

LIGHT

Reflection

Topics to be covered :-

- Introduction
- Reflection of light
- Laws of reflection
- Mirrors
- Properties of images formed by plane mirror
- Ray diagram for images formed by spherical mirror
- Sign convention
- Mirror formula

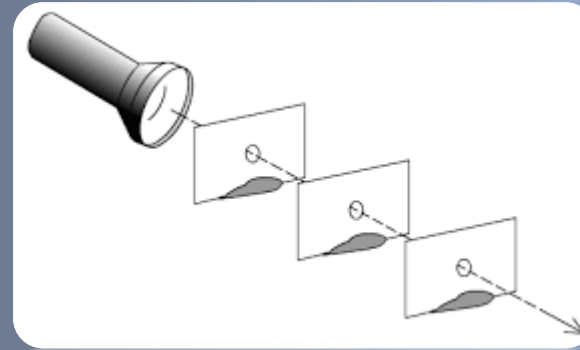


Introduction

Light :- It is a form of energy which produce a sensation of vision /sight (after reflection of light from object).

Note :- Light travels in a straight line.

Terminology of light



1. **Source :-** A source of light is an object , from which light is given out.

Luminous

Non
Luminous



2. Medium :- Substances through which light is propagates.

1.Transparent

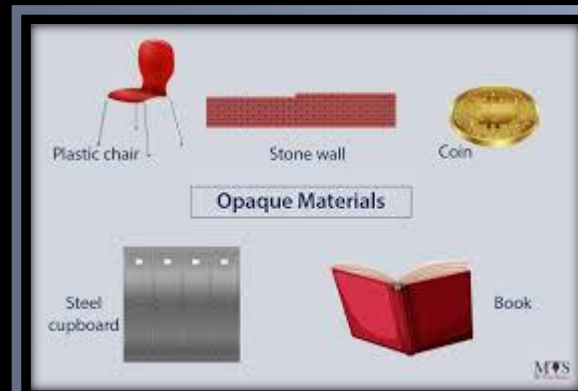
Eg. :- air, clean water, glass, etc

2.Translucent

Eg. :- oily paper, frosted glass, etc

3.Opaque

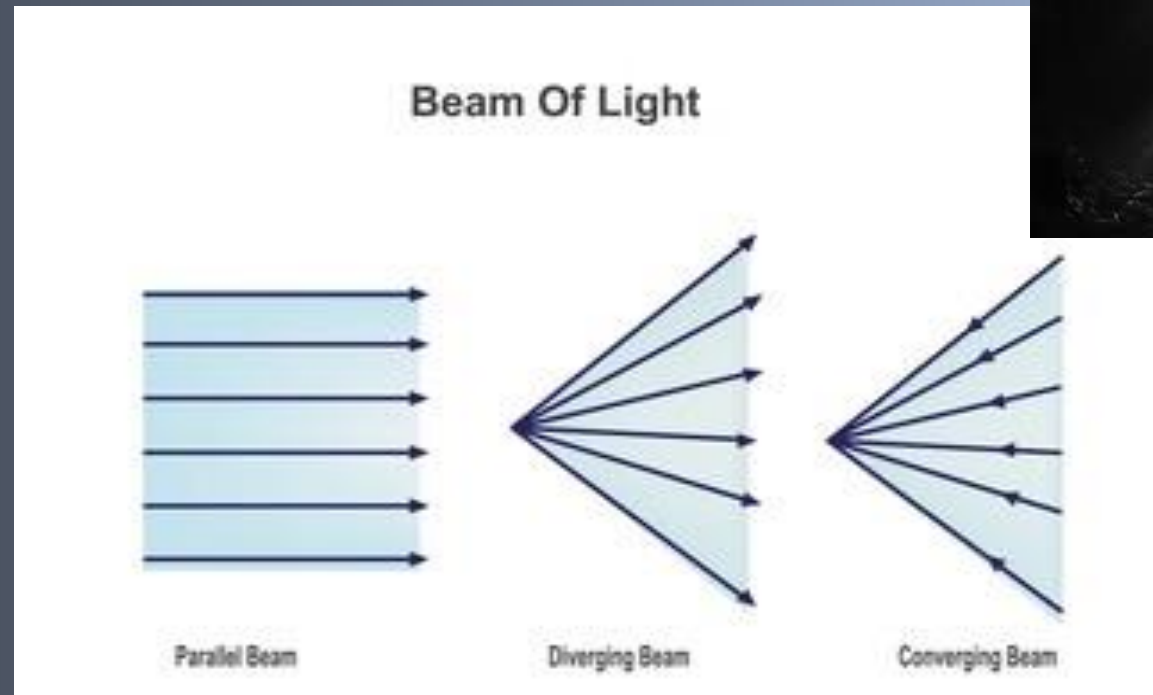
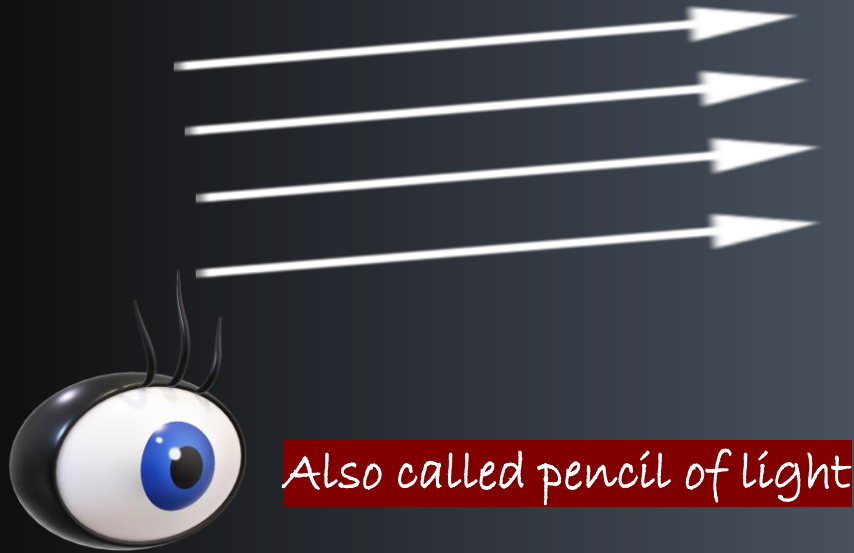
Eg. :- table, wall, book, etc



3. Ray of light :- A ray of light is a straight line path along which light travels.



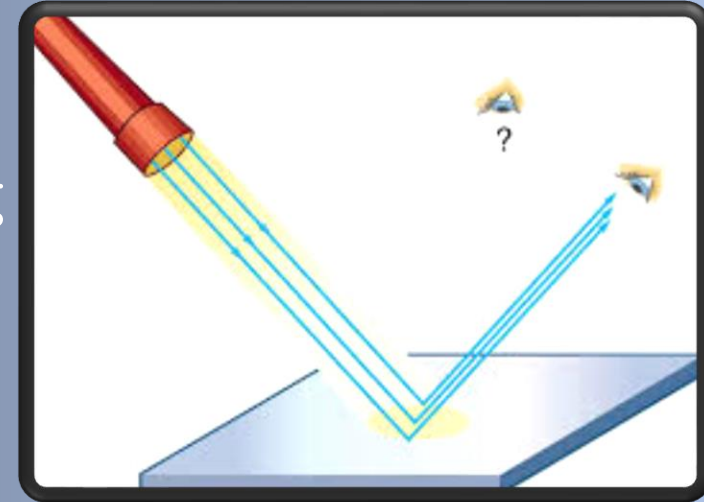
3. Beam of light :- A numbers of rays combine together to form beam of light.



Reflection of light

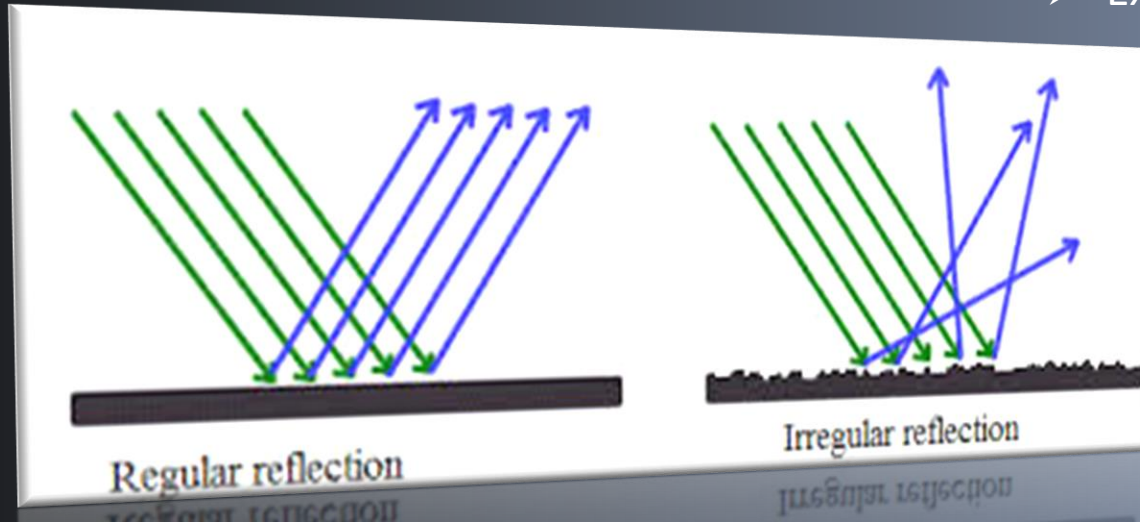
The returning back of light in same medium on striking the surface of any object, is called reflection of light.

REFLECTION



Regular reflection

- Reflection from a smooth / plane or polished surface.
- Example:- through plane mirror



Irregular reflection

- Reflection from a rough / irregular or unpolished surface.
- Example:- through wavy surface water

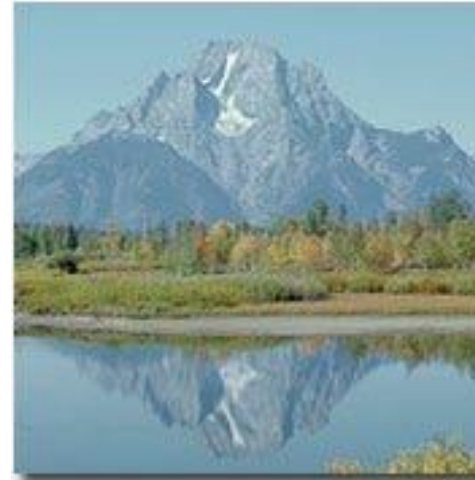


Silver is one of the best reflector of light that's why we use silver for coating mirror.

