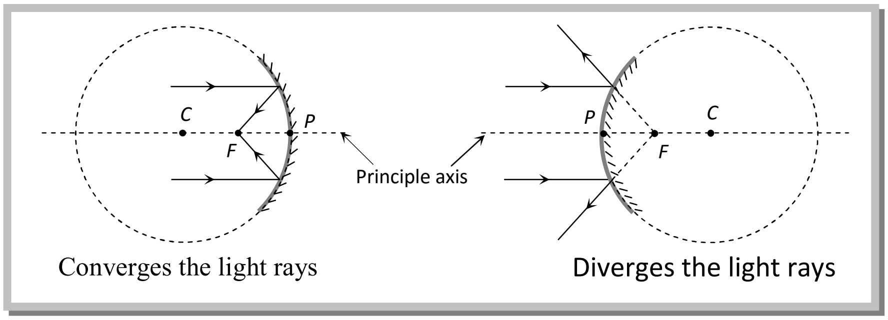
Curved Mirror.

It is a part of a transparent hollow sphere whose one surface is polished.



Some definitions:

(i) Pole (P): Mid-point of the mirror

(ii) Centre of curvature (C): Centre of the sphere of which the mirror is a part.

(iii) Radius of curvature (R): Distance between pole and center of curvature.

(Rconcave = –ve , Rconvex = +ve , Rplane =∞)

(iv) Principle axis : A line passing through P and C.

(v) Focus (F) : An image point on principle axis for which object is at ∞

(vi) Focal length (f) : Distance between P and F.

(vii) Relation between f and R: $f = \frac{R}{2}$ (fconcare = –ve , fconvex = + ve , fplane = ∞)

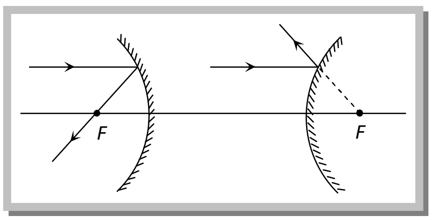
(viii) Power : The converging or diverging ability of mirror

(ix) Aperture : Effective diameter of light reflecting area. Intensity of image ∝ Area ∝ (Aperture) 2

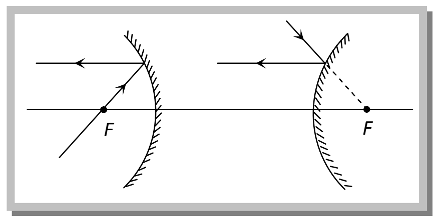
(x) Focal plane : A plane passing from focus and perpendicular to principle axis.

(2) Rules of image formation and sign convention:

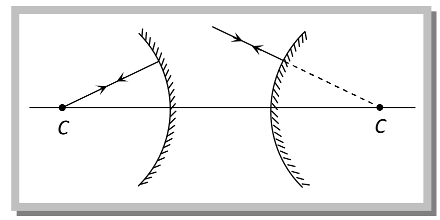
Rule (i)



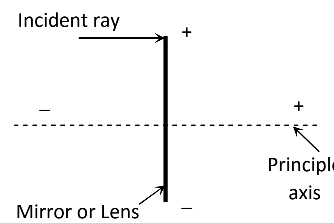
Rule (ii)



Rule (iii)



(3) Sign conventions:



(i) All distances are measured from the pole.

(ii) Distances measured in the direction of incident rays are taken as positive while in the direction opposite of incident rays are taken negative.

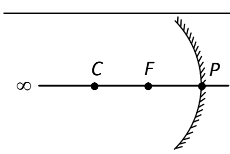
(iii) Distances above the principle axis are taken positive and below the principle axis are taken negative.

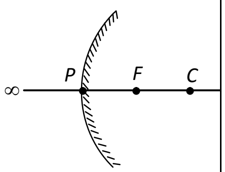
Note: Same sign convention are also valid for lenses.

Use following sign while solving the problem:

Concave mirror		Convex mirror
Real image (u ≥ f)	Virtual image (u< f)	
Distance of object u → −	u → −	u → −
Distance of image v → −	v → +	v → +
Focal length f → −	f → −	f → +
Height of object O → +	O → +	O → +
Height of image I → −	I → +	I → +
Radius of curvature R → −	R → −	R → +
Magnification m → −	m → +	m → +

(4) Position, size and nature of image formed by the spherical mirror

Mirror	Location of the object	Location of the image	Magnification, Size of the image	Nature	
				Real / virtual	Erect / inverted
(a) Concave	At infinity i.e. u = ∞	At focus i.e. v = f	m << 1, diminished	Real	inverted
	Away from center of curvature (u > 2f)	Between f and 2f i.e. f < v < 2f	m < 1, diminished	Real	inverted
	At center of curvature u = 2f	At center of curvature i.e. v = 2f	m = 1, same size as that of the object	Real	inverted
	Between center of curvature and focus :	Away from the center of curvature	m > 1, magnified	Real	inverted

	F < u < 2f	v > 2f			
	At focus i.e. u = f	At infinity i.e. v = ∞	m = ∞, magnified	Real	inverted
	Between pole and focus u < f	v > u	m > 1 magnified	Virtual	erect
(b) Convex	At infinity i.e. u = ∞	At focus i.e., v = f	m < 1, diminished	Virtual	erect
	Anywhere between infinity and pole	Between pole and focus	m < 1, diminished	Virtual	erect

Note: In case of convex mirrors, as the object moves away from the mirror, the image becomes smaller and moves closer to the focus.

Images formed by mirrors do not show chromatic aberration.

For convex mirror maximum image distance is its focal length.

In concave mirror, minimum distance between a real object and its real image is zero.
(i.e. when u = v = 2f)