LIGHT CHAPTER-1

(i) Light is a form of energy.
(ii) Light year is a measurment of length.
(iii) Light travels in a straight line
(iv) Light is a radiation means it doesnot require matrial medium travels. $c = 3 \times 10^8$ m/s

Q- What are the different kinds of optic materials?

Ans. There are three kinds of optic materials —

(i) Transparent medium — A material medium in which light can travel freely over large distance is called a transparent medium.
Ex- Glass, Glycerine.

(ii) opaque — A material medium in which light cannot travel is called opaque.
Ex- wood, metals.

(iii) Translucent — A material medium in which light can travel some distance, but its

intensity reduces rapidly. Such materials are called translucent

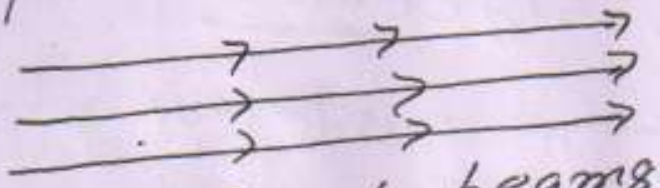
Ex- Thin sheets of Plastic, oily paper etc

Q- what is beam? How many types of beams?

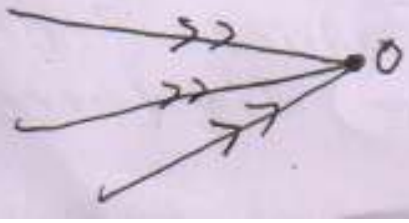
Ans — A bundle of light rays is called a beam of light.

There are three types of beams-

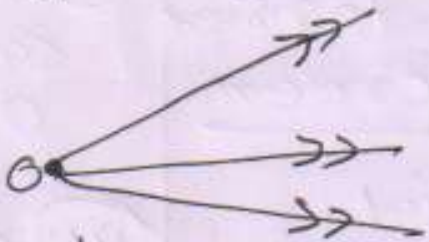
1. parallel beams — when the rays of light travel parallel to light travel parallel to each other then the collection of such rays is called parallel beams.



2. convergent beams — when the rays of light converge or meet at a point, after travelling are called convergent beams.



(iii) Divergent beams — when the rays of light diverge (deviates in all direction) from a point, are called divergent beams.



Q- what is optical image?

Ans — when the rays of light after reflection of light from a mirror, actually meet at a point or appear to meet at a point then the image formed by these rays is called to be optical image.

Q- what are different between real image & virtual images

Ans - Following differentes between real & virtual image-

Real image	virtual image
(1) If the light rays coming from a point actually meet after reflection then the image formed is called a real image	(1) If the light rays coming from a point after reflection does not meet actually but appear to meet at another point

	the image formed is called a virtual image.
(ii) A real image can be formed on a screen.	(ii) A virtual image cannot be formed on a screen.
(iii) A real image is generally inverted	(iii) A virtual image is generally erect.
(iv) A real image formed on Cinema screen.	(iv) A virtual image can be seen only be looking into a mirror

Q- what is reflection of light?

Ans- The phenomenon of bouncing back of light ray in the same medium. after striking a smooth surface is called reflection of light.

SPHERICAL MIRROR

Q- what is spherical mirror & what are the types of spherical mirror? Define it?

Ans. – Spherical mirror are curved mirrors in which the surface of the mirror is a part of a big sphere, having its radius R, which is also known as Radius of curvature.

They are two types of spherical mirror-

(i) concave mirror – The spherical mirror with inward curved reflecting surface is called concave mirror. It is also called convergent mirror.

(ii) covex mirror – A spherical mirror with outward curved reflecting surface is called convex mirror. It is also called divergent mirror.

Q. Define the term of pole, principle axis, centre of curvature, Radius of curvature, Aperture.

Ans. pole :— The straight line passing through the pole and the centre of curvature of the mirror is called the principle axis. It is denoted by xy.

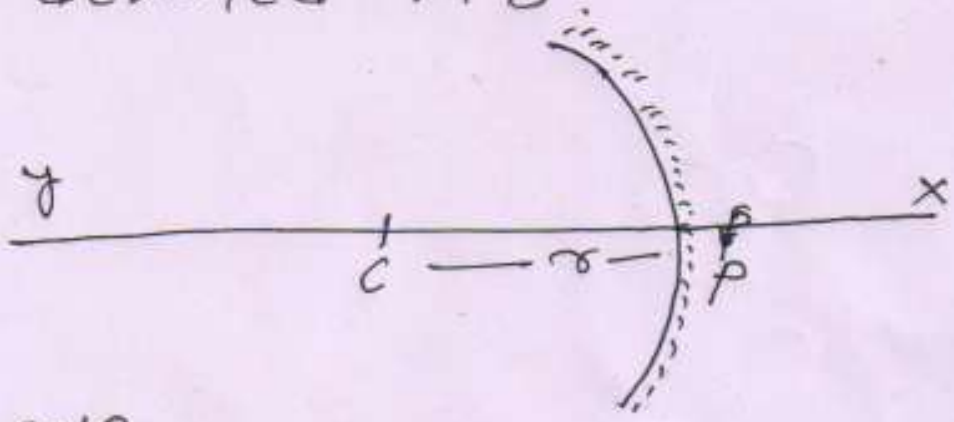
principle axis — The straight line passing through the pole and the centre of curvature of the mirror is called the principle axis. It is denoted by xy.

Centre of curvature — The centre of the sphere of the which the mirror is a part is called the centre of curvature. It is denoted by c.

Radius of curvature — The Radius of the sphere of which the mirror is a part ~~of~~ is called the radius of curvature. It is

denoted by R.