Now aluminium are used.



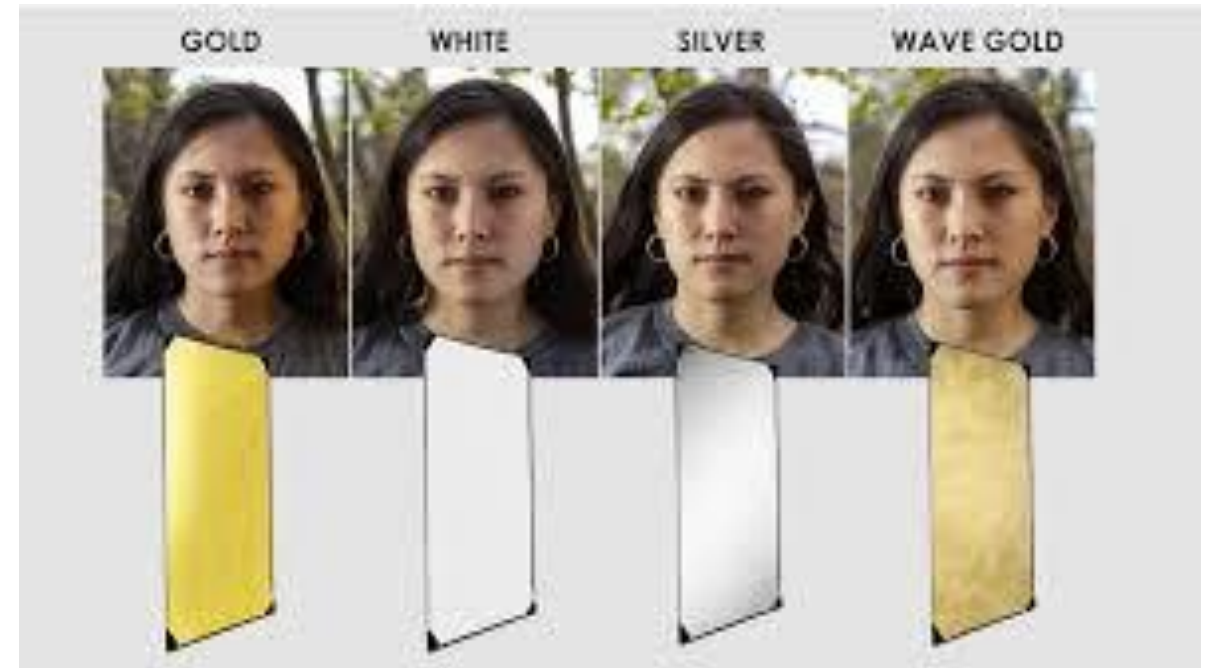
Reflections From the Surface of Water



Smooth Water Surface



Wavy Water Surface



Laws of reflection

First law :- According to First Law of reflection, incident ray, the reflected ray and the normal lies in the same point / plane.

Normal:- The normal is a line which is perpendicular to the surface

second law :- According to second law of reflection, the angle of incidence is always equal to the angle of reflection.

$$\angle i = \angle r$$

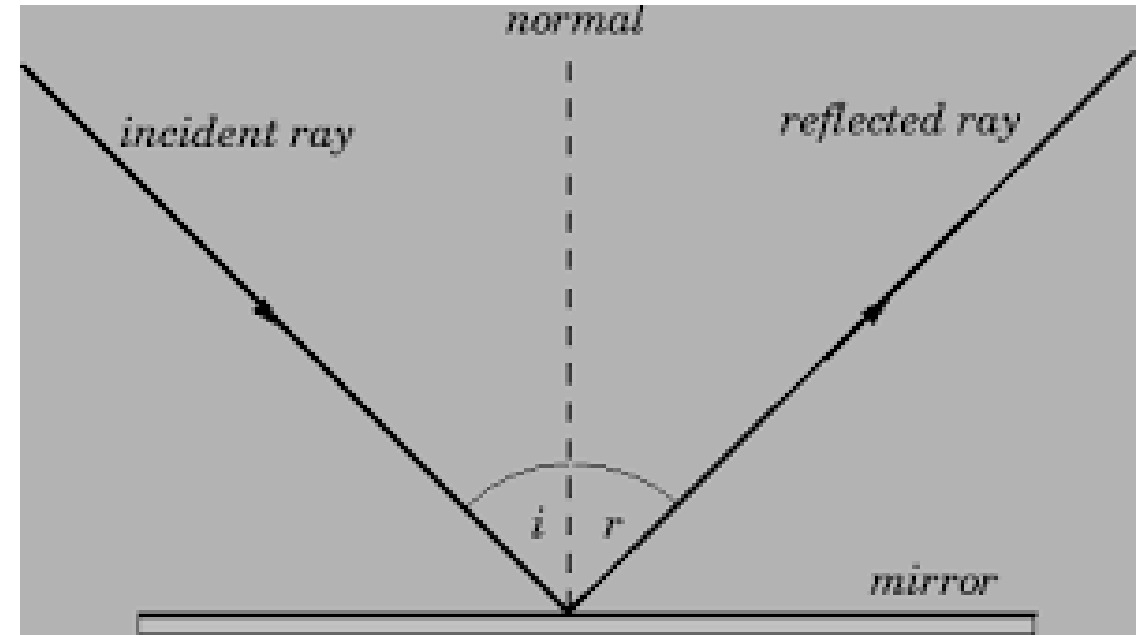
Note :- A ray of light which is incident normally or perpendicularly on mirror or a surface is reflected back along the same path.

Because $\angle i = \angle r = 0$

Video link

<https://www.youtube.com/shorts/JYpGPRA9-xk?feature=share>

<https://www.youtube.com/shorts/DRqnHjLz9-U?feature=share>



OBJECT :-

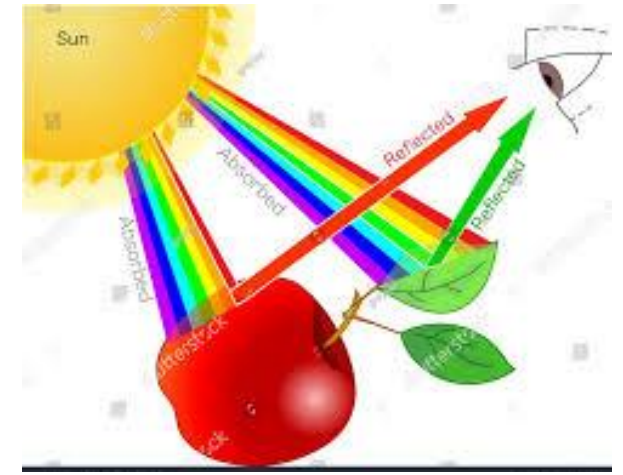
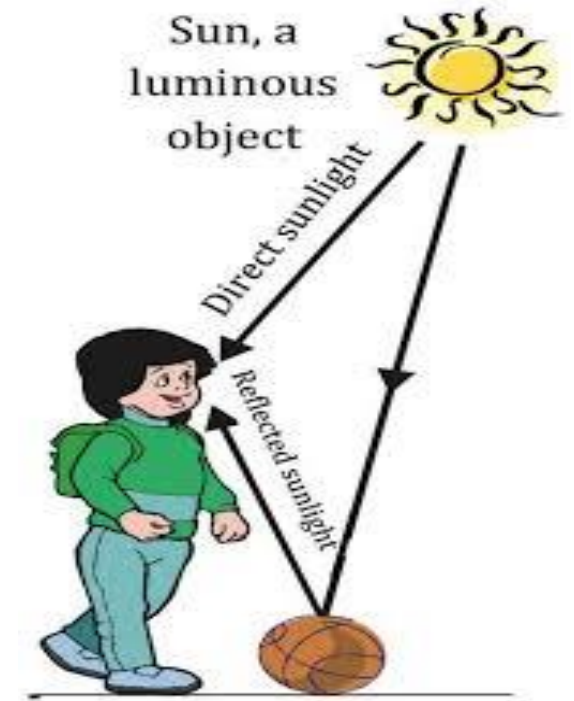
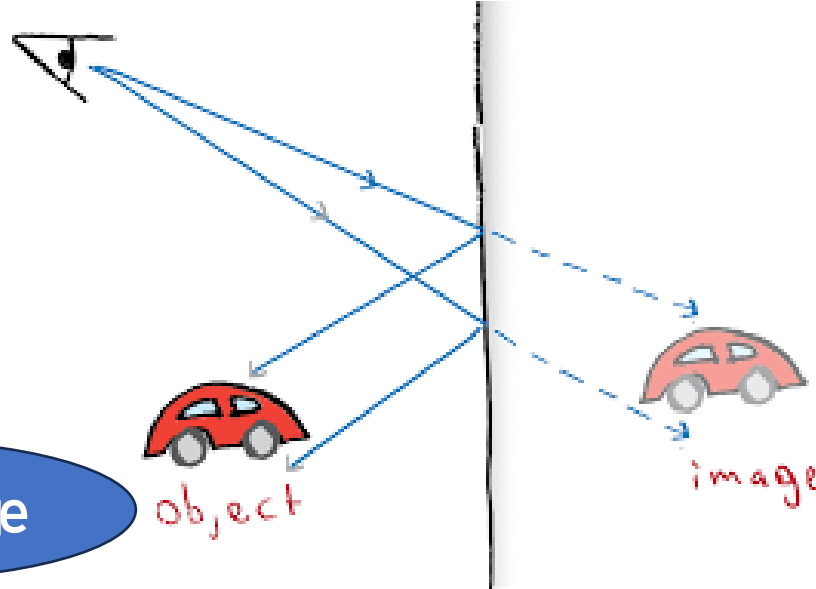
Anything which gives out light rays either its own or reflected by it, is called object.

