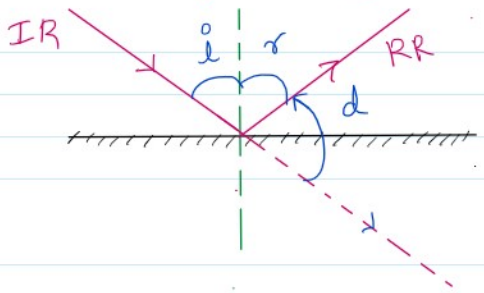
Reflection

Thursday, April 16, 2020 7:57 AM

Reflection

Reflection : Bouncing back of light is called Reflection.



i : angle of incidence
r : angle of reflection
d : angle of deviation.

∴ $d = 180 - (i + r)$

$d = 180 - 2i$

Laws of reflection

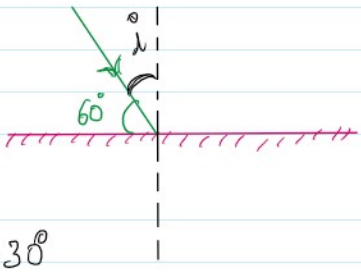
* The IR, RR and the normal drawn at the point of incidence lie on the same plane

* Angle of incidence = Angle of reflection

$\angle i = \angle r$

NOTE : This laws of reflection holds good for any reflecting surface.

Sample problem



find angle of reflection & deviation.

$i = 30°$

∴ $\angle r = 30°$

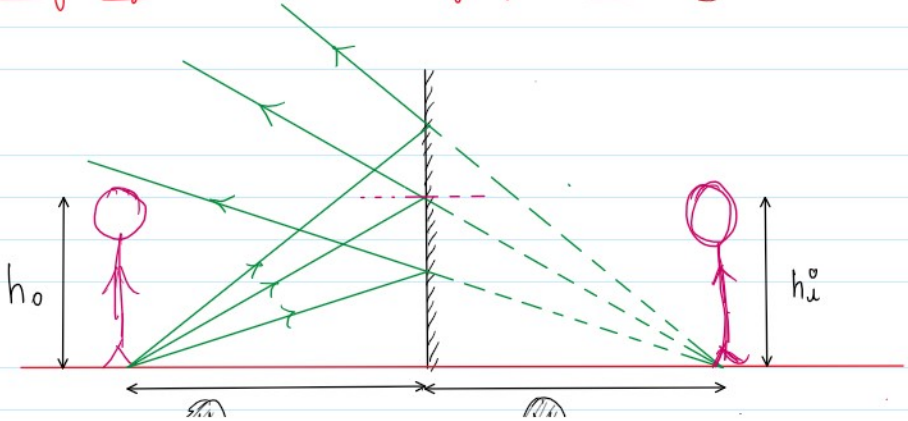
$d = 180 - 2i$

$= 180 - 2 \times 30$

$= 180 - 60$

$d = 120°$

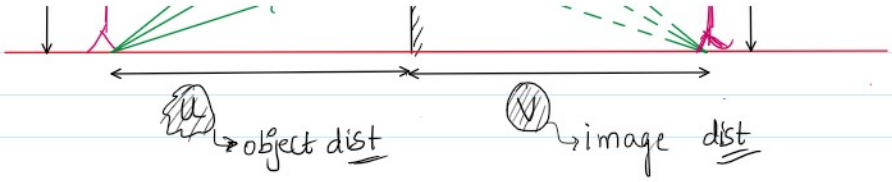
Image formation in case of plane mirror



* virtual image cannot be obtained on the screen.

* if the image is formed because of diverging rays then that image is virtual.

