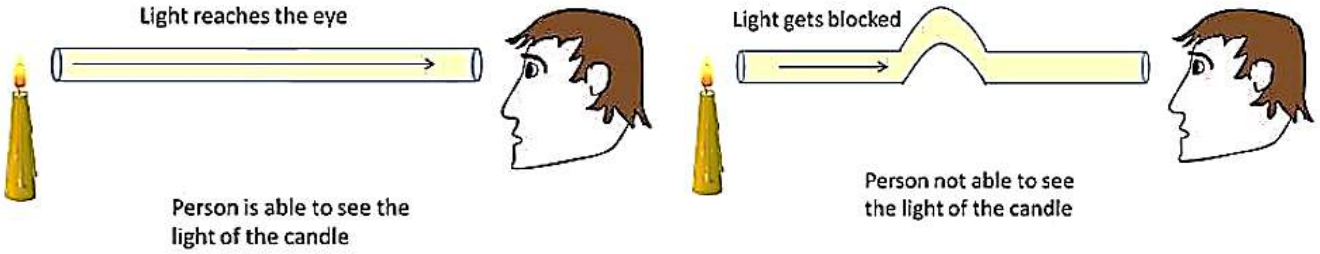
Board – CBSE	Class – 7	Topic – Light

- **What is light?**

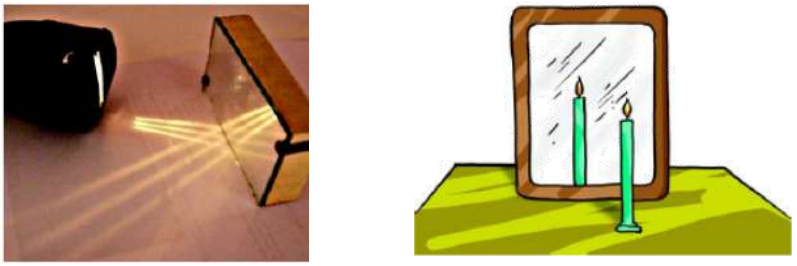
  Light is radiation or a form of energy that our eyes can detect. Light enables us to view our surroundings. Light travels from one place to another in a straight line.



Light always travels in a straight line

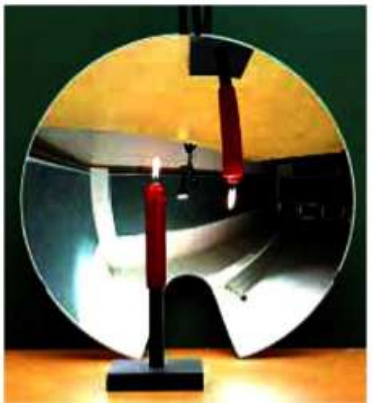
For instance, if you look at the flame of a candle with a straight pipe, we can easily view the candle. However, bending the pipe cannot view the candle and the light coming through it because it is blocked.

- **Reflection of Light**
  - ❖ Whenever light hits an object, it is either absorbed or reflected.
  - ❖ **Reflection of light** can be defined as the phenomenon of an object throwing back the light that falls on it. Hence, the reflection of light changes its path.
  - ❖ A **mirror** is generally any shiny surface that can reflect light.
  - ❖ A mirror that has a plane surface is called a **Plane Mirror**.
  - ❖ A curved mirror, it either bulges in or out, is called a **Curved Mirror**.



