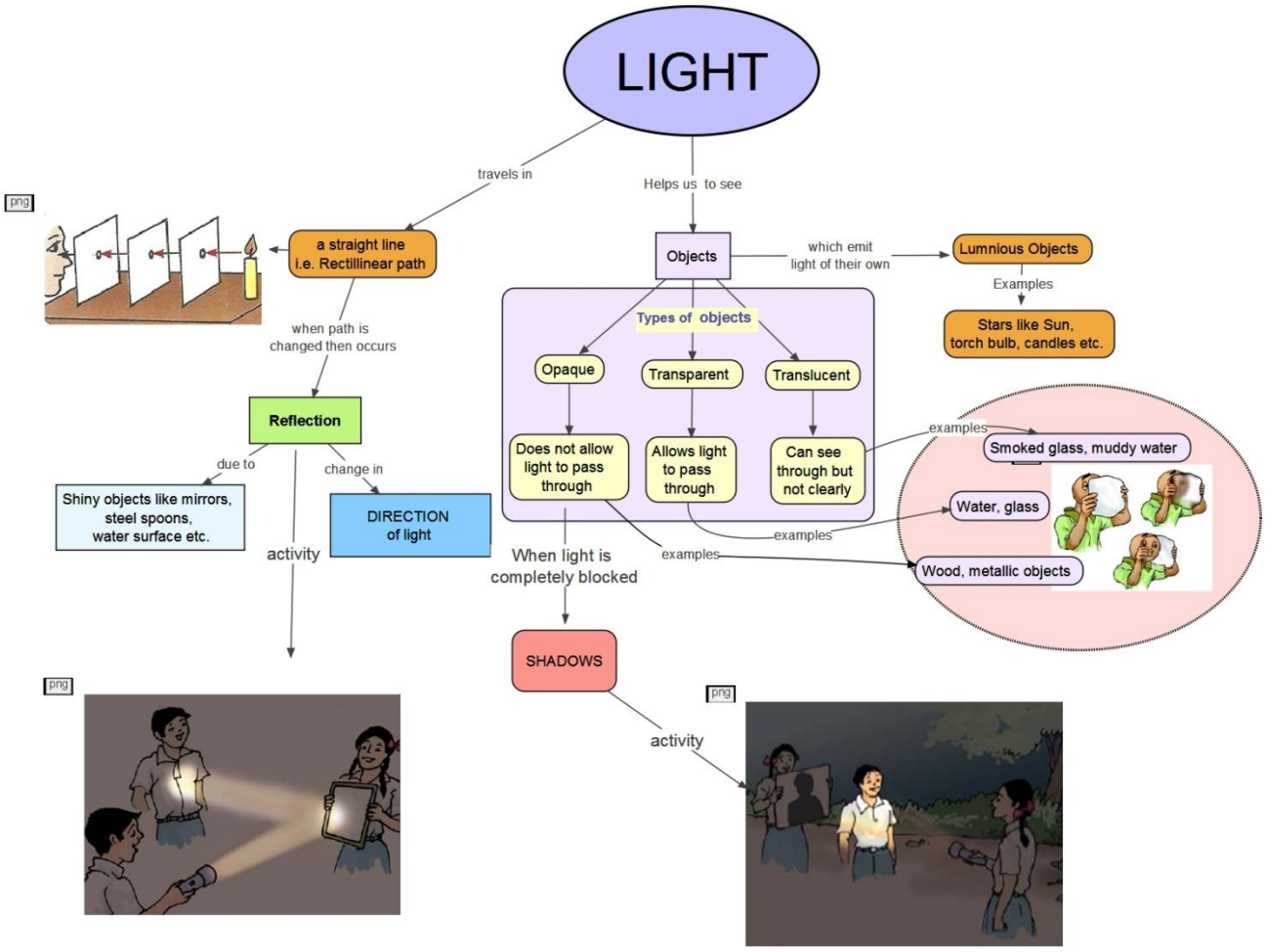
We produce a beam of light by using a light box.

The light box is composed of a cardboard box with a tiny hole on one of its faces and an electric bulb.

When an electric bulb glows, the light comes out of the hole producing a beam of light.



CONCEPT MAP


LIGHT
travels in
Helps us to see
a straight line
i.e. Rectillinear path
when path is
changed then occurs
Reflection
due to
Shiny objects like mirrors,
steel spoons,
water surface etc.
change in
DIRECTION
of light
activity
Objects
which emit
light of their own
Lumnious Objects
Examples
Stars like Sun,
torch bulb, candles etc.
Types of objects
Opaque
Transparent
Translucent
Does not allow
light to pass
through
Allows light
to pass
through
Can see
through but
not clearly
examples
Smoked glass, muddy water
Water, glass
Wood, metallic objects
examples
examples
When light is
completely blocked
SHADOWS
activity