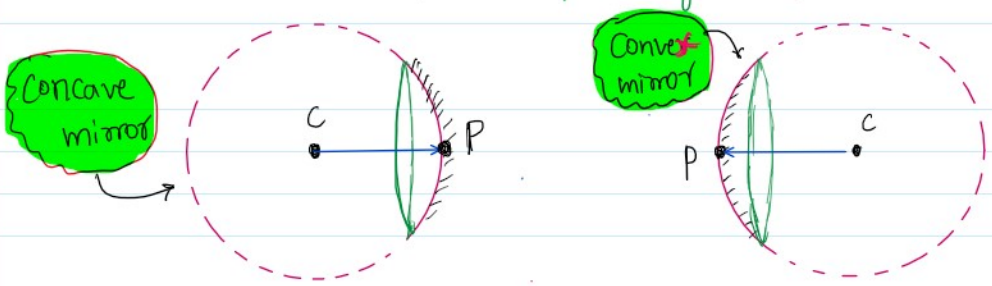
* Nature of image is
  - → virtual
  - → Erect
  - → Same size.
  - → $h_o = h_i$
  - → $u = v$



→ u = v

Spherical mirror

It is a part of a sphere.



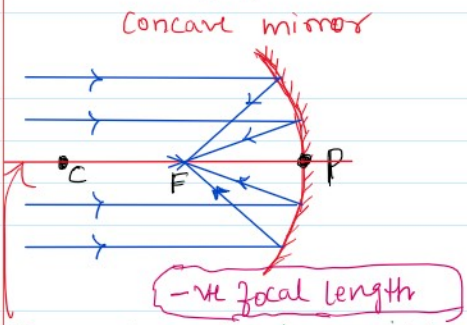
Centre of curvature: It is a centre of a sphere of which the mirror is a part.

Pole: Centre of mirror

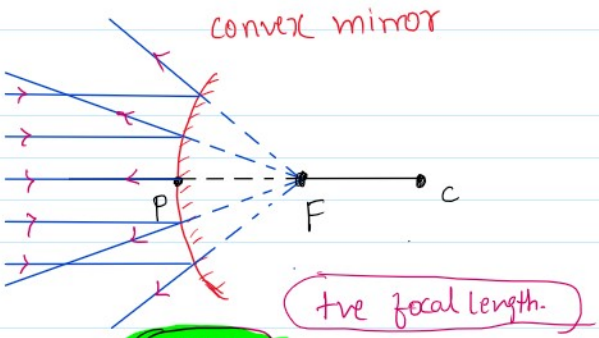
CP : R (Radius of curvature)

Principal focus

It is the point on the principal axis about which the incident rays parallel to principal axis after reflection appears to be converging or diverging.



Principal axis : line joing C to P



NOTE

* PF : focal length (f)
* R = 2f

PC = 2PF

R = 2f

Cartesian Sign Convention

* All measurements must be made from pole
* Any measurement made in the direction of incident ray is taken +ve & in the opposite direction of incident ray is taken -ve.
* Any measurement made above the principal axis is +ve & any measurement made below the principal axis is -ve.

Sample problem

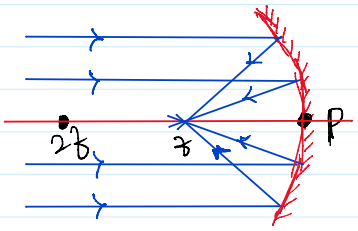
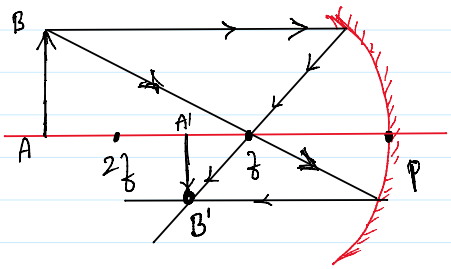
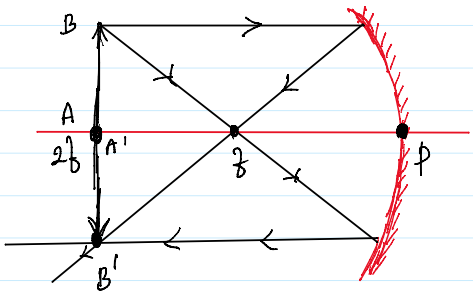
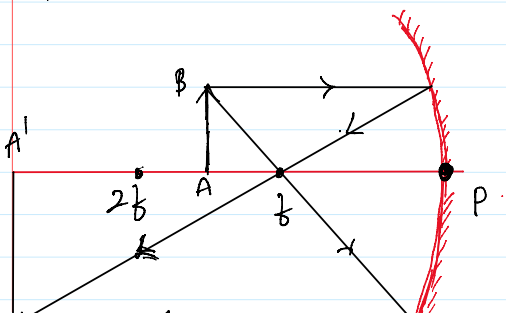
① A concave mirror has radius of curvature of 10m. If the object is ∞ find at what distance from the pole the image will be formed.

