Class – 6
Light, Shadow & Reflection

We are able to see an object only when light from the object reaches our eyes. When a ray of light hits an object it gets bounced back from the object and this reflected light reaches our eyes and hence we are able to see the surface.

Inside a dark room, eyes don't receive any light from the various objects in the room. Therefore we are unable to see anything in the dark room.
But the moment light is switched on and falls on the objects in a room we are able to see the objects on which the light is falling.

Light is the form of energy which gives us the sensation of sight

When you think about light, What all comes to your mind??
SUN, besides we can think about light from bulb, diya, candle, torch, traffic lights.

SOURCES OF LIGHT

There are 2 sources of light:
Natural Sources of light –Sun, stars and fireflies
Human made Sources- Candles, Electric Bulb

Depending on whether an object also generates heat along with light, we can distinguish sources of Light as being:

Hot/ Cold Sources of Light

Sun, Bulb and candle produce heat along with light- **Hot Sources of Light**
Firefly and Glow worm produce light but not heat- **Cold Sources of Light**

Depending on whether an object has its own light or not , we can distinguish objects as :

Luminous
Non Luminous/Illuminated

Luminous objects: are the ones which are able to produce their own light

Illuminated or non-luminous objects: are objects that don't have their own light and only reflect light coming from some other light source into our eyes. E.g. objects like chairs, tables, sofa etc.

HOW DOES OUR BRAIN HELP US TO SEE??

So since light helps us to see lets understand how it happens. Our eyes as well as our brain are needed for us to see. Our eyes have lenses that capture lights and forms and image, but the interpretation of the image is done by the brain. Nerves carry the image to the brain which processes it.

Light is the form of energy which gives us the sensation of sight. It is invisible in itself but makes the object falling in its path visible.

Uses of Light…

It plays an important role in our daily lives.

Its uses are seen in looking mirrors, spectacles, telescopes, periscopes, driving glasses, cameras…the list is endless

-Light travels very fast at a speed of about 3,00,000km/sec in air .

-So it can cover the distance of 2000km between Delhi and Chennai in just $1/150^{th}$ of a second.

- It travels from Sun to earth covering a distance of 1485 lakh kilometers in $8^{1/4}$ minute.

REFLECTION OF LIGHT

What is Reflection?

You look itself in the mirror, or an object in the mirror, or a scenery forming in the water body. So this all is reflection due to which we are able to see an object at another place

So how do we see things due to reflection??

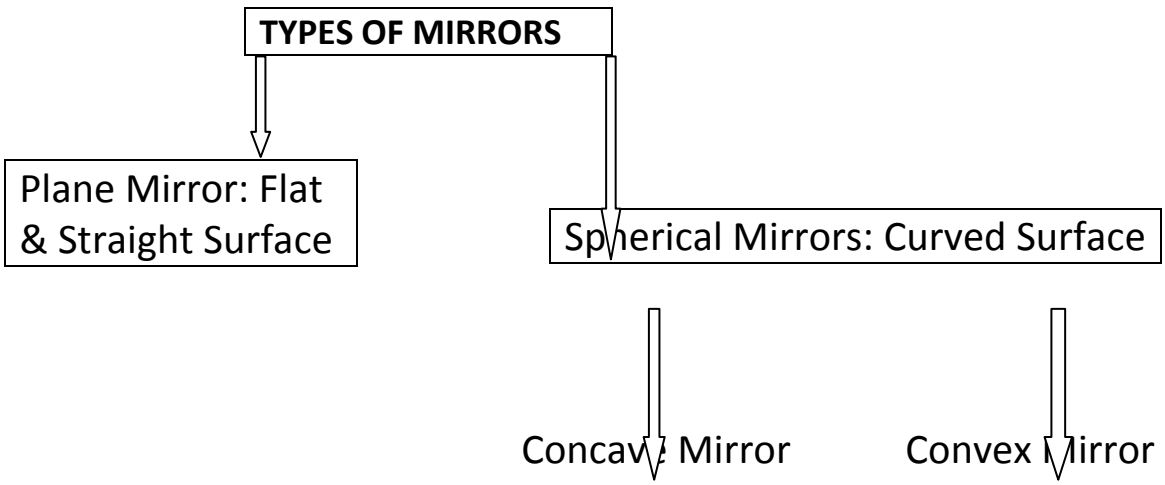
When a ray of light hits an object it gets bounced back from the object and this reflected light reaches our eyes and hence we are able to see the surface.

HOW LIGHT BEHAVES

- Light travels in a straight line AND THIS IS KNOWN AS RECTILINEAR PROPAGATION OF LIGHT. However, we can change the path of the light by making it fall on a surface.
- The change in the direction of light after falling on a surface or the bouncing back of light on striking a given surface is called Reflection.
- For e.g. The direction of light changes when it falls on a shiny surface like a mirror, a metal pencil box, shiny surface like a steel plate or a spoon.
- **The pinhole camera works on the principle that light travels in a straight line. The image formed by a pinhole camera is real, inverted and diminished in size when compared to the original object. Pinhole cameras are inexpensive and are easy to make.**

WE OBSERVE DIFF IMAGES DEPENDING ON WHAT TYPE OF SURFACES THEY ARE STRIKING ON :

TYPES OF MIRROR



All the 3 diff types of mirrors form diff types of images when rays hit them and get reflected.