Reflection of light by a plane mirror

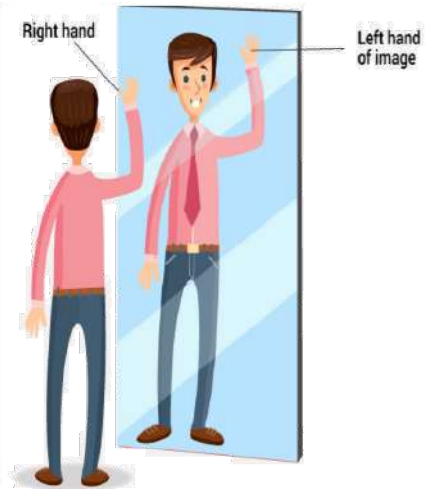
- **What is an image?**
  - ❖ As a mirror reflects light, an **image** of the object that is in front of the mirror is formed on it.
  - ❖ The image of an object can be defined as the impression of the object created by the light in the mirror.
  - ❖ The distance between the image and the mirror and the object and the mirror always remain the same.
  - ❖ Suppose we increase or decrease the distance between the object and the mirror. In that case, the distance between the image and the mirror also increases or decreases, respectively.
  - ❖ However, the size of the image formed on the mirror can vary with respect to the distance between the object and the mirror.
  - ❖ If the distance between the object and the mirror increases, the size of the image decreases and vice-versa.
  - ❖ An image is said to be **erect** if formed on the same side up as the object.



Inverted Image of a Candle

  - ❖ The image will be called **Inverted** if it is formed upside-down compared to the object.

- **Left-right inversion of the image**



Left-right inversion of the image

The image formed by the mirror is always left-right inverted. This means that the right side of the object appears on the left side of the image, and the object's left side appears on the right side of the image.

- **Why is the word 'AMBULANCE' painted on an ambulance left-right inverted?**

  This is because of the left-right inversion of the image on a mirror. The word ambulance is written as left-right inverted would, therefore, be read easily by the driver of the vehicle ahead of the ambulance in its rearview mirror. The rearview mirror will again invert the word left-right wise.

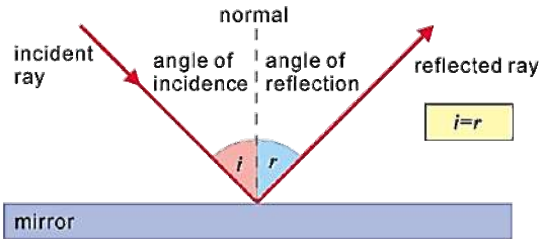
Ambulance

- **The Laws of Reflection of Light**
  - **Incident Ray** –

    The light ray that falls on the reflecting surface is called an **Incident Ray**.
  - **Reflected Ray** –

    The light ray that gets reflected from a reflecting the surface is called a **Reflected Ray**.
  - **Normal** –

    It is a line perpendicular to the reflected plane at the point of incidence of **Incident Ray**.



Incident Ray, Reflected Ray and Normal

- **Laws of reflection of light**

  (I) The incident ray, the reflected ray and the normal to the mirror at the point of incidence all lie in the same plane.

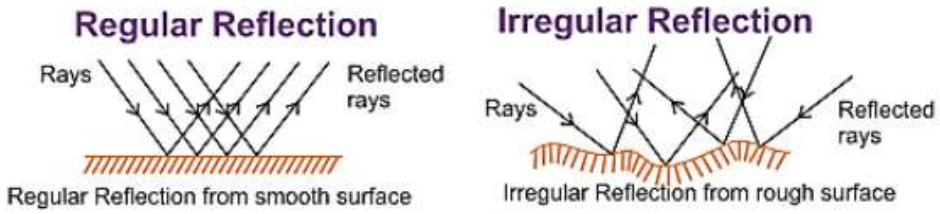
  (II) The angle of incidence is equal to the angle of reflection.
- **Types of Reflection**

  Depending upon the surface of the reflecting object, the reflection of light can vary.
- **Diffused Reflection or Irregular Reflection**:

  In this type of reflection, the light rays that fall on the surface are irregularly reflected in different directions. This generally happens in the case of an irregular or roughly surfaced object.

- **Regular Reflection**:

In this type of reflection, the light rays that fall on the surface of the reflecting object reflect in a particular direction. Thus, the reflected rays are always parallel to each other. This generally happens in the case of a smooth and shiny surface.