Aperture - A diametre extension of mirror is called a aperture. on the fig it is denoted A'B'.



P = pole

C = C.o.C

R = R.o.C

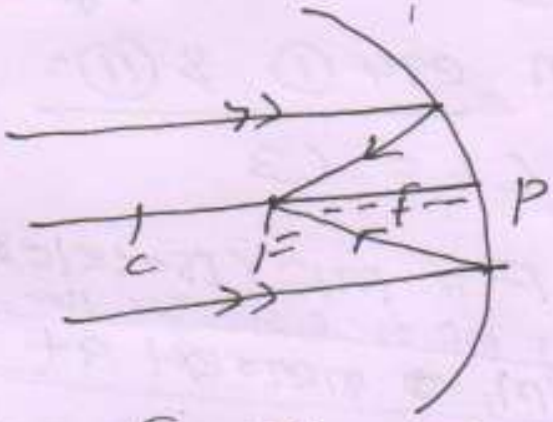
xy = principle axis

A'B' = Aperature.

Q- What are principle ~~axis~~ focus. (4)
and focal length

Ans- The point on the principle axis where ~~rays~~ incident rays parallel to the principle axis converge to or appear to diverge from after reflection is called the focus. It is denoted by F.

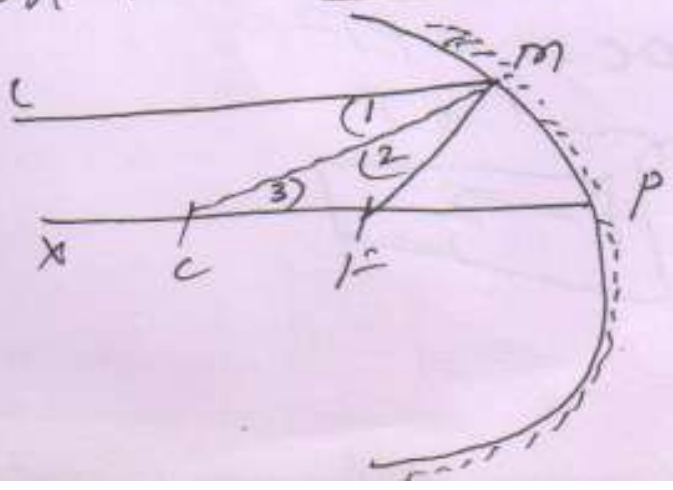
Focal length - The distance of the focus from the pole is called the focal length. It is denoted by f.



Q- Proove that - $f = \frac{r}{2}$ in the concave mirror

or.

relation between focal length and radius of curvature in concave mirror



Let, in fig AB is concave mirror. pole (P) focus (F), & centre of curvature is (C). parallel of principle axis. PX. the rays. reflected LM.

Angle of incident = Angle of reflection.

$\angle 1 = \angle 2$ —— (I)

LM || PX

$\angle 1 = \angle 3$ (alternative angles) —— (II)

from eqn (I) & (II)

$\angle 2 = \angle 3$

$CF = MF$ (Isoceles $\triangle$) —— (III)

Taking MF as a straight line, as it is part of a big sphere. of M, & nearest at P.

$PF = MF$ —— (IV)

from (I) and (IV)

$CF = PF$

$PC = PF + CF$

$PC = PF + PF$

$PC = 2PF$

$r = 2f$

$f = \frac{r}{2}$

Q- what is plane mirror? light characteristics of the image formed by plane mirrors

Ans- when the reflecting surface of a mirror is plane, then the mirror is called a plane mirror.

~~the~~ Image formed by a plane mirror has following properties :-

(i) Image produced is upright
(ii) Image is virtual.
(iii) Size of image & object is same.
(iv) Distance of the image and the object from the mirror is same.
(v) Image is laterally inverted

Q- what is ~~laterally~~ lateral inversion?

Ans- when an object is placed in a front of a plane mirror, then the right side of object appears to become the left side of a image and the left side of object appears to become the right side of image. This change of sides of an object and the mirror image is called Lateral inversion.

Q- what is the magnification of the images formed by plane mirror and why?

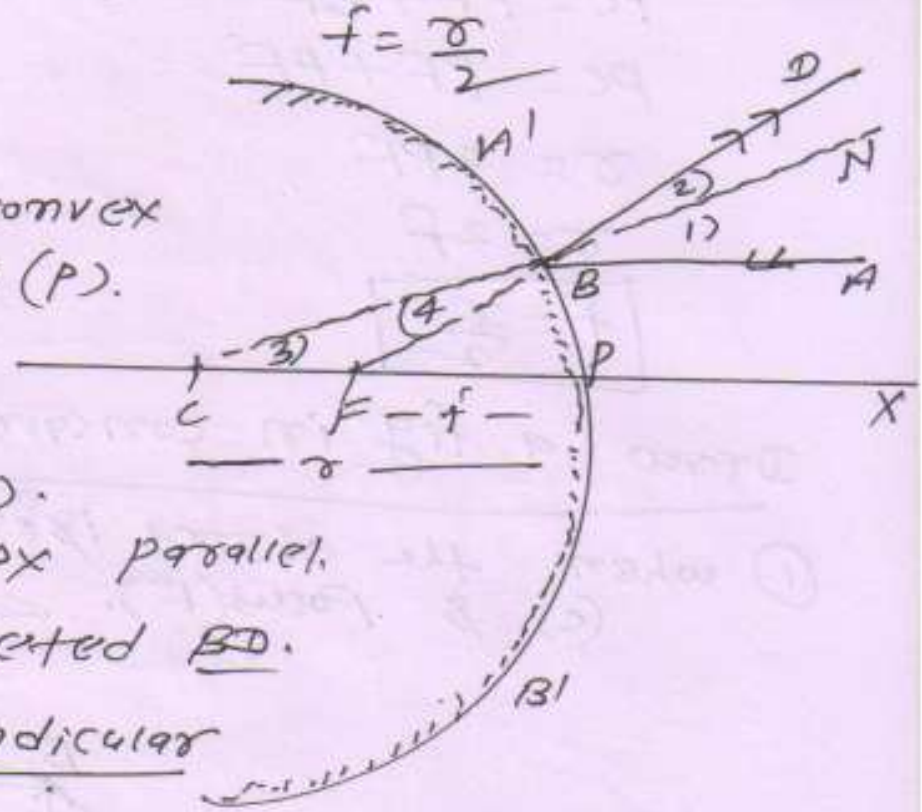
Ans. Its magnification is +1 because plane mirror always forms a laterally inverted image; of same height of object.