1)PLANE MIRROR

A plane mirror is a smooth polished surface that acts as a reflecting surface. When and object is held in front of a plane mirror, a copy of the object is visible in the mirror. The copy of the object in the mirror is called its image. When you look into a mirror, you see your image in the mirror.

CHARACTERSTICS OF PLANE MIRROR

The image formed by a plane mirror shows certain characteristics:

1. Is of same size as that of the object.
2. The distance of the object in front of the mirror is same as the distance of the image behind the mirror
3. If the object moves away or come closer to the mirror, the image also seems to move away or come closer to the mirror.
4. The image formed is always erect
5. The image formed is of the same size, colour and same details.
6. LATERAL INVERSION – When an image is formed by a plane mirror, the left appears as the right and the right appears as the left. This is known as lateral inversion.

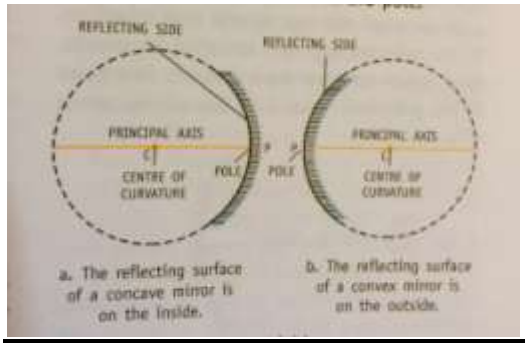
e.g. Ambulance has the word AMBULANCE written on it in an inverted manner.
The image of the word is further inverted in the rear-view mirrors of vehicles moving ahead of the ambulance van. The image thus appears as AMBULANCE.

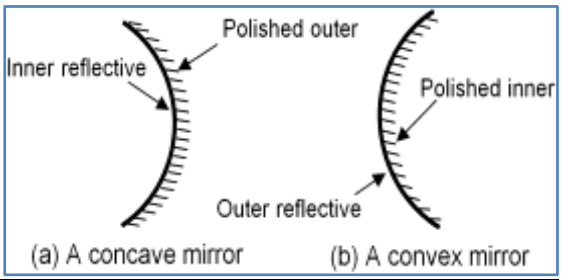
Uses of Plane Mirror:

1) Periscopes
2). Looking Glasses
3).Kaleidoscopes
4). Box –Type Solar Cookers

SPHERICAL MIRRORS

- Mirrors with curved surfaces are called spherical mirrors.
- Spherical mirrors can be thought of as a portion of a sphere that was sliced away and then silvered on one of the sides to form a reflecting surface. **Concave mirrors** were silvered on the inside of the sphere and **convex mirrors** were silvered on the outside of the sphere
- Spherical mirror with a concave reflecting side is called a concave mirror.
- Spherical mirror with a convex reflecting side is called a convex mirror.





USES OF SPHERICAL MIRRORS

Concave mirrors

1. Used by dentists to obtain a large virtual image of the teeth
2. Used in headlights of cars /torches
3. Used as makeup and shaving mirrors
4. Used in concentrator type solar cookers - This is because a concave mirror focuses sunlight at its focus and this point becomes very hot, hence this heat generated is used to cook food.
5. Used in reflector type telescopes – Here a large concave mirror is used to form an image of the star or the planet. This image is then magnified in the telescope.

Convex mirrors

1. Used in vehicles as rear view mirrors, since they form the image of objects spread over a large area
2. Used in shops / malls for surveillance.

SHADOW

There are 3 types of objects that we see around us:

- **Transparent Objects** : Transparent objects are the objects that allow all the light to pass through them,
- **Translucent Objects**: Translucent objects are the objects that allow partial light to pass through them .
- **Opaque Objects**: Opaque objects are the objects that allow no light to pass through them.

What Is a Shadow?

- You are running around in the park on a bright, sunny day, but you aren't alone. It seems that everywhere you go, something is following you. When you walk slowly, it walks slowly; and when you run, it runs! But you aren't being chased by a person - it's just your shadow!

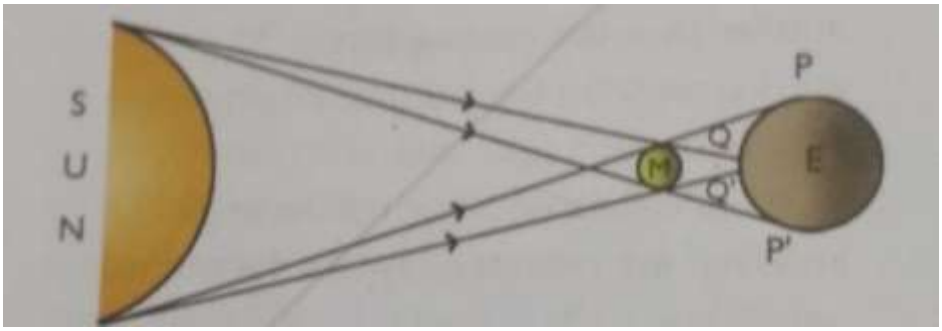
- A shadow is the dark shape made when something blocks light. You must have a source of light in order to have shadows.
- Note that a shadow can show an object's shape, but it can't show colors or details (like a smile or a frown).
- We can change a shadow's shape by moving/turning our body or the object, or by moving the light source.
- We can change the size of a shadow by moving our body or the object closer to / farther from the light.
- Your shadow is longest in the early morning and in the late afternoon. ...
- Is there anything that doesn't have a shadow? Some objects, such as glass, are transparent. Light can shine through them. Some light shines through translucent objects, such as a balloon or sheet of wax paper. Light cannot shine through opaque objects and you can't see through them. Opaque objects, including a desk, bath towel or blanket, are solid.
- If an object is close to the light source, then the shadow formed is large.