IMAGE :-

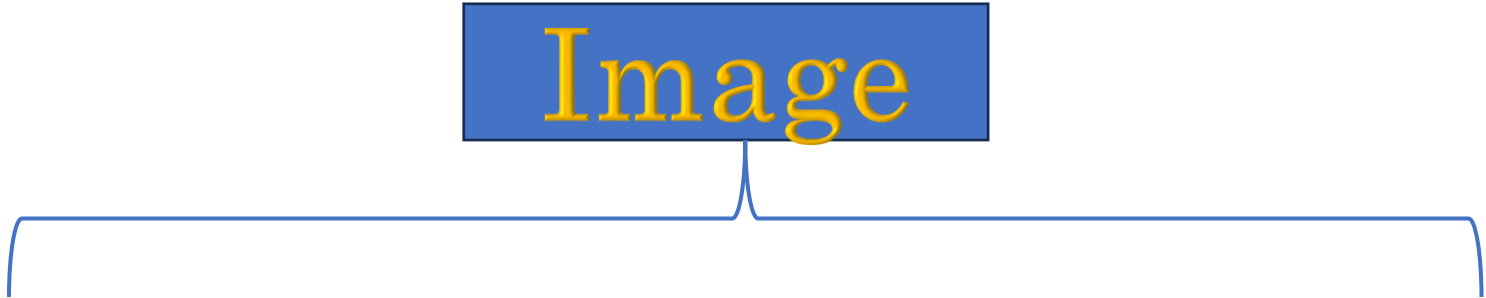
Image is an optical appearance produced when light rays reflected from a mirror or refracted through a lens.

Real Image

Virtual Image



Image



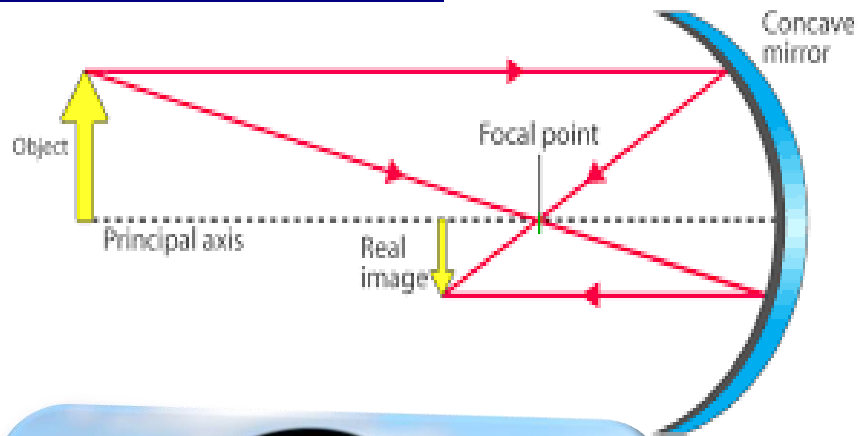
Real Image

- i). Real image is formed by actual intersection of two or more reflected rays.
- ii). These are always inverted and formed in front of mirror.
- iii). These can be obtain on screen.
- iv). Image formed on a screen in cinema wall are real.

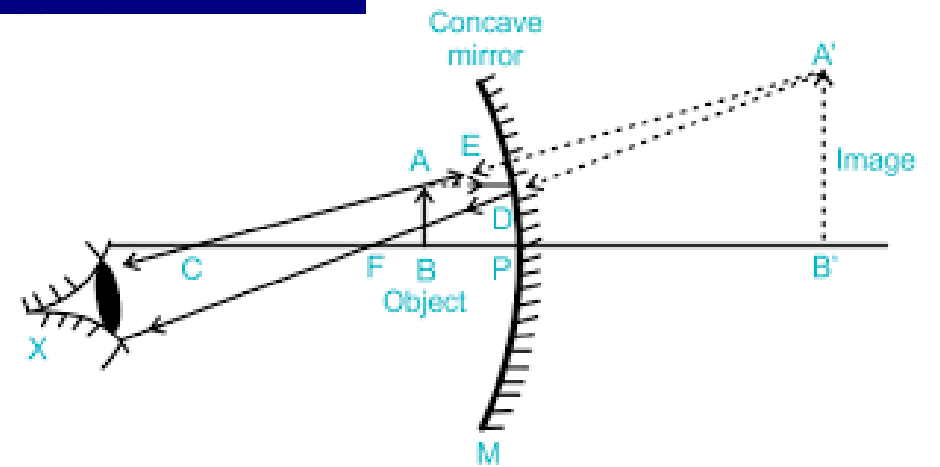
Virtual Image

- i). Virtual image is formed by virtual intersection of two or more reflected rays.
- ii). These are always erect and formed in the behind of mirror.
- iii). These can not be obtained on screen.
- iv). Image formed by a plane & convex mirror is virtual.

REAL IMAGE



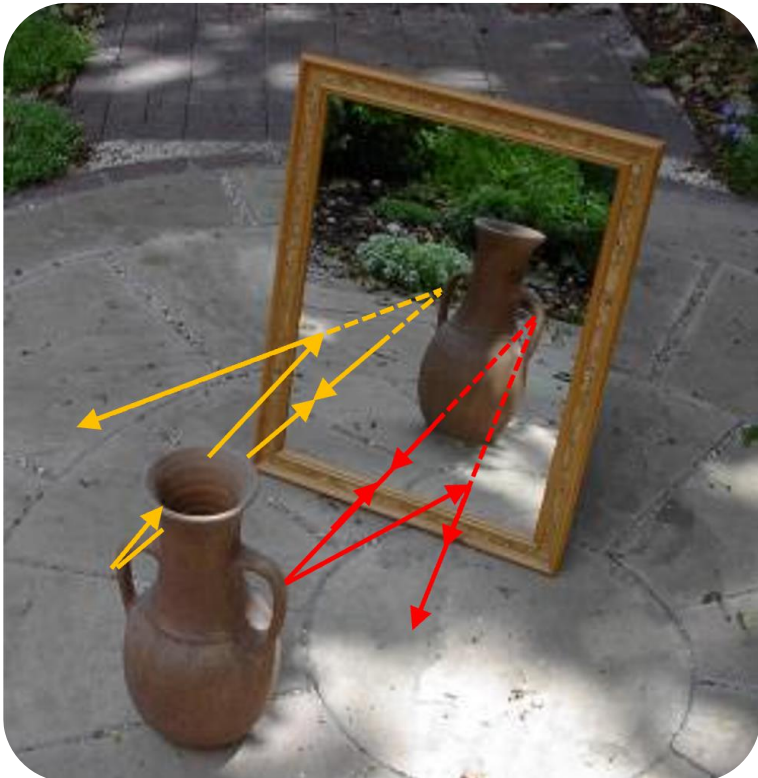
VIRTUAL IMAGE



Mirror

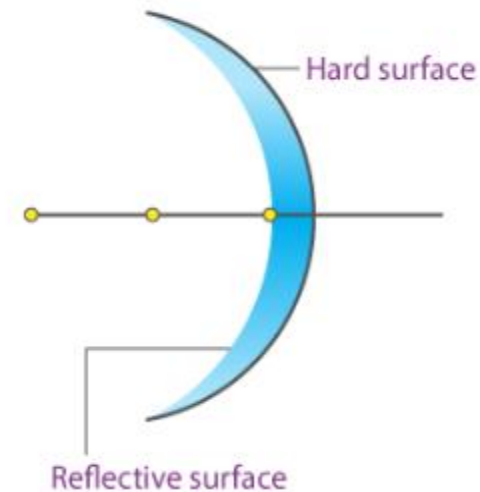
A smooth and well polished surface through which reflection takes place.

Plane Mirror



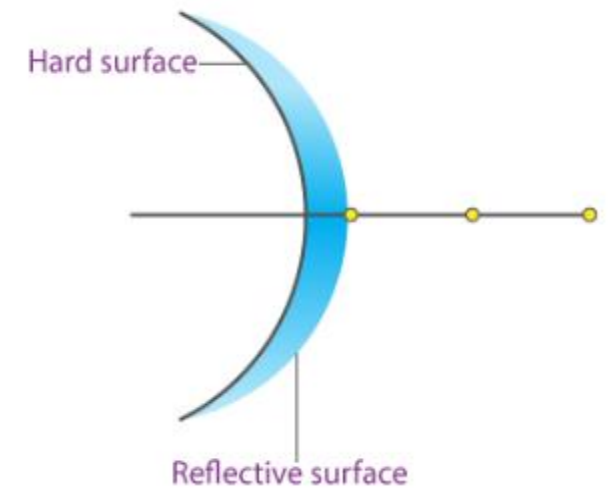
Spherical Mirror

Concave Mirror



Concave mirror

Convex Mirror



Convex mirror

Characteristics of image formed by plane mirror :-

- ❖ Image is always virtual and erect.
- ❖ Size of object is always equal to size of image.
- ❖ Distance of object is always equal to distance of image.
- ❖ Image is always laterally inverted.

