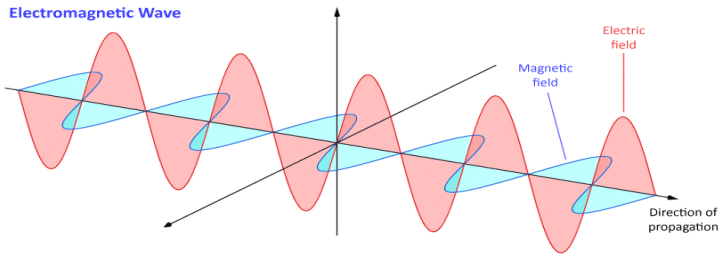
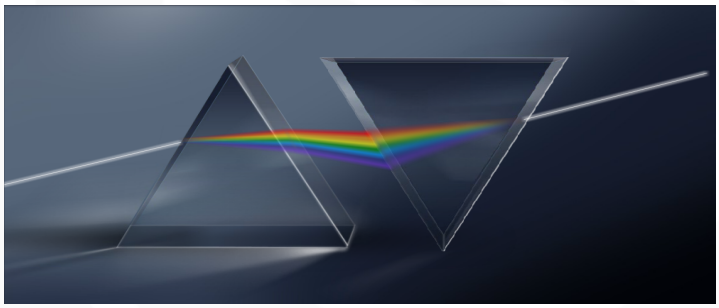
LIGHT (Reflection)

ABOUT LIGHT:-

- Light is a form of energy which helps us to see objects.
- It has dual nature, wave as well as particle.
- It is an nonmechanical electromagnetic wave, propagating with speed of 3x10*8 m/s in vaccum.



- Wave nature of light can be verified by Interference and Deffraction of light phenomena.
- Particle nature of light is called Photon and this nature was shown with Photoelectric Effect by Einstein.
- White color of light is consists of 7 colors VIBGYOR.It was shown by double prism experiment done by Newton.



- Frequency of light in decreasing order : V>I>B>G>Y>O>R
- Wavelength in decreasing order : R>O>Y>G>B>I>V

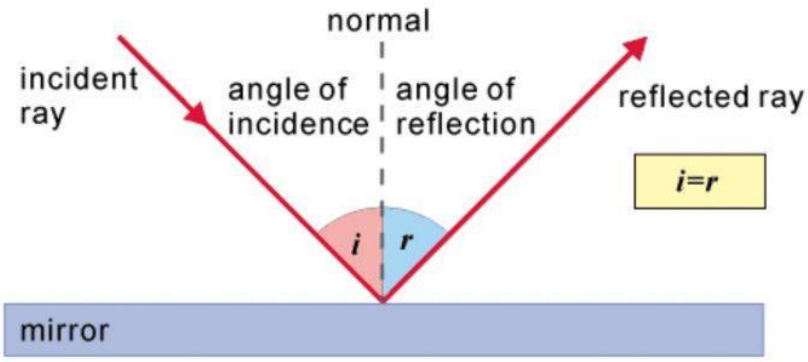
INTERACTION OF LIGHT WITH MATTER:-

- Reflection
- Refraction
- Dispersion
- Interference
- Deffraction
- Polarisation

REFLECTION OF LIGHT

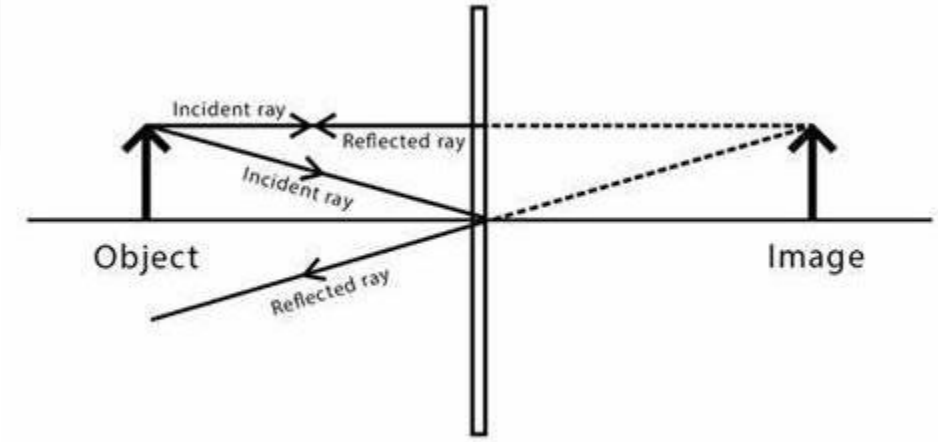
Bouncing back of light in same medium after striking a surface is known as reflection of light.