Distance of object = Distance of image

Q- The magnification for a plane mirror is +1. what does this mean.?

Ans- It means that the size of the image is equal to the size of the object. The positive sign indicates the image is virtual & erect.

Q- prove that in cat convex mirror. (6)



let, A'B' is a convex mirror. pole (P). focus (F). & centre of curvature (C). principle axis PX parallel. ray AB reflected BD. CH is perpendicular

incident angle = Reflected angle.

$\angle 1 = \angle 2$ —— (I)

$\angle 4 = \angle 2$ (vertical opposite angle) —— (II)

Equ (I) & Equ (II)

$\angle 1 = \angle 4$ —— (III)

AB || PX

$\angle 1 = \angle 3$ —— (IV)

Equ (III) & Equ (IV)

$\angle 3 = \angle 4$

$CF = BF$ —— (V)

If B is nearest at P.

$PF = BF$ —— (VI)

Equ (V) & Equ (VI)

$CF = PF$

$PC = PF + CF$

$PC = PF + PF$

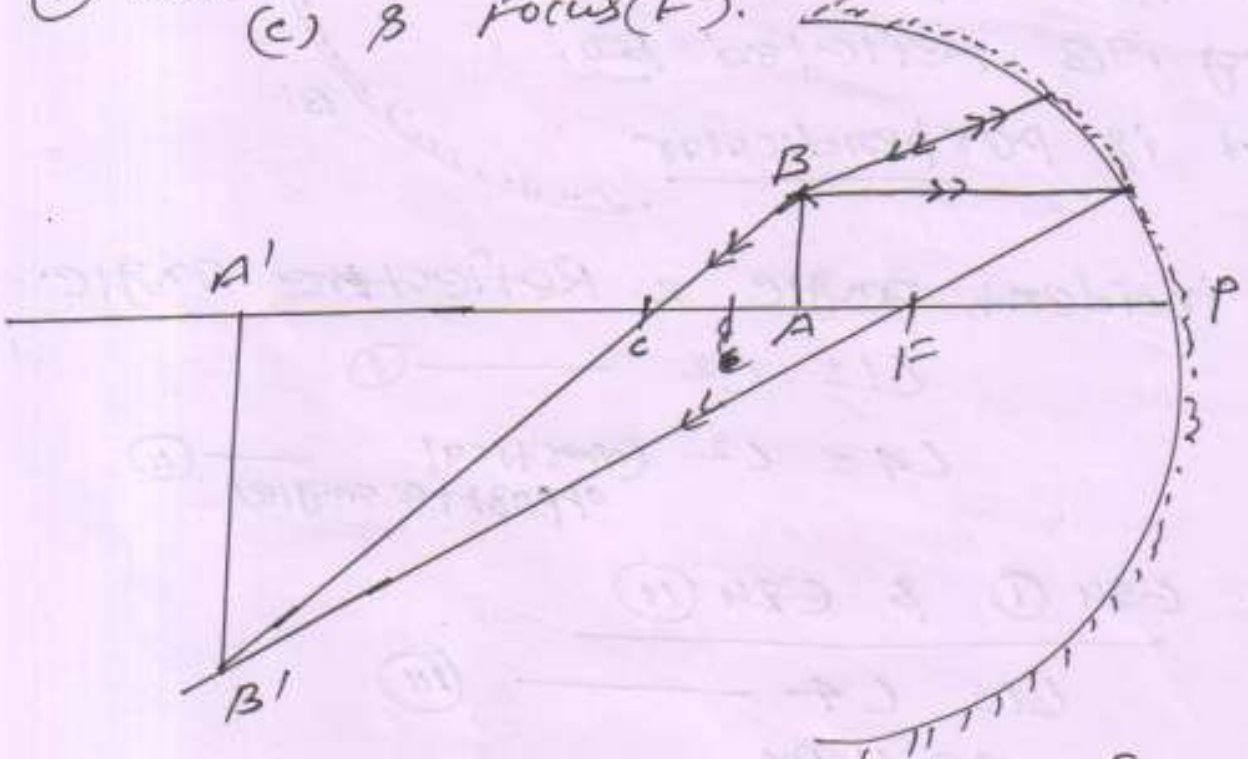
$r = 2PF$

$r = 2f$

$$\boxed{f = \frac{r}{2}}$$

Draw a fig in concave mirror

(1) when the object is between centre of curvature (c) & Focus (F).