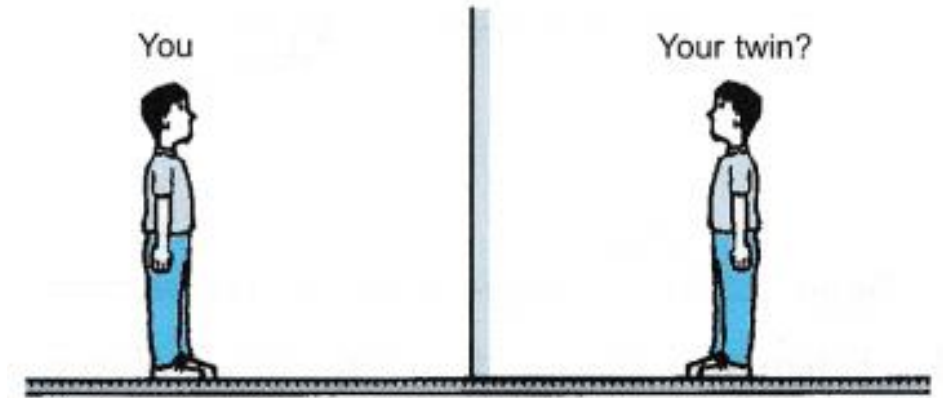
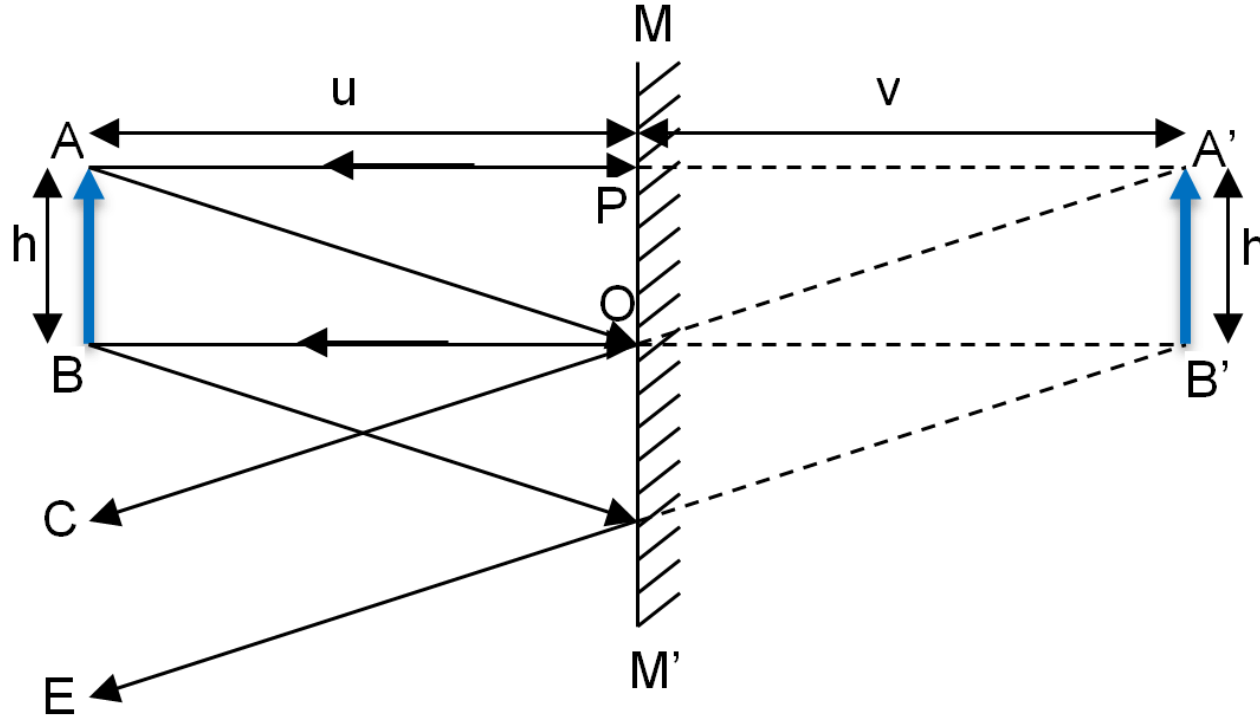
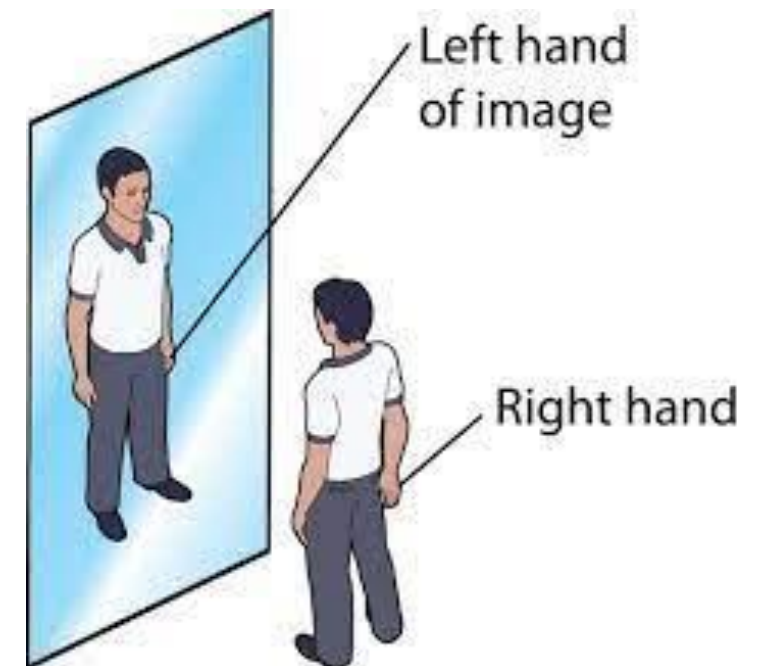
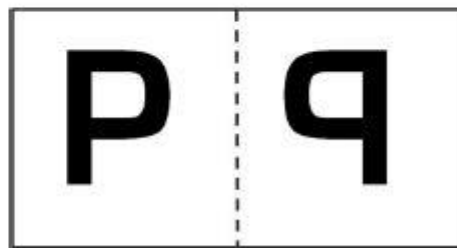
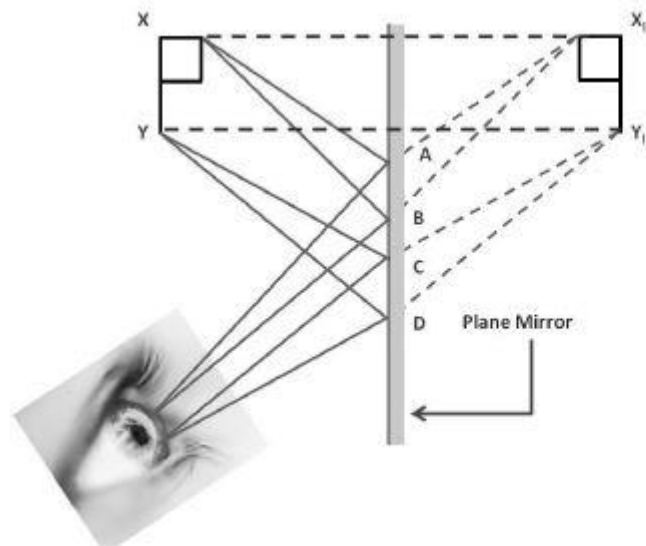


Figure Your image and you are identical

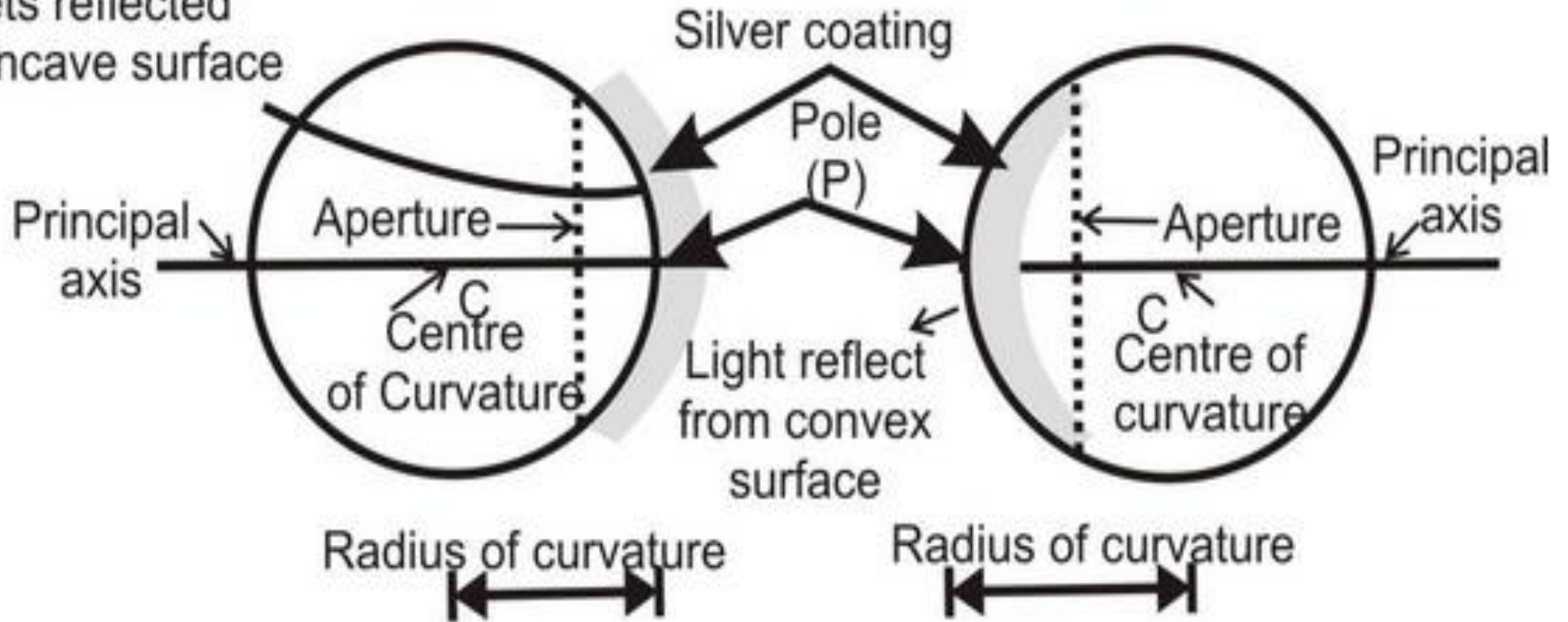




Terminology related to spherical Mirror

Terminology related to spherical Mirror

Light gets reflected from concave surface



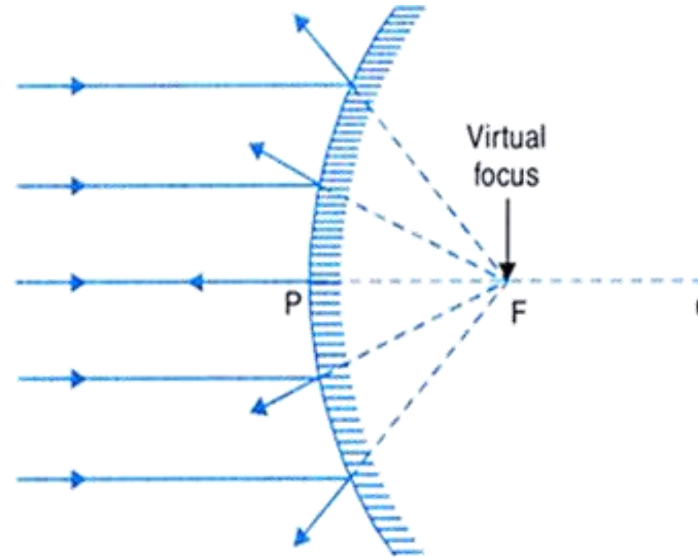
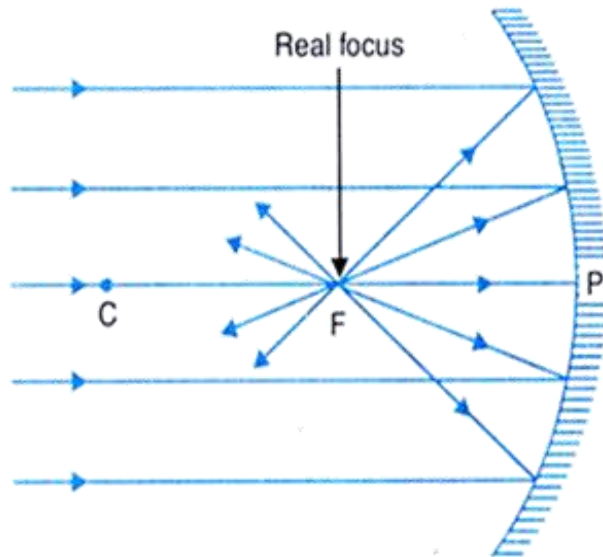
Terminology related to spherical mirror

- 01 Centre of curvature :-** Centre of curvature of a spherical mirror is centre of hollow sphere of glass from which spherical mirror is cut.
→ Represented by C.
- 02 Pole :-** The pole of a spherical mirror is the centre of the mirror.
→ Represented by P.
- 03 Principal axis :-** Principal axis of a spherical mirror is the straight line passing through centre of curvature and pole and can be produced both side.
→ Represented by xx' .
- 04 Radius of curvature :-** Radius of curvature of a spherical mirror is radius of hollow sphere of glass from which spherical mirror is cut.
Represented by R.
- 05 Aperture :-** Aperture of a spherical mirror is the diameter of reflecting surface.
→ Represented by MM' .