- **Laws of reflection:-**
  i) The angle of incidence is equal to the angle of reflection.
  ii) The incident ray, the reflected ray and the normal to the mirror at the point of incidence all lie in the same plane.



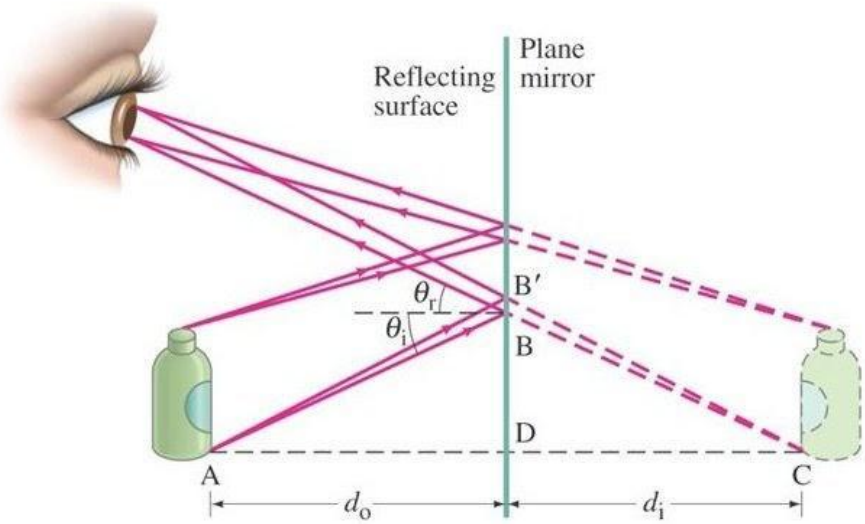
- **Types of Images:-**
  a) Real Image - Which can be obtained on a screen.
  b) Virtual Image - Which can not be obtained on a screen.

- **Image formation by plane mirror**
  Ray Diagram :-



Properties of the Image formed :-
i) The image is erect.
ii) The image is same size as the object.
iii) The image distance and object distance are same.
iv) The image is virtual (cannot be obtained on a screen).
v) The image is laterally inverted.

- **This is how we see an objects in a plane mirror :-**



- **Image formation by Spherical Mirrors :-**

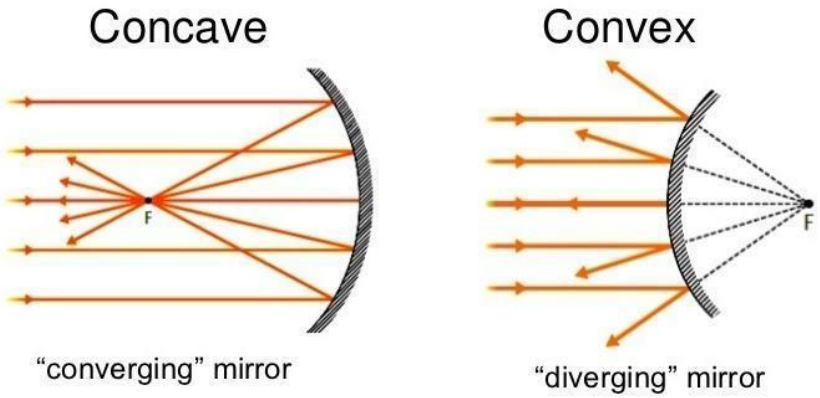
 # Spherical Mirrors -

Spherical mirror is a curved mirror which is a part of a hollow sphere.

Spherical mirrors are of two types. They are concave mirror and convex mirror.

i) <u>Concave mirror</u> :- is a spherical mirror whose reflecting surface is curved inwards. Rays of light parallel to the principal axis after reflection from a concave mirror meet at a point (converge) on the principal axis.

ii) <u>Convex mirror</u> :- is a spherical mirror whose reflecting surface is curved inwards. Rays of light parallel to the principal axis after reflection from a convex mirror get diverged and appear to come from a point behind the mirror.



 # Terms used to study spherical mirrors :-

i) **Center of curvature** :- is the centre of the sphere of which the mirror is a part (C).

ii) **Radius of curvature** :- is the radius of the sphere of which the mirror is a part (CP).

iii) **Pole** :- is the geometrical centre of the spherical mirror (P).

iv) **Principal axis** :- is the straight line passing through the centre of curvature and the pole (X-Y).