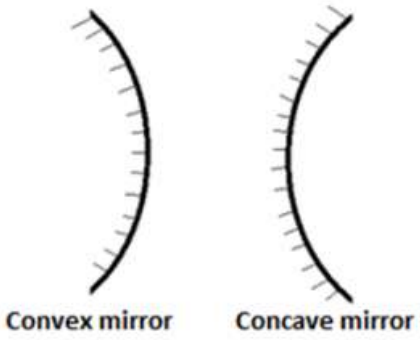


Types of Reflection

- **Spherical Mirrors**

A spherical mirror, as the name suggests, has a sphere-like shape. It appears as if it is a part of a sphere. There are two types of spherical mirrors:

- **Concave Mirror** - It is a spherical mirror whose reflecting surface is curved inwards.
- **Convex Mirror** - It is a spherical mirror whose reflecting surface is curved outwards.



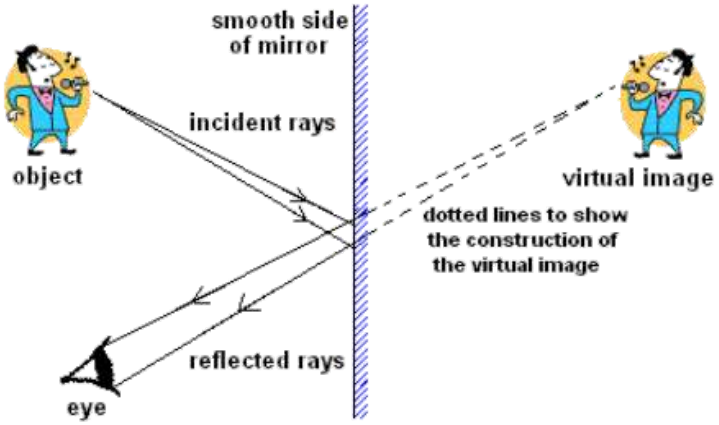
- **The image formed by a Concave and Convex Mirror**

An image can be of two types:

Real Image	Virtual Image
The real image is formed when the light rays reflect and meet at the same point.	A virtual image is formed when light rays reflect and diverge from the same point.

It can be viewed on a screen.	It cannot be viewed on the screen.
It is always inverted.	It is always erect.
Formed by Concave mirror	Formed by Convex, Concave and Plane Mirrors

Formation of Real Image by Concave Mirror



Virtual Image by Plane Mirror

- **The image formed by a concave mirror has the following properties:**
  - It can either be real or virtual.
  - It can either be inverted or erect.
  - It can have the same size as that of the object, larger size that of the object, or smaller than that of the object.

- **The image formed by a convex mirror has the following properties:**
  - It is always virtual.

- It is always upright (erect).
- It is smaller in size than that of the object

- **Applications of Concave Mirrors:**
  - Satellite dishes use a concave mirror to gather all the signals and reflect them on a certain point.
  - Dentists use a concave mirror to reflect light on a particular tooth.
  - Shaving Mirrors are concave in shape.
  - The headlights of a car have a concave mirror to reflect light straight on the path.
  - Torches also use concave Mirrors.

Concave Mirror Used in Torch

- **Applications of Convex Mirrors**
  - The rearview mirrors are convex as they provide a wider view of the road behind.
  - Security mirrors near an ATM are convex so that the user can detect easily if anyone else is watching from behind or not.

Convex Mirror used in a Rear view Mirror

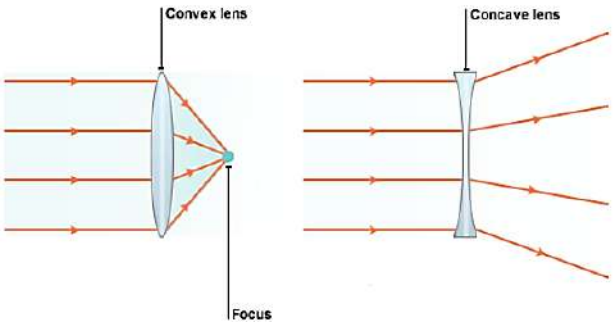
- **Lenses**

A lens is a part of a reflecting material like glass or plastic but curved from both sides. Lenses are unlike mirrors that have a reflecting surface only on one side. Depending upon its shape, a lens can be categorized as:

❖ **Convex Lens** –

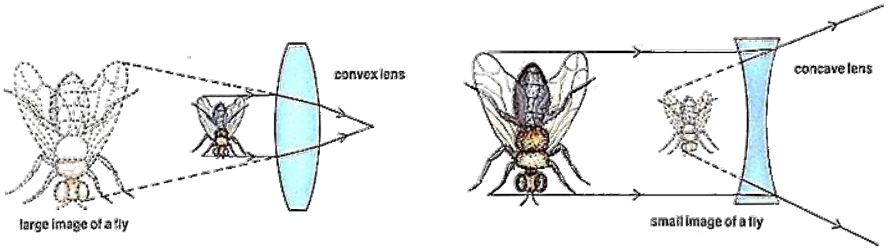
A Convex Lens is curved outwards. It is thicker in the centre and narrows down at the edges. This is because it merges the light rays passing through it at a certain point. Therefore, it is also called a **Converging Lens**.

❖ **Concave Lens** - A Concave Lens is curved inwards. It has wider edges and a thinner centre. It reflects the light that travels through it in different directions. Therefore, it is also called a **Diverging Lens**.



Convex Lens and Concave Lens

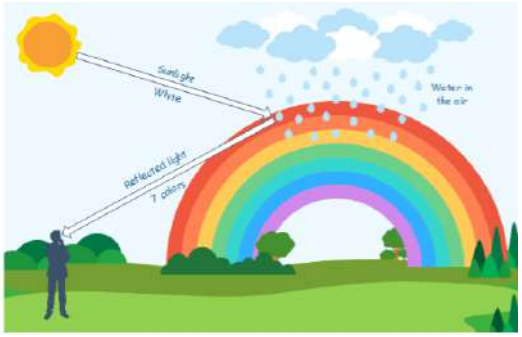
- **Images formed by Convex and Concave Lenses**
  - ❖ **A Convex lens forms an image that is:**
    - real
    - inverted
    - the image is large and appears close to the lens
  - ❖ **A Concave lens forms an image that is:**
    - virtual
    - erect
    - small and appears far away



An image formed by Convex and Concave Lens

- **Sunlight**

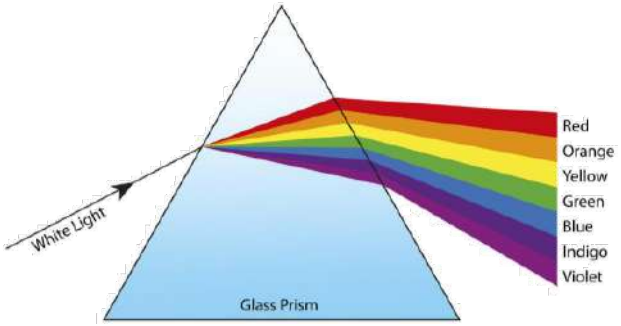
  What is a Rainbow?



Formation of Rainbow

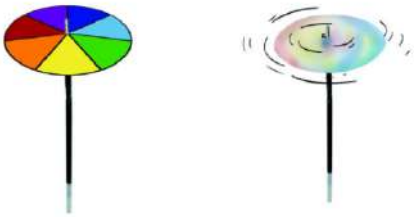
- A rainbow is a natural phenomenon in which the sun's light rays are reflected and refracted by the water droplets present in the atmosphere.
- A rainbow appears as an arc on the sky that contains a band of seven colours – Red, orange, yellow, green, blue, indigo and violet.
- This also means that the sun's white light contains seven coloured lights that separate due to refraction (called a **Spectrum of Lights**). This spectrum of white light can be seen in the following:

- Rainbows
- Soap bubbles surface of a CD
- The
- Prisms



The spectrum of White Light through a Prism

- **Newton's Disc**



Newton's Disc

- Newton's disc can be obtained by dividing a disk into seven partitions and painting each of them with the seven colours of the rainbow.
- When the disc is rotated quickly in daylight, all the colours tend to mix, and the disc appears whitish.