06

Principal focus :- A point on a principal axis where the rays of incidence parallel to principal axis actually (concave) / virtually (convex) meet after the reflection from the mirror.

➔ Represented by F.



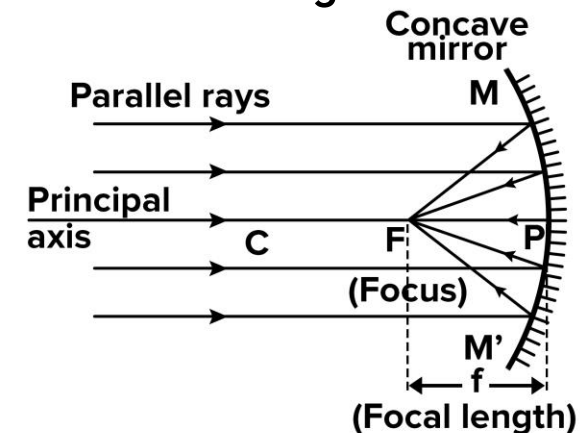
06

Focal length :- The length between focus and pole is called focal length. Denoted by f .

$$2f = R$$

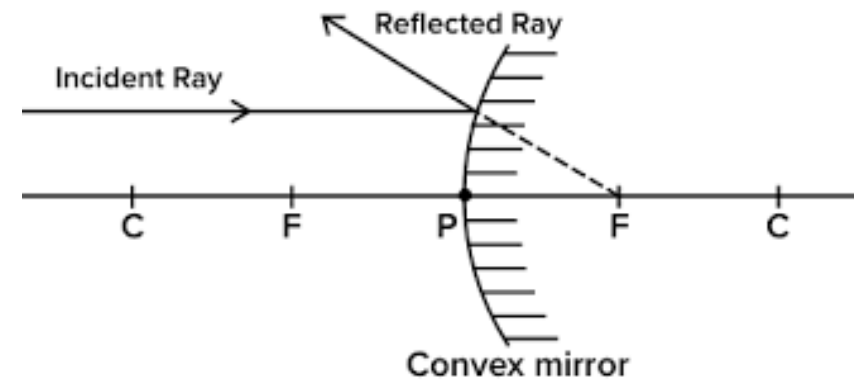
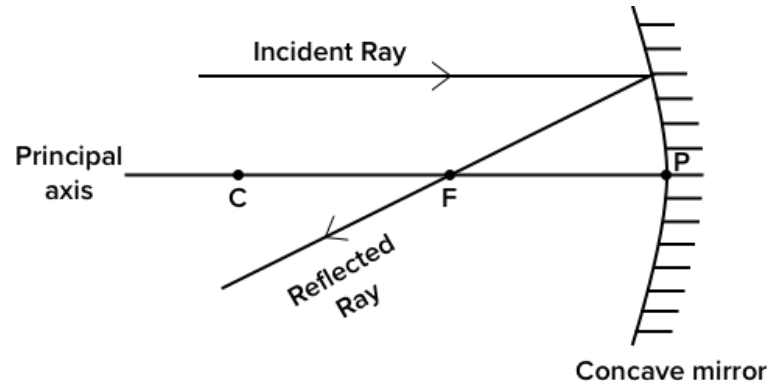
$$f = R/2$$

Where R = radius of curvature

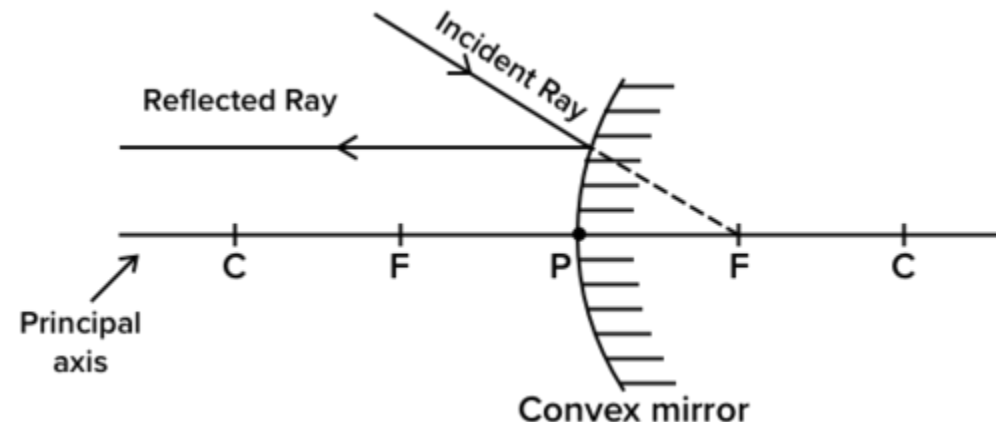
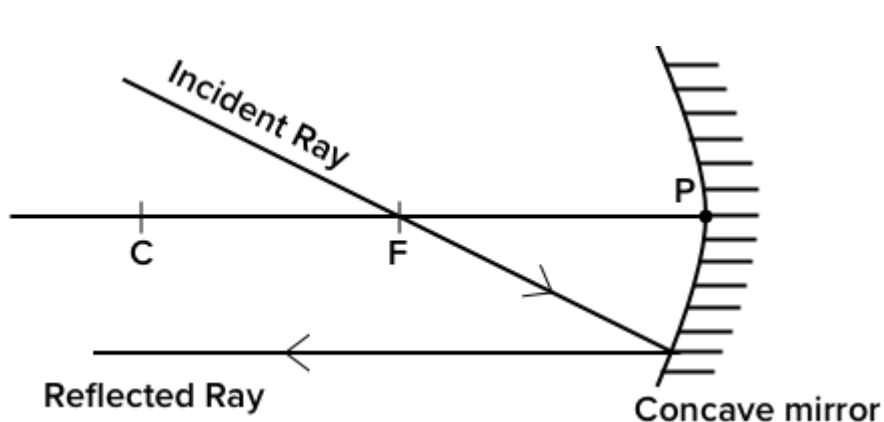


Rules for obtaining images formed by spherical mirror

Rule 01 When a ray of light passes parallel to the principal axis of a spherical mirror, pass through its focus after reflection from the mirror.

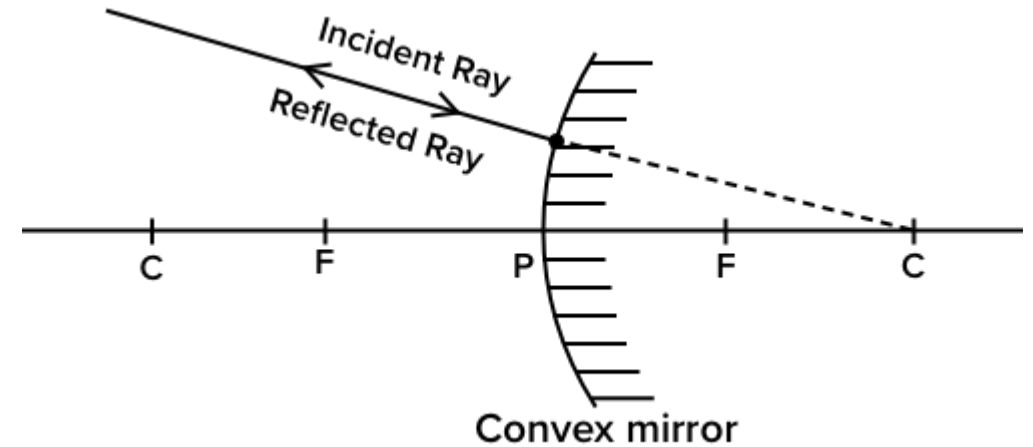
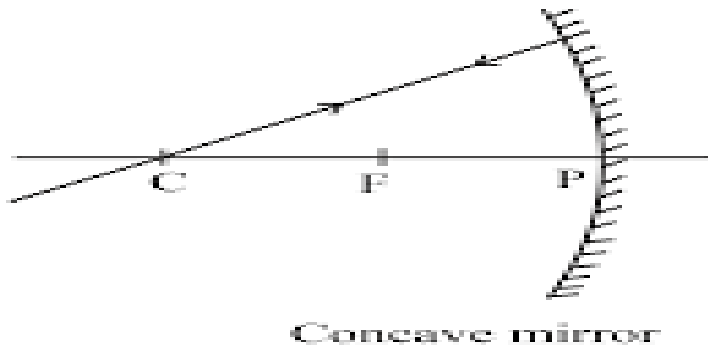


Rule 02 When a ray of light passes through the focus of a spherical mirror become parallel to principal axis after reflection from the mirror.



Rules for obtaining images formed by spherical mirror

Rule 03 When a ray of light passes through centre of curvature of a spherical mirror is reflected back along the same path.



Rule 04 When a ray of light incident at the pole of a spherical mirror is reflected back making the same angle with the principal axis.