Shadow formation in nature

- Shadow formation takes place in nature also.
- When the moon blocks the light from the sun, a shadow of the moon is cast on the earth. This is called **solar eclipse.**
- Similarly, when the earth comes between the sun and the moon, then the moon passes through the shadow of the earth. This referred to as **lunar eclipse**

Solar Eclipse:

- A solar eclipse occurs when the sun, the moon, and the earth lie in a straight line, with the moon in the centre.
- The moon blocks the light of the sun from reaching the earth.
- Thus, the shadow of the moon is formed on the earth.
- Due to the respective positions of the sun, the moon, and the earth, a solar eclipse always occurs on a new or no moon day.
- The part of the earth which lies in the umbra region of the moon's shadow experiences a total solar eclipse and the part of the earth lying in the penumbra of the moon's shadow experiences a partial solar eclipse.



- In figure, you will find that the region of the earth lying between QQ' experiences a total solar eclipse while the regions marked PQ and P'Q' experiences a partial solar eclipse.
- One must not look at the sun without protection.
- The eye lens is a converging lens which will converge the rays of the sun to a point on the retina, burning that part of it.
- This will cause a permanent damage which cannot be rectified.

The following are safer ways to view the eclipse:

- Use correct solar filters / goggles to view the solar eclipse. Solar filters are easily available at planetariums, observatories, or science museums.
- Use a welder's glass of rating 14 or higher to view the solar eclipse.
- Use binoculars or telescopes with specially designed solar filters to view eclipse.

Lunar Eclipse:

- Lunar eclipse occurs when the sun, the earth, and the moon are in a straight line, with the earth in the centre.
- In this position, we have a full moon day on the earth.
- As the moon passes through the earth's shadow, we experience a lunar eclipse.
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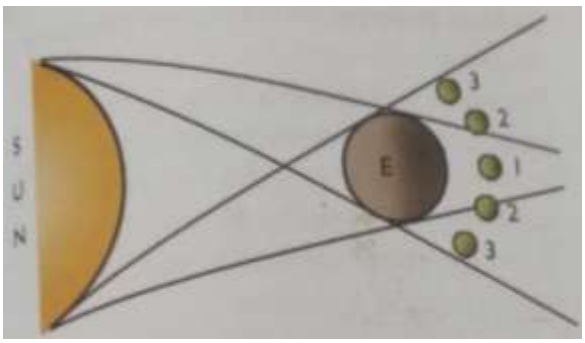

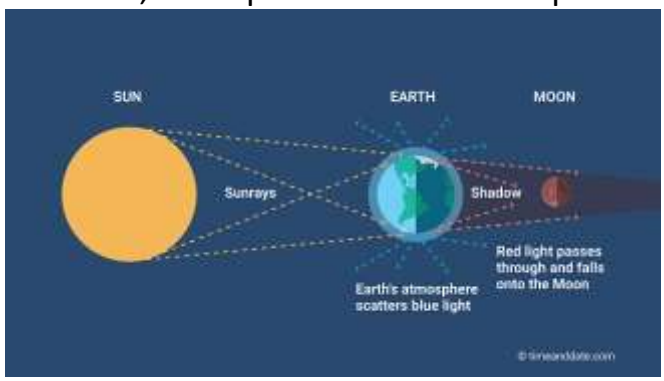

The different stages of the lunar eclipse are discussed below:

- When the moon lies completely in the umbra region of the earth's shadow, it is a **Total lunar eclipse.** This shown in **position 1.**
- **During a total lunar eclipse, the Earth moves between the Sun and the Moon and cuts off the Moon's light supply**. When this happens, the surface of the Moon takes on a reddish glow instead of going completely dark. This is also called Blood Moon

- When the moon lies partly in the umbra region and partly in the penumbra region, as shown in **position 2,** it is a **partial lunar eclipse.**
- When the moon lies completely in the penumbra region of the earth's shadow, as shown in **position 3,** there is no lunar eclipse.
- It is so because the penumbra region is a region which is partly illuminated and the moon in this region receives some light.

NOTE: MYTH CLARIFIED

The **phases of the moon** are actually just a result of our perception of the **moon's** half-illuminated surface. They don't happen cause of earth's shadow. When the **moon** does pass through **Earth's shadow** the result is a **lunar** eclipse.