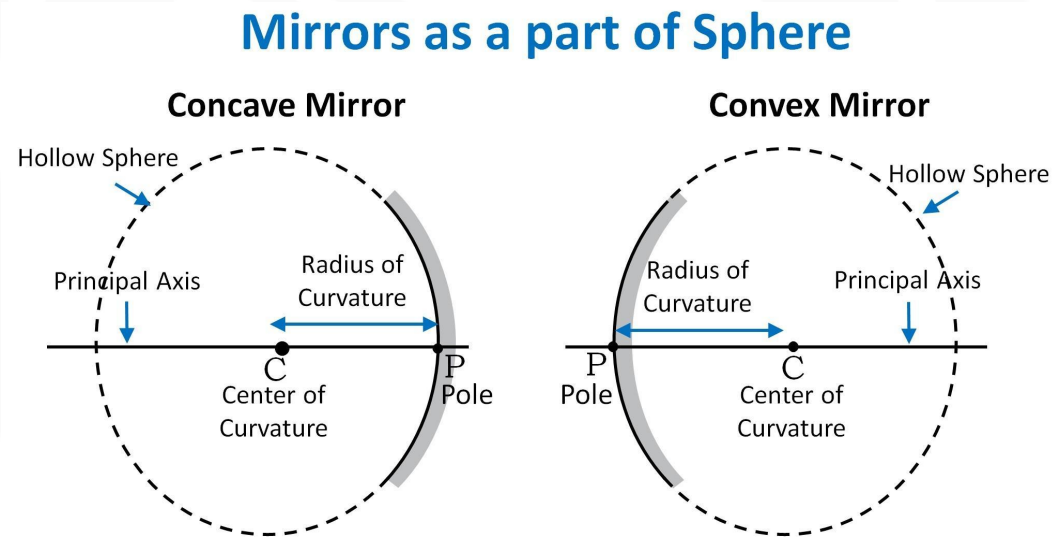
v) **Principal focus** :-

In a concave mirror, rays of light parallel to the principal axis after reflection meet at a point on the principal axis called principal focus(F).

In a convex mirror, rays of light parallel to the principal axis after reflection get diverged and appear to come from a point on the principal axis behind the mirror called principal focus (F).

vi) **Focal length** :- is the distance between the pole and principal focus (f). In a spherical mirror the radius of curvature is twice the focal length.

$$R = 2f$$



 # Rays reflecting from curved mirrors:-

To construct the ray diagrams, in order to locate the image of an object, an arbitrarily large number of rays emanating from a point could be considered. However, it is more convenient to consider only two rays, for the sake of clarity of the ray diagrams.

- Out of these 4 options we will take only two convenient rays to construct the ray diagram for image formation.

Image Formation by Concave Mirrors :-

Table 10.1 Image formation by a concave mirror for different positions of the object

Position of the object	Position of the image	Size of the image	Nature of the image
At infinity	At the focus F	Highly diminished, point-sized	Real and inverted
Beyond C	Between F and C	Diminished	Real and inverted
At C	At C	Same size	Real and inverted
Between C and F	Beyond C	Enlarged	Real and inverted
At F	At infinity	Highly enlarged	Real and inverted
Between P and F	Behind the mirror	Enlarged	Virtual and erect