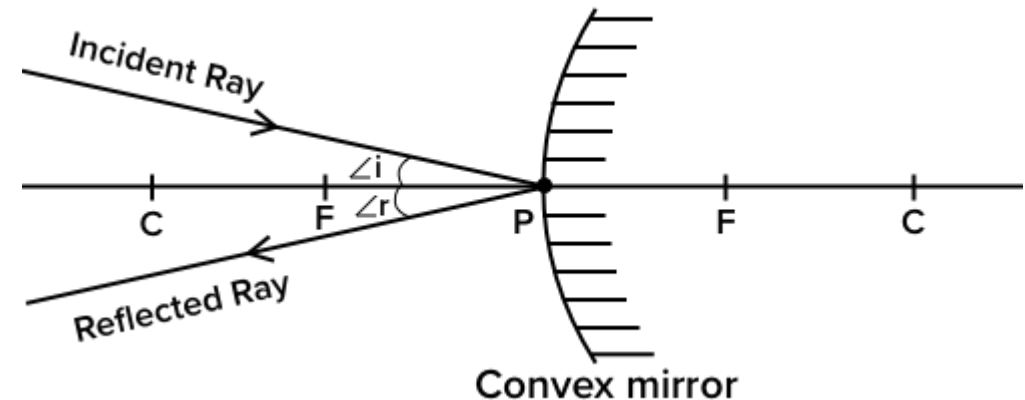
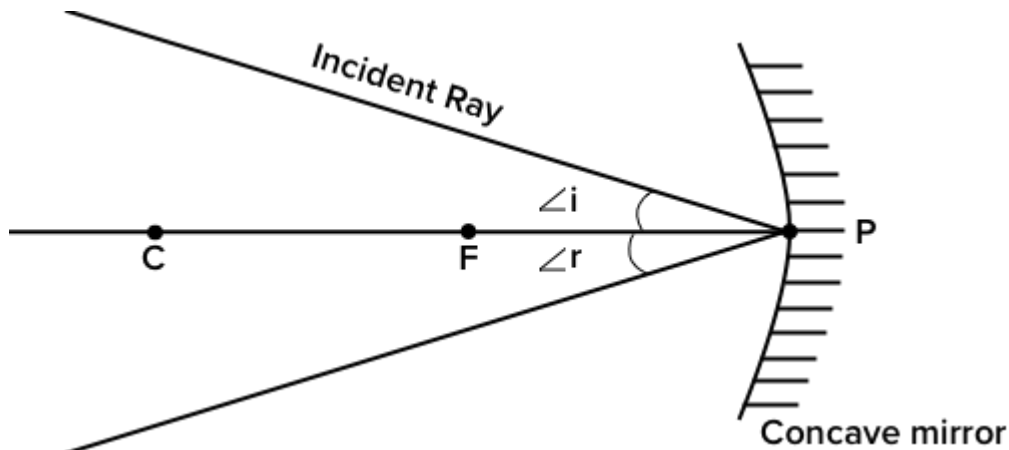
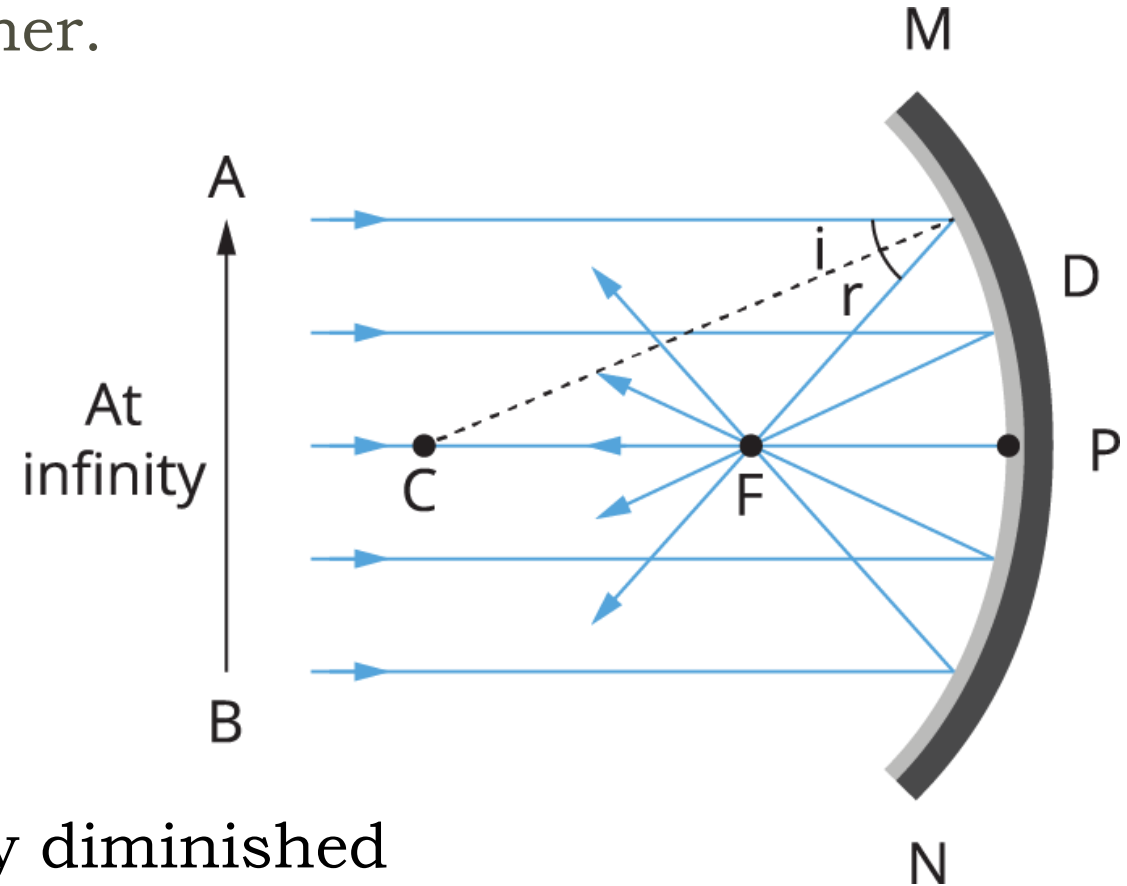


Image formation by concave mirror

Case 1 :- when object is placed at infinity, the rays of light reaching the concave mirror is **parallel** to each other.



I. Position of image :- At the F.

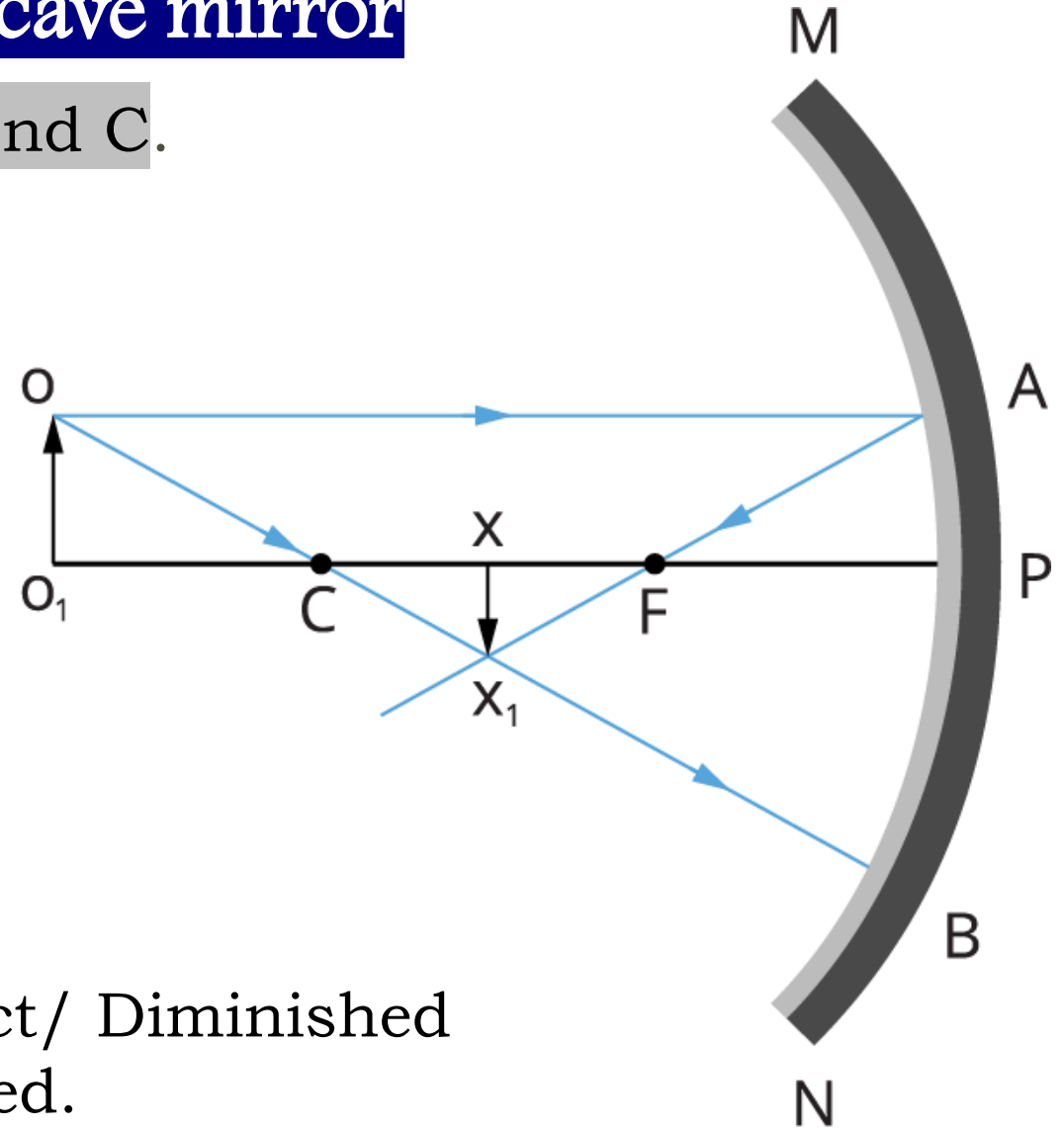
II. Size of image :- Point sized/ Highly diminished

III. Nature of image :- Real and inverted.

Video link :- https://youtube.com/shorts/oplXXhH8i7E?si=gnQO_3dNDmogtvQE

Image formation by concave mirror

Case 2 :- when object is placed at beyond C.