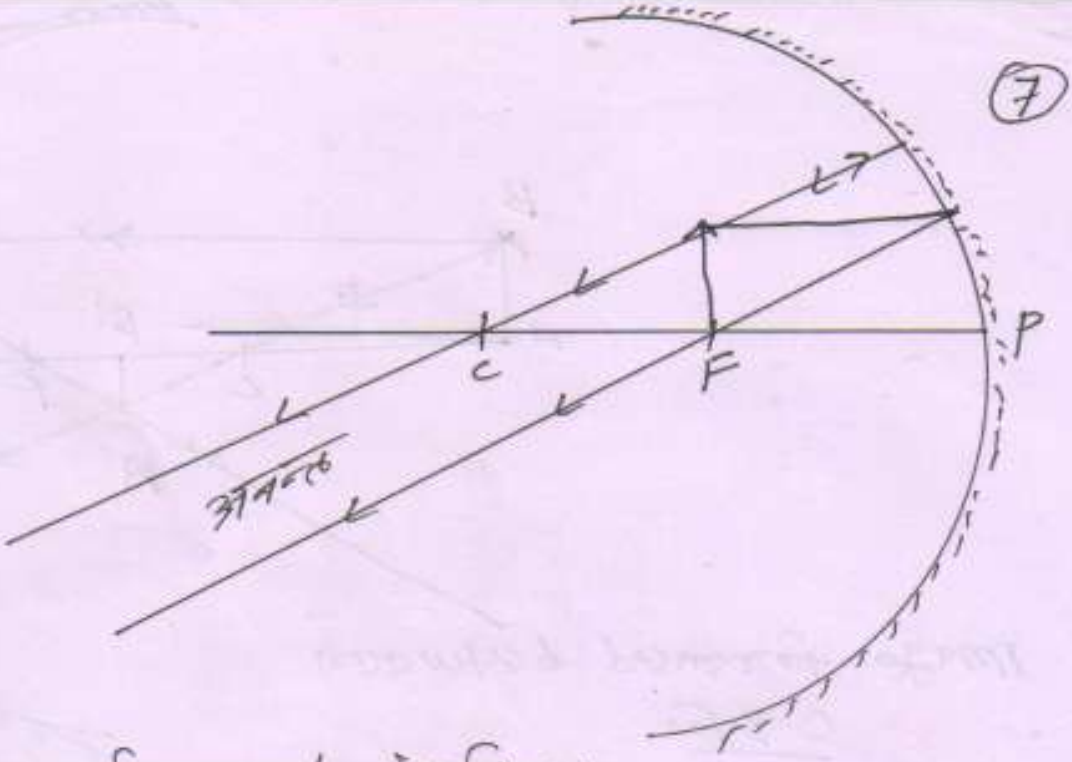
(a) object image formed c & infinity.

(b) It is image is real, enlarged & inverted

use - In flood light

(11) when the object is Focus (F)

(7)

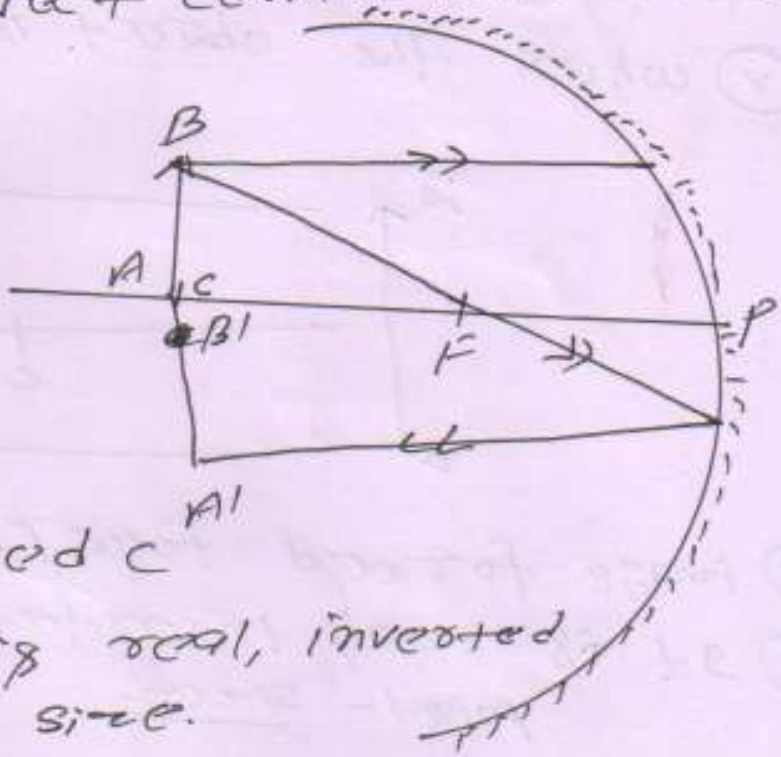


(a) image formed infinity.

(b) It image is real, inverted & large.

use- Torch, head light

(iii) when the object centre curvature (c)

