# 11. Reflection of Light

- Light travels only in a straight line in all directions.
- This phenomenon is called the **rectilinear propagation of light**.
- Light emanating from a source (bulb) travels in all directions.
- The formation of image in a pinhole camera is a proof of **rectilinear propagation** of light.

Medium	Speed of light (in m/s)
Air/ Vacuum	3×10^8
Water	2.25×10^8
Glass	2×10^8

- Reflection of light makes things visible.
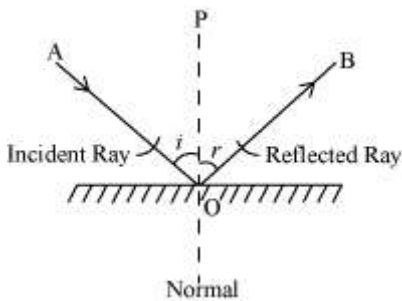
(a) i (Angle of incidence) = r (Angle of reflection)
(b) AO, OP, and OB lie on the same plane.

- **Laws of reflection:**
  - The angle of incident is equal to the angle of reflection
  - The incident ray, the normal at the point of incidence and the reflected ray all lie in the same plane.
- **Image formation by a plane mirror**
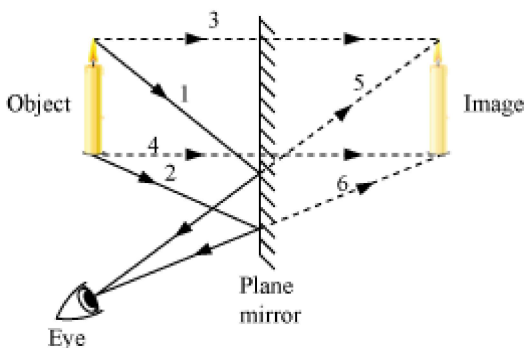
Left part of the candle appears on the right and its right part appears on the left. This is known as **lateral inversion.**

- **Characteristics of images formed by plane mirror**
  - virtual and erect
 - same size as of object
  - laterally inverted

- image distance and object distance are same and perpendicular from mirror
- Virtual images are those images which cannot be obtained on screen. But there are some images which can be obtained on screen. Such images are called real image.

- **Uses of plane mirror**
  - It is used as a looking glass.
  - It is used to increase the effective length of an optician's room.
  - In periscope, two parallel plane mirrors are inclined at 45 degrees with vertical walls such that they are facing each other.
  - In kaleidoscope, three plane mirrors are inclined with each other at 60 degrees.
  - It is used in solar heaters and cookers to heat substances by reflecting the sunlight towards the substances.

- Kaleidoscope works on the principle of **multiple reflections**.

- **Periscope** is an optical device used to see objects that are not along the line of sight.

- Sunlight consists of several colours.
- Splitting of white light into diffrent colours is called dispersion.
- Number of image formed in multiple reflection $= \dfrac{360^o}{angle\ between\ two\ plane\ mirros} - 1$

Spherical Mirror

- Centre of curvature: Centre of the sphere of which the spherical mirror is a part
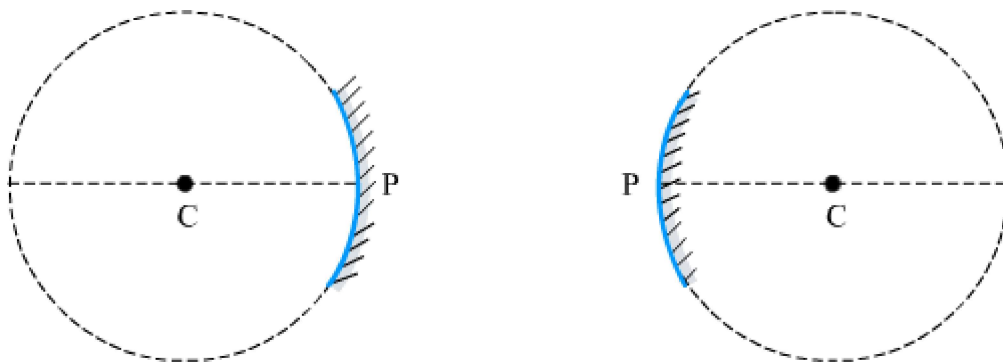
- Pole: It is the midpoint of the aperture of the spherical mirror or mirror centre.
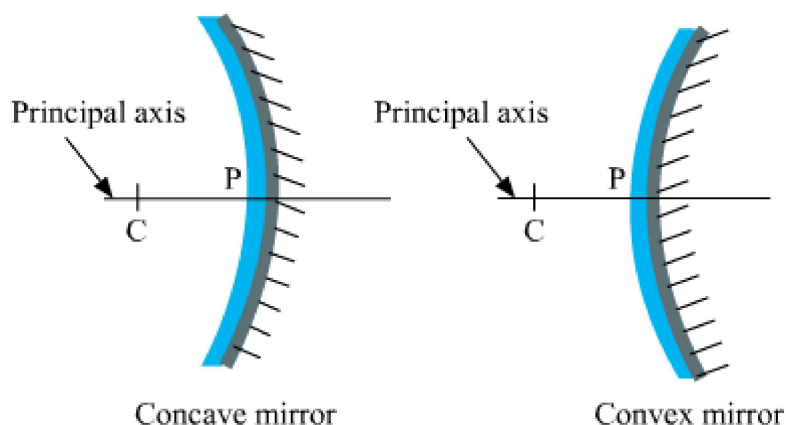