I. Position of image :- B/w C & F.

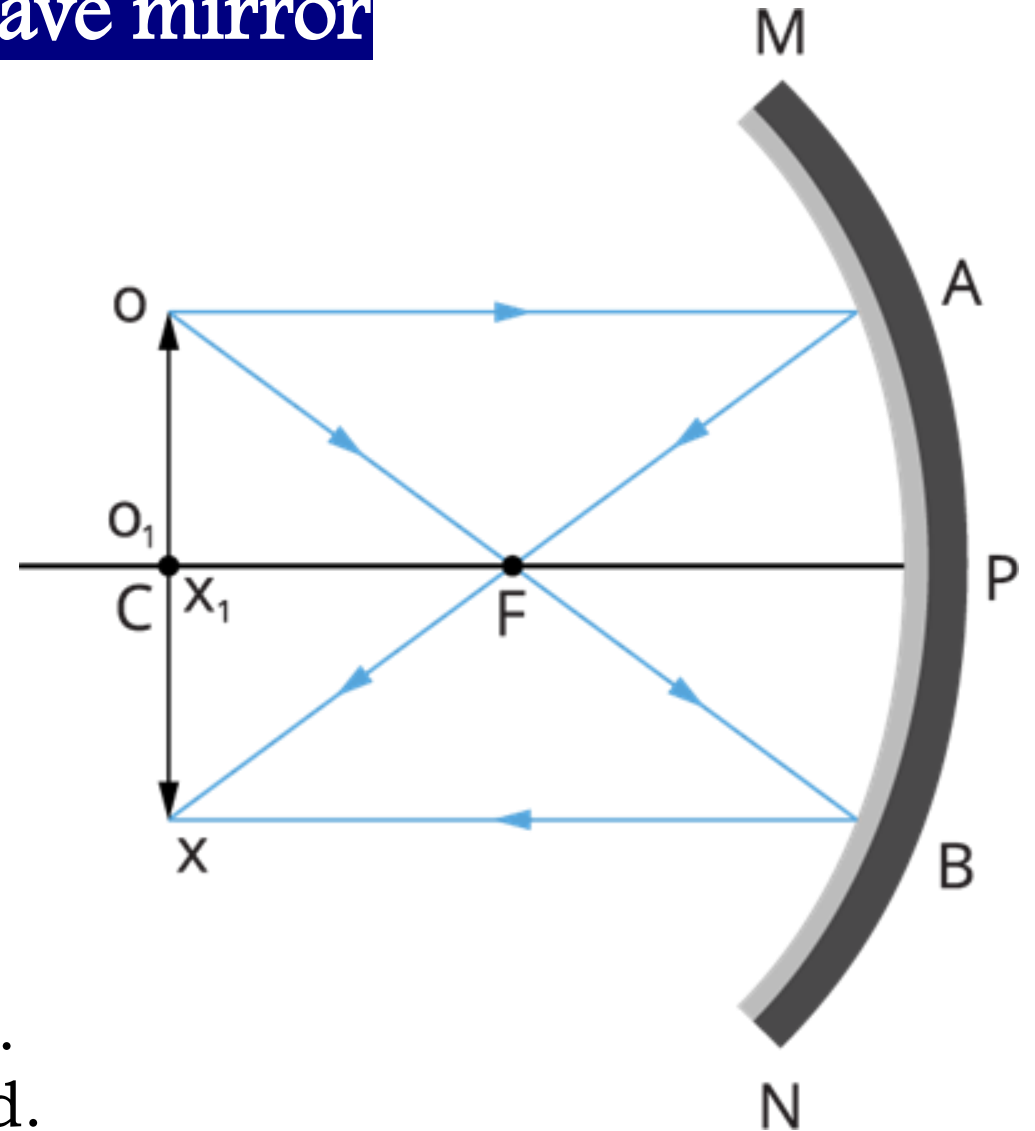
II. Size of image :- Smaller than object/ Diminished

III. Nature of image :- Real and inverted.

Video link :- <https://youtu.be/BcuU4uzO-Ec?si=StrF8ABBPux1FxWU>

Image formation by concave mirror

Case 3 :- when object is placed at C.



I. Position of image :- At C.

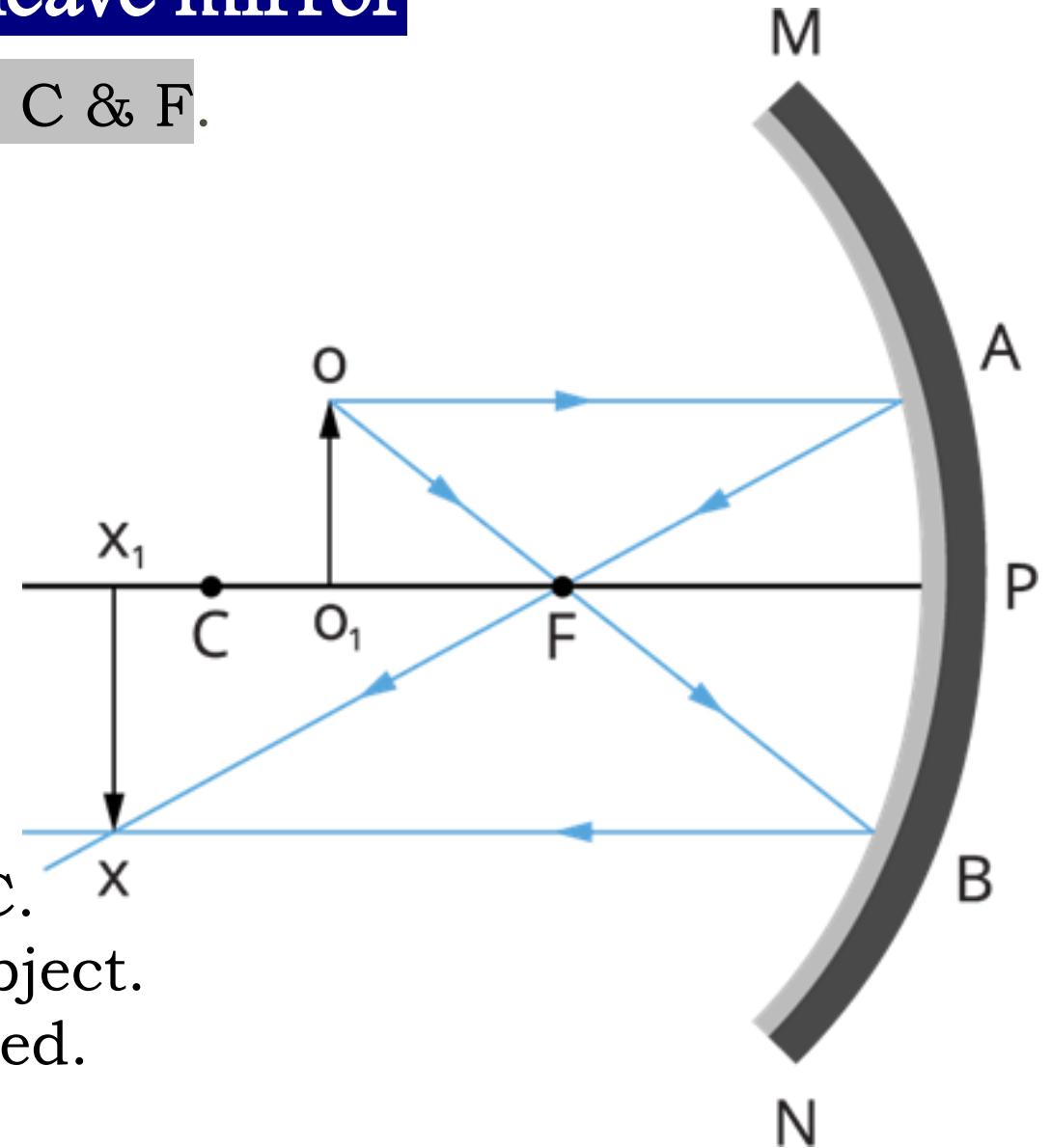
II. Size of image :- Same size as object.

III. Nature of image :- Real and inverted.

Video link :- <https://youtu.be/BcuU4uzO-Ec?si=StrF8ABBPux1FxWU>

Image formation by concave mirror

Case 4 :- when object is placed at b/w C & F.



I. Position of image :- Beyond the C.

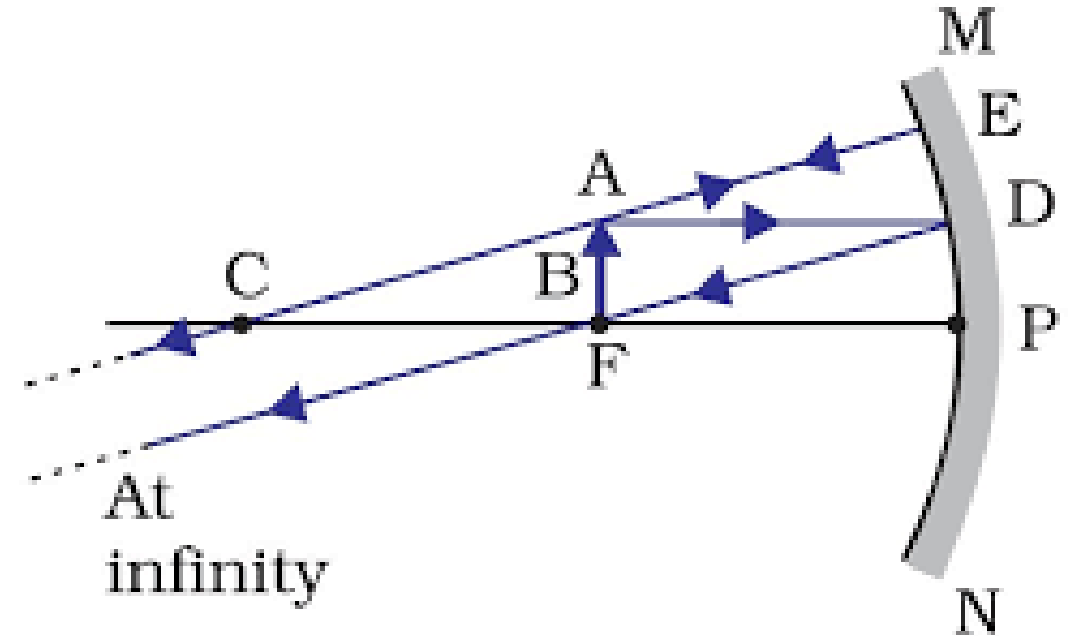
II. Size of image :- Larger than the object.