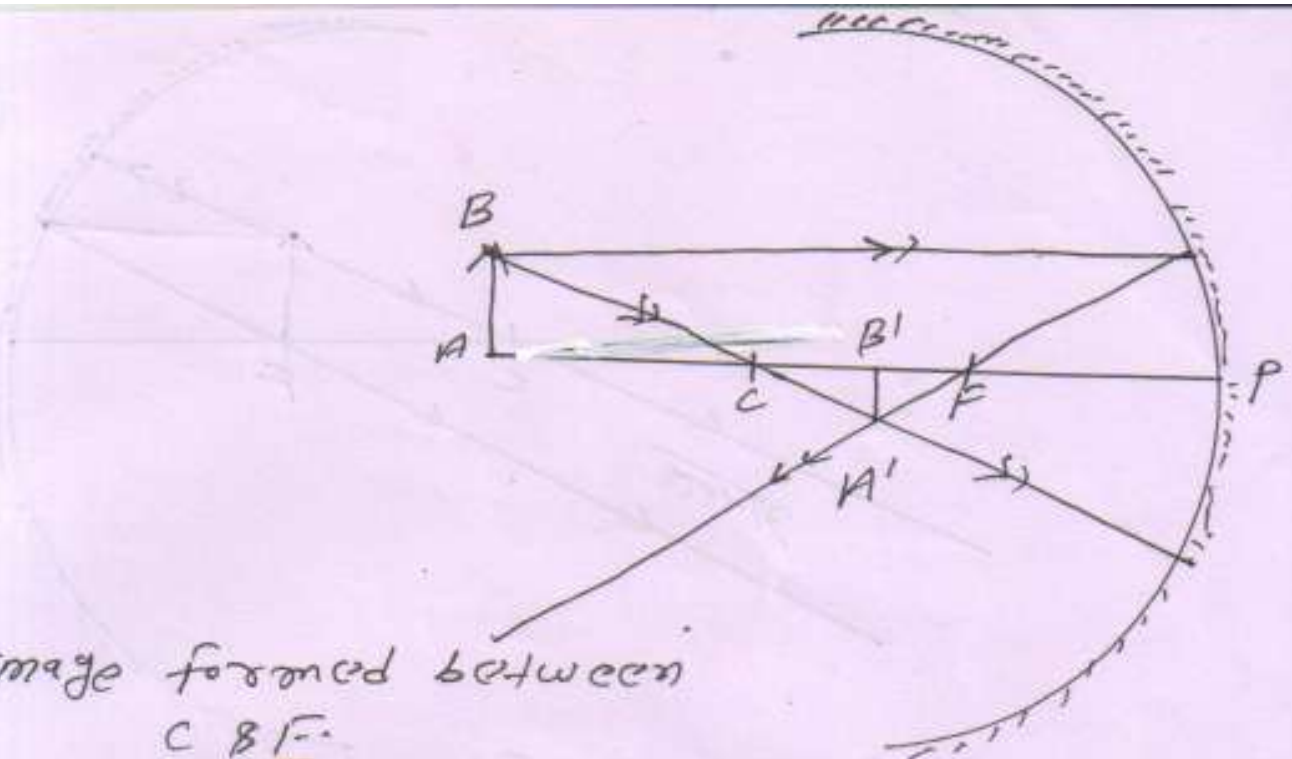


(a) image formed C

(b) It image is real, inverted & same size.

use- projector lamp.

(iv) when the object is infinity & centre of curvature C.

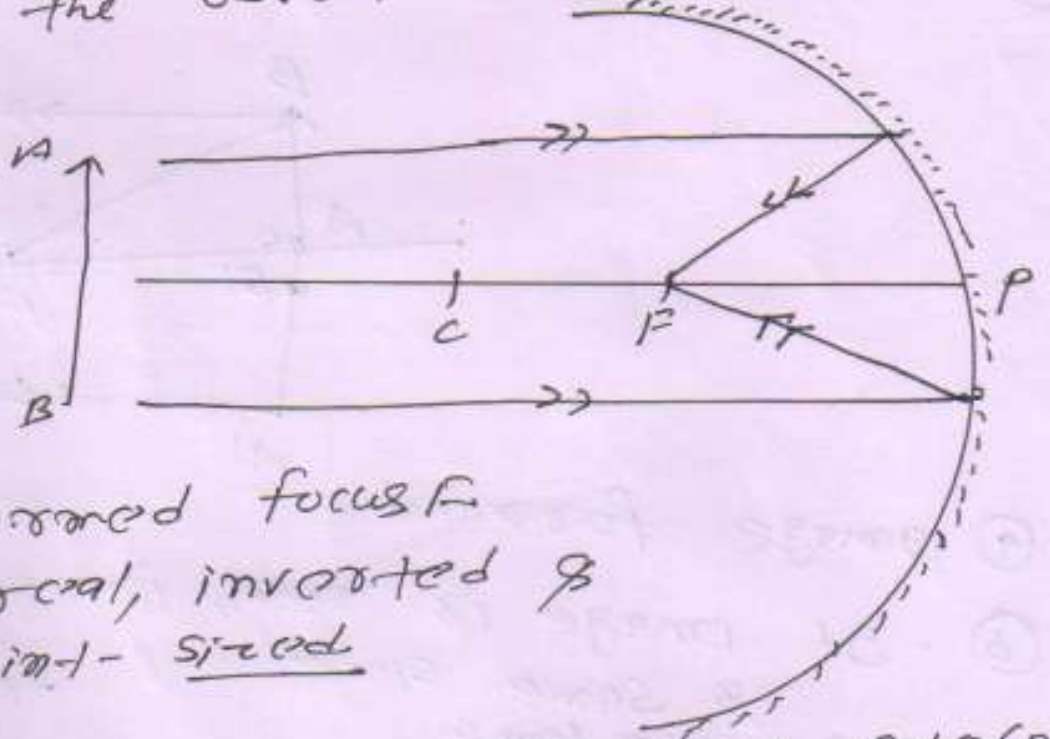


(a) Image formed between C & F.

(b) It is real, inverted & smaller than the object.

use- solar devices.