Concave mirror   Convex mirror
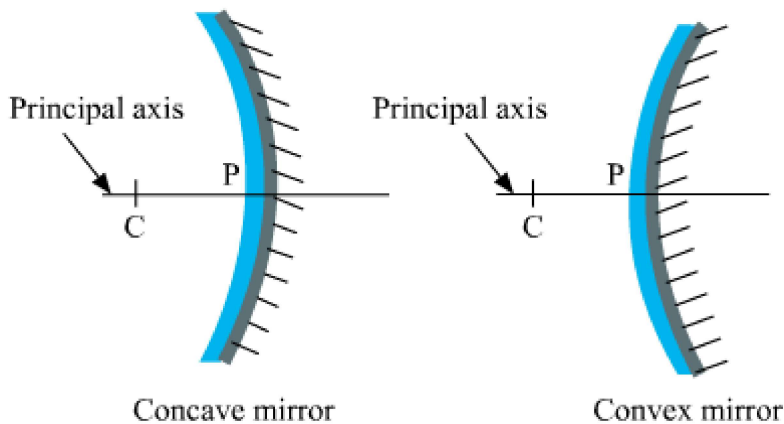
- Focus: Where parallel rays (parallel to the principal axis) meet or appear to meet after reflection.

- Principal Axis: The imaginary line that runs through the pole and the center of curvature of a spherical mirror.
- Distance of focus from the pole is half the radius of curvature.

Concave mirror   Convex mirror
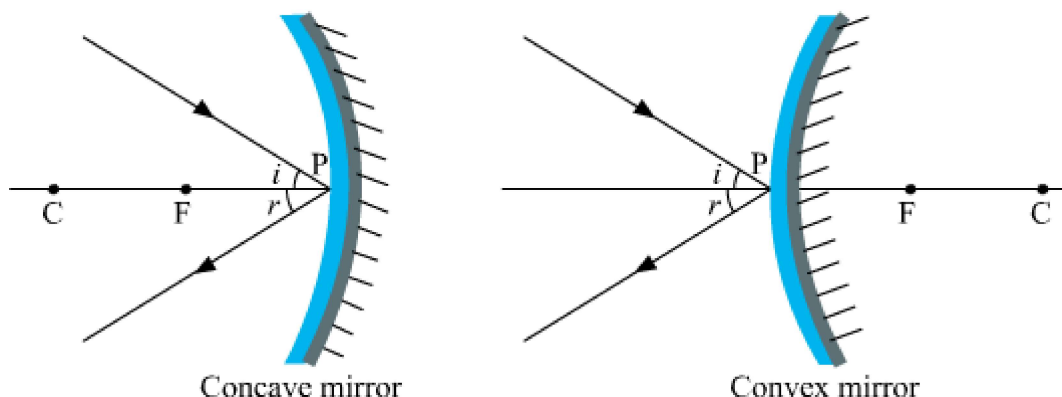
Two types of spherical mirrors

Concave mirror   Convex mirror

1. The image formed by a convex mirror is **erect** and **diminished**. It is formed behind the mirror.
2. The image formed by a concave mirror can be **erect as well as inverted, diminished as well as magnified**, behind the mirror as well as in front of the mirror, depending on the distance of the object from the mirror.
3. The image that can be obtained on a screen is called **real** image. The image that cannot be obtained on a screen is called **virtual** image.
4. The image formed by a **convex** mirror is always **virtual**. The image formed by a **concave** mirror can be **real** as well as **virtual**.

- **Sign Conventions for Spherical Mirrors:**

Concave mirror   Convex mirror
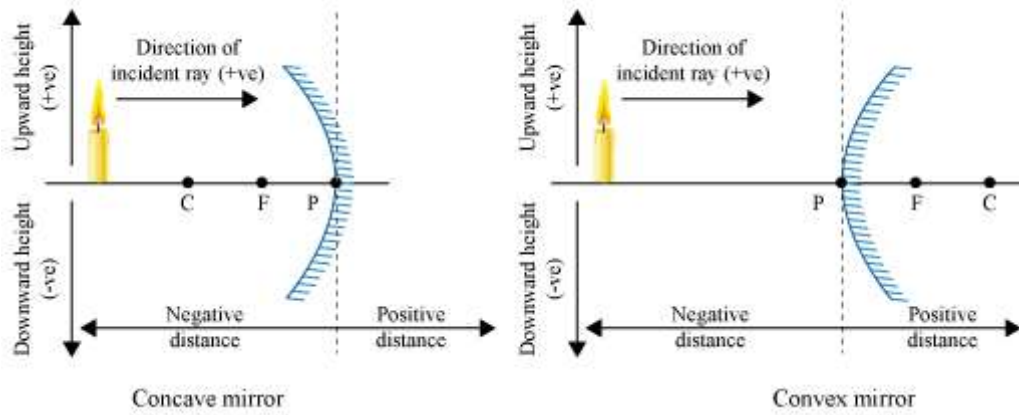
- **Mirror formula**

$$\frac{1}{f} = \frac{1}{v} + \frac{1}{u}$$

For concave mirror, $f = -$ve and for convex mirror, $f = +$ve

- **Magnification**

Magnification = -vu

For real image, $v = -$ve

Virtual image, $v = +$ve

1. Concave mirror is used as the reflector of a torch, dentist mirror, etc. It is also used in solar furnaces.
2. Convex mirror is used as a rear view mirror in vehicles. It also used road safety mirrors.