III. Nature of image :- Real and inverted.

Video link :- <https://youtu.be/BcuU4uzO-Ec?si=StrF8ABBPux1FxWU>

Image formation by concave mirror

Case 5 :- when object is placed at F.

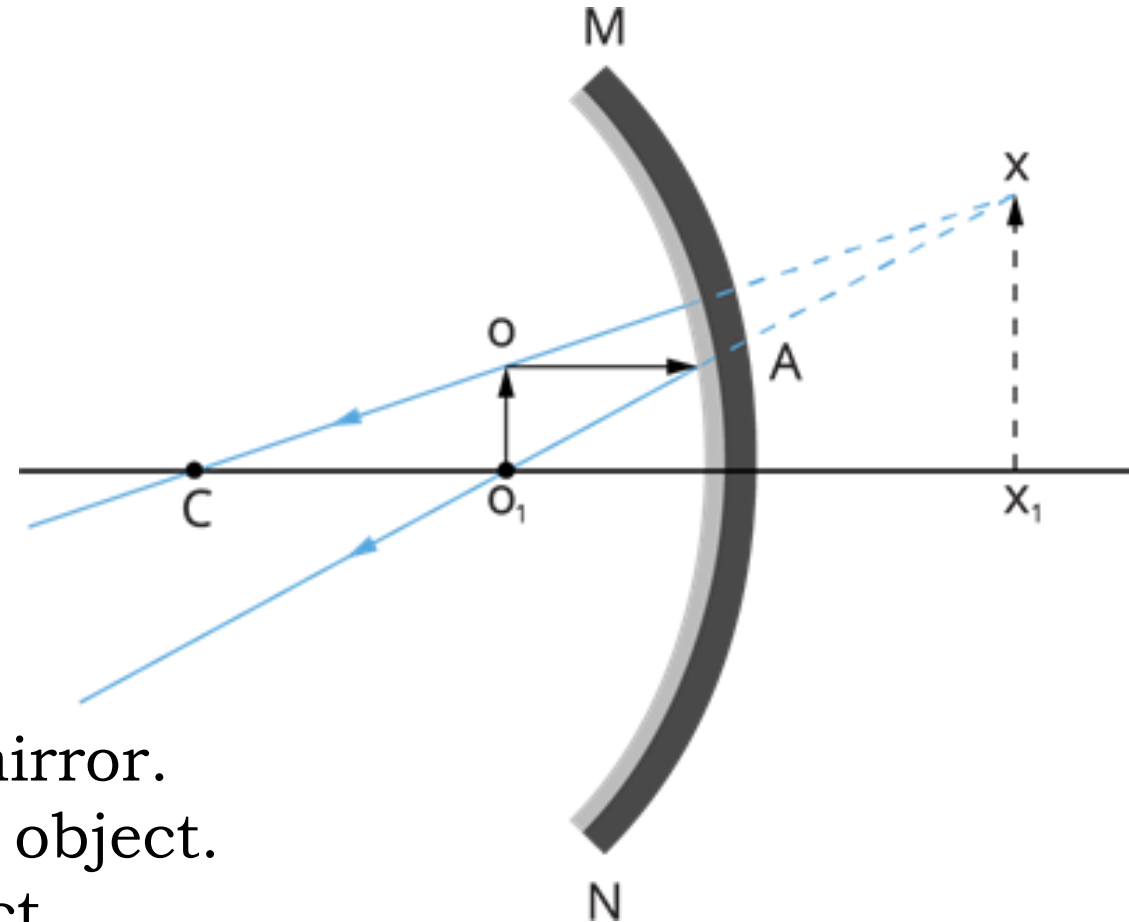


- I. Position of image :-** At infinity.
- II. Size of image :-** highly enlarged than the object.
- III. Nature of image :-** Real and inverted.

Video link :- <https://youtu.be/BcuU4uzO-Ec?si=StrF8ABBPux1FxWU>

Image formation by concave mirror

Case 6 :- when object is placed at b/w F & P.



I. Position of image :- Behind the mirror.

II. Size of image :- Enlarged than the object.

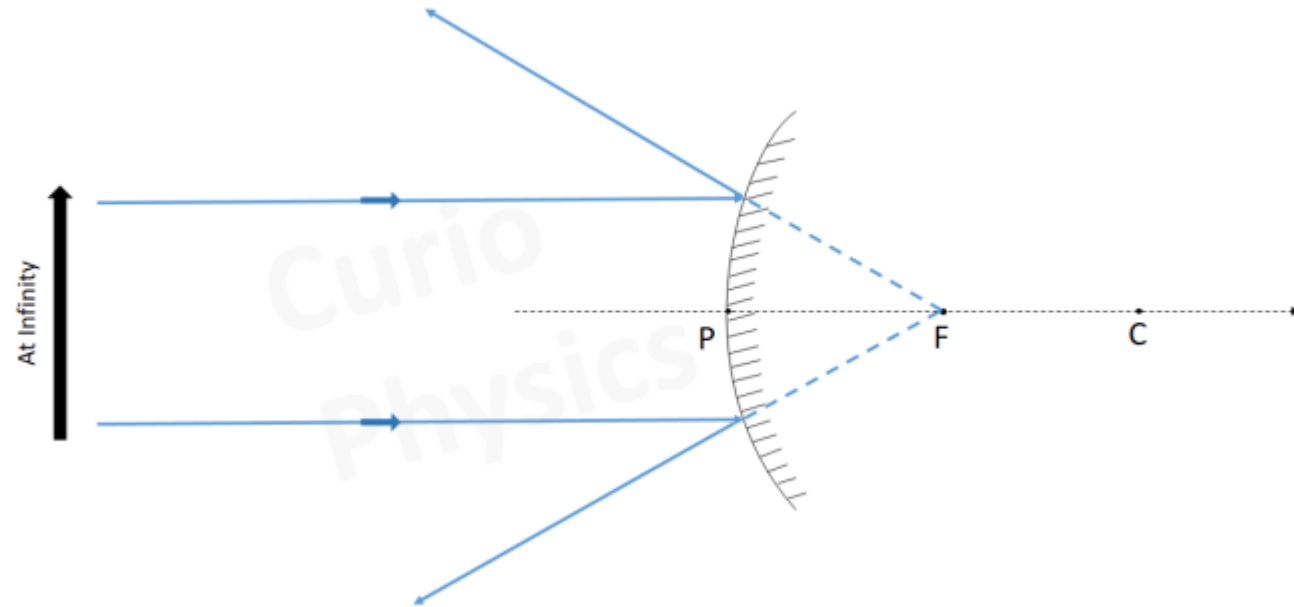
III. Nature of image :- Virtual and erect.

Video link :- <https://youtu.be/BcuU4uzO-Ec?si=StrF8ABBPux1FxWU>

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

Image formation by convex mirror

Case 1 :- when object is placed at infinity, the rays of light reaching the convex mirror is **parallel** to each other.



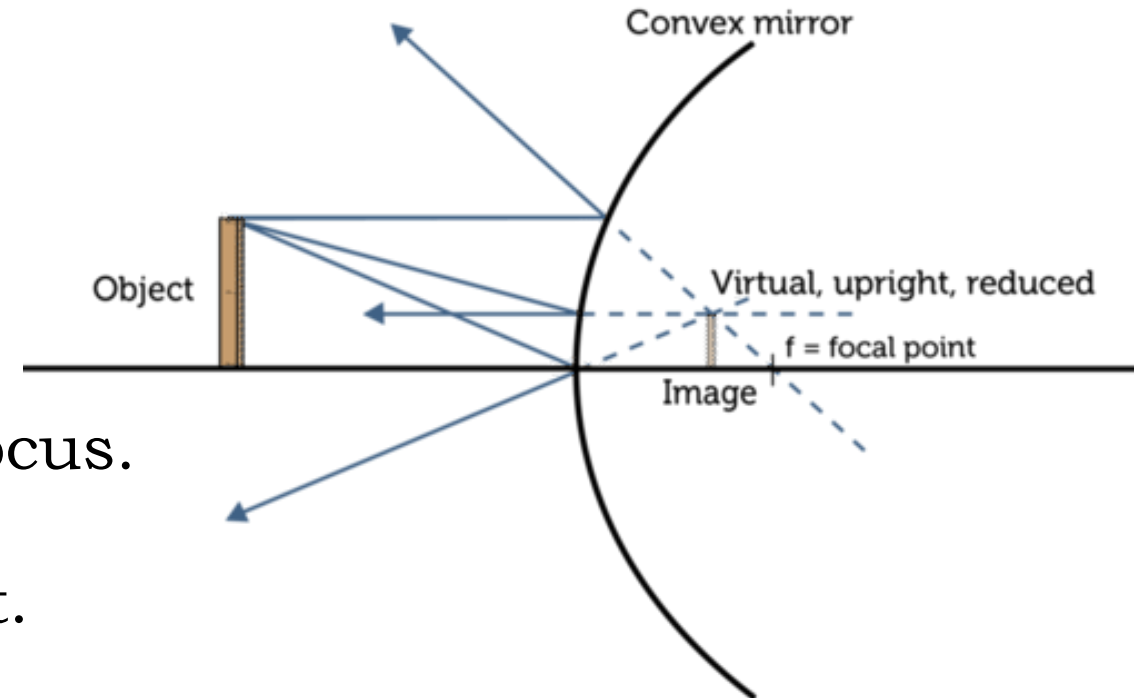
I. Position of image :- At the F.

II. Size of image :- Point sized/ Highly diminished

III. Nature of image :- Virtual and erect.

Image formation by convex mirror

Case 1 :- when object is placed at less than infinity.



I. Position of image :- B/w Pole & Focus.

II. Size of image :- Diminished

III. Nature of image :- Virtual and erect.

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

Uses of concave mirror

- ❑ Used as shaving mirrors (to see large image of the face).
- ❑ Used by dentists (to see the large images of the teeth of patients).
- ❑ Used as reflector
- ❑ Used as doctor's head (mirror to focus light).
- ❑ To converge solar radiations for heating solar furnaces/cooker
- ❑ Used in TV dish antennas to receive TV signal.



Uses of convex mirror

- ❑ Used as rear view mirrors in vehicles.
- ❑ Used in T- junction type road (to avoid accidents).
- ❑ Used in parking areas.
- ❑ Big convex mirrors are used as “shop security mirrors”.



Figure 3.5 Uses of Convex mirror