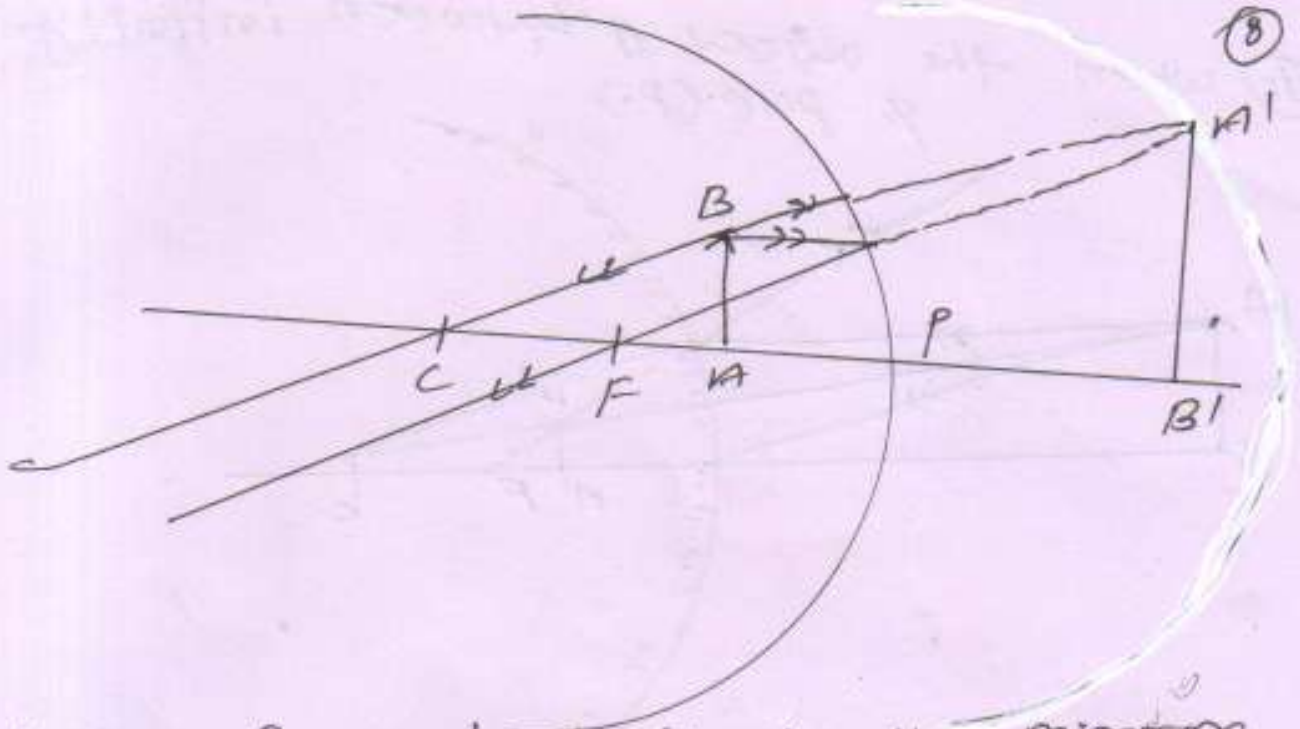
(v) when the object is infinity.



(a) image formed focus F.

(b) It is real, inverted & point-sized

(vi) when the object Focus(F) & pole(P)