Ray Diagrams

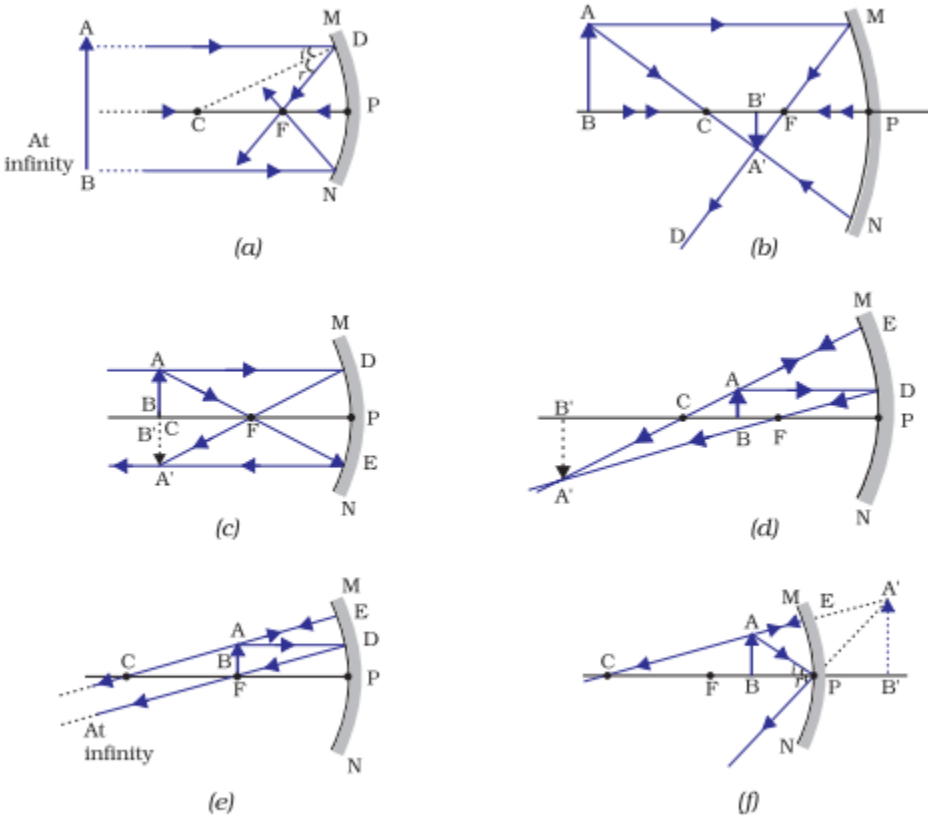


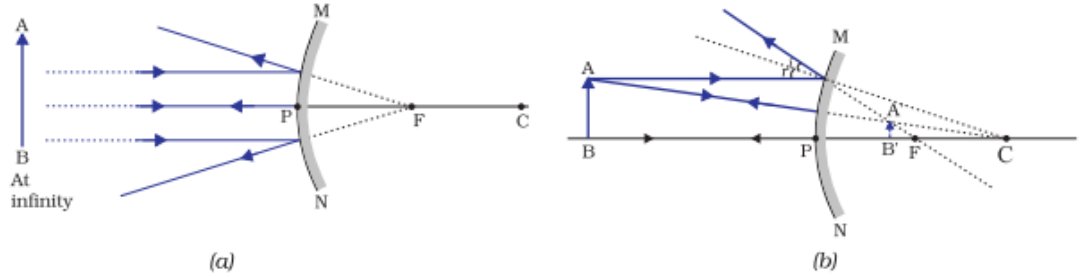
Figure 10.7 *Ray diagrams for the image formation by a concave mirror*

 # Image Formation by Convex mirrors :-

Table 10.2 Nature, position and relative size of the image formed by a convex mirror

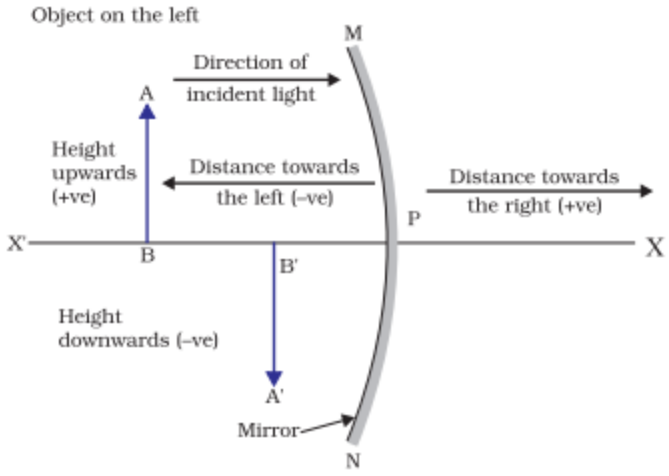
Position of the object	Position of the image	Size of the image	Nature of the image
At infinity	At the focus F, behind the mirror	Highly diminished, point-sized	Virtual and erect
Between infinity and the pole P of the mirror	Between P and F, behind the mirror	Diminished	Virtual and erect

Ray Diagrams for Convex mirrors



Formation of image by a convex mirror

- **Sign Convetions for solving numericals related to spherical mirrors :-**
  - (i) The object is always placed to the left of the mirror. This implies that the light from the object falls on the mirror from the left-hand side.
  - (ii) All distances parallel to the principal axis are measured from the pole of the mirror.
  - (iii) All the distances measured to the right of the origin (along + x-axis) are taken as positive while those measured to the left of the origin (along – x-axis) are taken as negative.
  - (iv) Distances measured perpendicular to and above the principal axis (along + y-axis) are taken as positive.
  - (v) Distances measured perpendicular to and below the principal axis (along –y-axis) are taken as negative.



The New Cartesian Sign Convention for spherical mirrors

Mirror Formula –

1/v + 1/u = 1//f

Magnification –

$$m = \frac{\text{Height of the image } (h')}{\text{Height of the object } (h)}$$

$$m = \frac{h'}{h}$$

and,

$$\text{Magnification } (m) = \frac{h'}{h} = -\frac{v}{u}$$