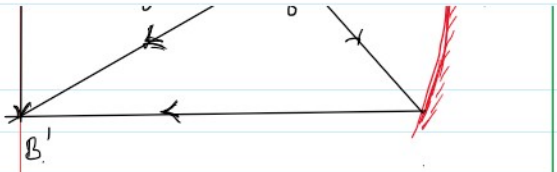
Solution

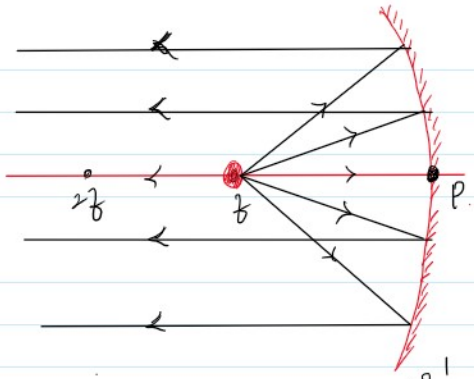
$$f = R/2$$

$$f = 10/2 = 5\,m$$

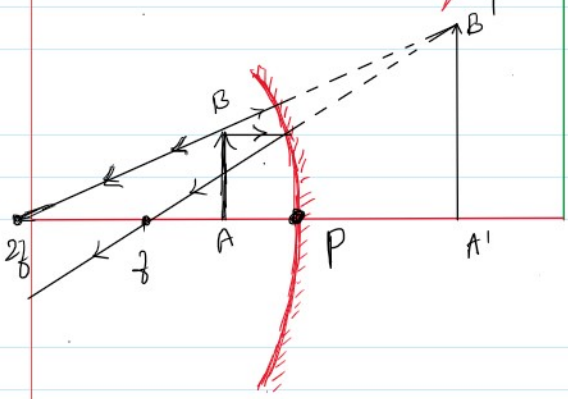
Image formation in case of concave mirror

Ray diagram	object dist	Image dist	Nature of image
	$u = \infty$	$v = f$	Real & point sized image.
 AB: object A'B': image	$\infty > u > 2f$	$2f > v > f$	Real Inverted & diminished.
	$u = 2f$	$v = 2f$	Real Inverted & same size.
	$2f > u > f$	$v > 2f$	Real Inverted & magnified.





$u = f$ | $v = \infty$ | highly magnified.



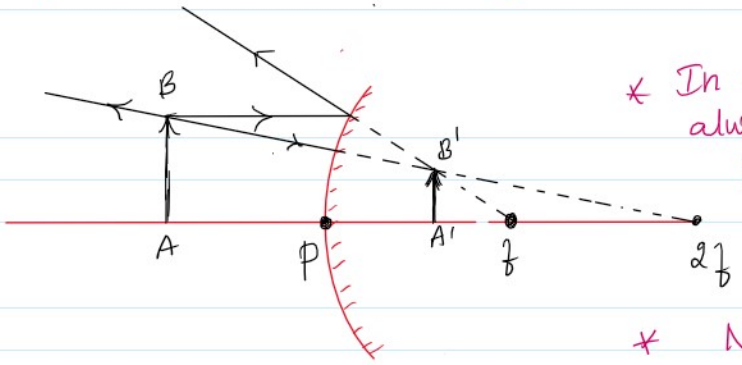
$u < f$ | Behind the mirror | virtual Erect & magnified.

NOTE : Under 2 situation a concave mirror produces magnified image

(a) $2f > u > f$: Real inverted magnified

(b) $u < f$: virtual Erect magnified.

Image formation in case of convex mirror



* In case of convex mirror, the image is always formed b/w pole & focus irrespective of position of object.

* Nature of the image is
  - → virtual
  - → Erect
  - → diminished.

NOTE

Mirror formula

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

where f : focal length

u : object distance

v : image distance.

Magnification

$$m = \frac{\text{height of image}}{\text{height of object}} = \frac{h_i}{h_o}$$

$$m = \frac{h_i}{h_o} = -\frac{v}{u}$$