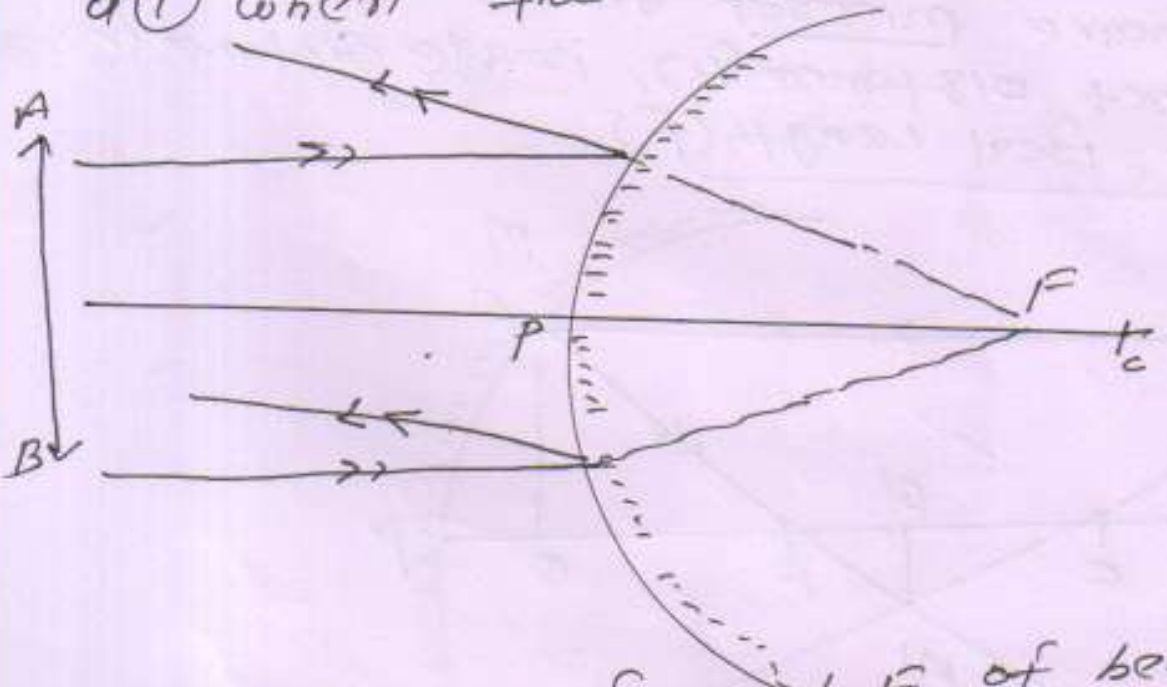


(a) image formed behind the mirror
(b) It image is virtual, erect & enlarged

use- shaving mirror

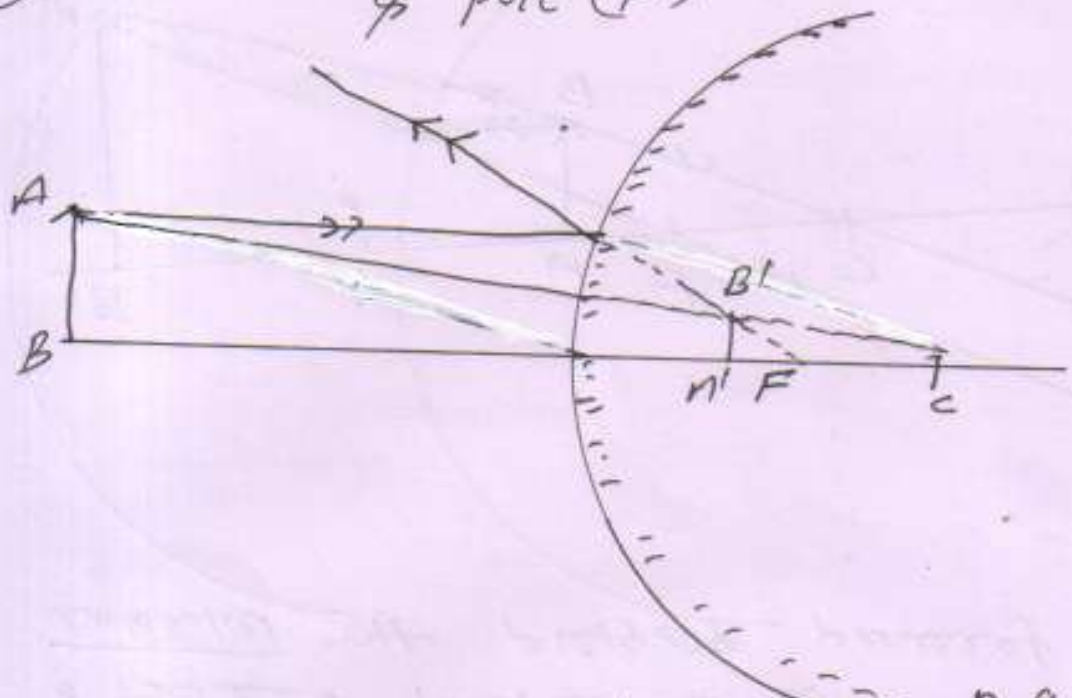
Draw a fig. image formed convex mirror

(a)(i) when the object is infinity



(a) image formed F of behind of mirror
(b) It is virtual, erect & Smallest

(ii) when the object is between infinity & pole (P.)



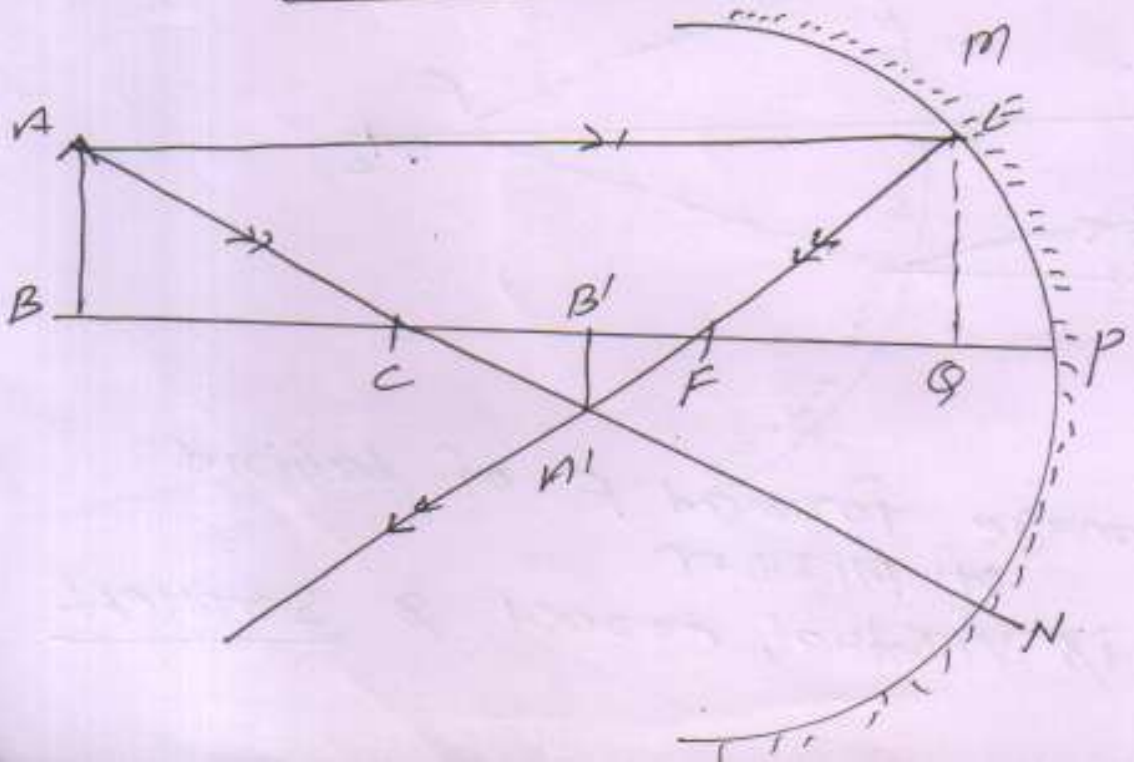
(a) image formed between P & F.

(b) it is virtual, erect & Small.

prove that in concave mirror $\frac{1}{v} + \frac{1}{u} = \frac{1}{f}$

or.

In concave mirror relation between object distance (u), image distance (v) & focal length (f)



Let in fig. MN is a concave mirror. Its pole is (P), Focus (F) & centre of curvature is (C). C to infinity distance object AB. Its image is formed, A'B'.

In $\triangle ABC$ & $A'B'C$.

$$\frac{AB}{A'B'} = \frac{AB}{A'B'} = \frac{BC}{B'C} \quad \text{——(1)}$$

Again in $\triangle CQF$ & $A'B'F$

$$\frac{CQ}{A'B'} = \frac{QF}{B'F}$$

Let C Nearest to P.

$$QF = PF, \quad CQ = AB$$

$$\frac{AB}{A'B'} = \frac{PF}{B'F} \quad \text{——(11)}$$

From sign convention

$PB = -u$
$PC = -r$
$PF = -f$
$B'P = -v$

In eqn (1) & (11)

$$\frac{BC}{B'C} = \frac{PF}{B'F}$$

$$\frac{PB - PC}{PC - B'P} = \frac{PF}{B'P - PF}$$

$$\frac{-u-(-r)}{-r-(-v)} = \frac{-f}{-v+f}$$

$$\frac{-u+r}{-r+v} = \frac{-f}{-v+f}$$

$$(-u+r) \times (-v+f) = (-r+v) \times (-f)$$

$uv - rv - uf + rf = rf - vf$

$uv - rv - uf = -vf$

$(r = 2f)$

$uv - 2vf - uf = -vf$

$uv - uf = -vf + 2vf$

$uv - uf = vf$

दोनों तरफ uvf से भाग देने पर

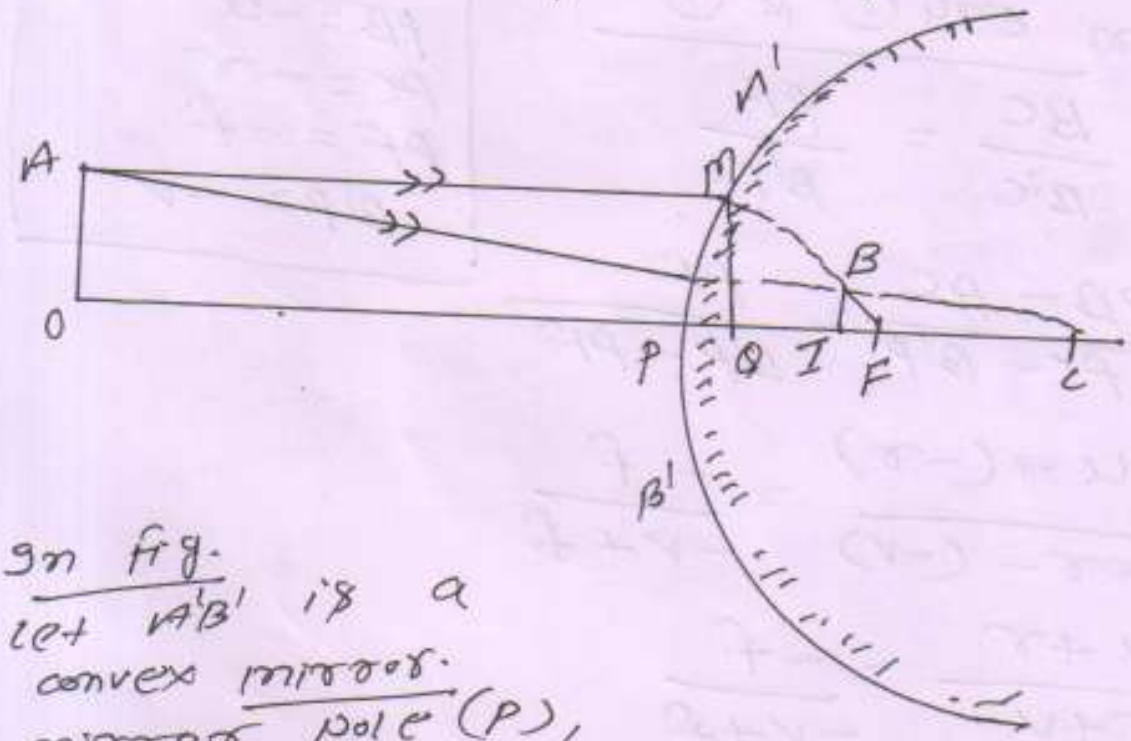
$$\frac{uv}{uvf} - \frac{uf}{uvf} = \frac{vf}{uvf}$$

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

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

prove that in convex mirror.

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



In fig. let $A'B'$ is a convex mirror. mirror pole (P), focus (F) & the centre of curvature (C)

In $\triangle OAC$ & $\triangle IBC$

$$\frac{OA}{IB} = \frac{OC}{IC} \quad \text{——— (I)}$$

Again $\triangle QMF$ & $\triangle IBC$.

$$\frac{QM}{IB} = \frac{QF}{IF}$$

$(QM = OA)$

If PF is small QF

$QF = PF$

$$\frac{OA}{IB} = \frac{PF}{IF} \quad \text{——— (II)}$$

From Equ (I) & Equ (II)

$$\frac{OC}{IC} = \frac{PF}{IF}$$

$$\frac{OP + PC}{PC - PI} = \frac{PF}{PF - PI}$$

$$\frac{-u + r}{r - v} = \frac{f}{f - v}$$

From sign convention

$OP = -u$
$PI = +v$
$PF = +f$
$PC = +r$

$$(-u + r)(f - v) = (r - v) \times f$$

$$-uf + rf + uv - rv = rf - vf$$

$$-uf + uv - rv = -vf$$

$(r = 2f)$

$$-uf + uv - 2fv = -vf$$

$$-uf + uv = -vf + 2vf$$

$$-uf + uv = vf$$

$$\frac{-uf}{uvf} + \frac{uv}{uvf} = \frac{vf}{uvf}$$