# PHYSICS

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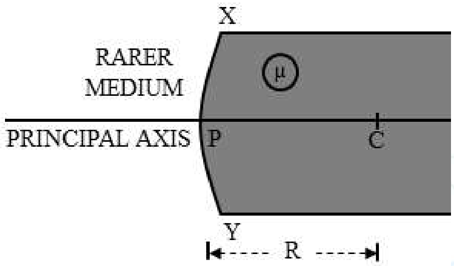
## 01. Spherical Refracting Surface

*The portion of a refracting medium, whose curved surface forms the part of a sphere, is called spherical refracting surface.*

Spherical refracting surfaces are of two types :

(i) **Convex spherical refracting surface :-** Convex towards the rarer medium




(ii) **Concave spherical refracting surface :-** Concave towards the rarer medium.

Terms related to the refraction from spherical refracting surfaces :

*(a)* **Pole –** *Centre of the spherical refracting surface*

(b) **Centre of curvature –** *Centre of the sphere of which the curved surface forms a part*

(c) **Radius of curvature –** *Radius of the sphere of which the curved surface forms a part*

(d) **Aperture –** *Diameter of the spherical refracting surface*

(e) **Principal axis –** *Line passing through the pole and the centre of curvature of the spherical refracting surface*

## 02. Refraction at Convex Spherical Surface

(i) **When object lies in the rarer medium and image formed is real**

$$\frac{\mu_1}{-u}+\frac{\mu_2}{+v}=\frac{\mu_2-\mu_1}{+R}$$

$$-\frac{\mu_1}{u}+\frac{\mu_2}{v}=\frac{\mu_2-\mu_1}{R}$$

where $\mu_1$ is refractive index of rarer medium and $\mu_2$ for denser medium

(ii) **When object lies in the rarer medium and image formed is virtual**

$$-\frac{1}{u}+\frac{\mu}{v}=\frac{\mu-1}{R}$$

(iii) **When object lies in denser medium**

$$\frac{\mu_2}{-u}-\frac{\mu_1}{-v}=\frac{\mu_2-\mu_1}{-R}$$

$$-\frac{\mu_2}{u}+\frac{\mu_1}{v}=\frac{\mu_1-\mu_2}{R}$$

where $\mu_1$ is refractive index of rarer medium and $\mu_2$ for denser medium

## 03. Refraction at Concave Spherical Surface

$$-\frac{\mu_1}{-u}+\frac{\mu_2}{-v}=\frac{\mu_2-\mu_1}{-R}$$

$$-\frac{\mu_1}{u}+\frac{\mu_2}{v}=\frac{\mu_2-\mu_1}{R}$$

or

$$-\frac{1}{u}+\frac{\mu}{v}=\frac{\mu-1}{R}$$

where $\mu_1$ is reflective index of rarer medium and $\mu_2$ for denser medium

## 04. Lens Maker's Formula

This formula is used to manufacture a lens of a particular focal length from the glass of given refractive index

**Assumptions**

(i) The lens is thin

(ii) The aperture of the lens is small.

(iii) The object is a point object situated on the principal axis.

(iv) The incident and refracted rays make small angles with the principal axis.

$$\frac{1}{f}=(\mu-1)\left(\frac{1}{R_1}-\frac{1}{R_2}\right)$$

## 05. Gaussian Form of Lens Equation (From Lens Maker's Formula)

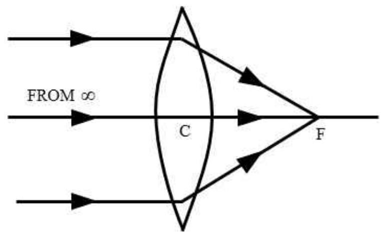
$$-\frac{1}{u}+\frac{1}{v}=(\mu-1)\left(\frac{1}{R_1}-\frac{1}{R_2}\right)$$

$$\frac{1}{f}=(\mu-1)\left(\frac{1}{R_1}-\frac{1}{R_2}\right)$$

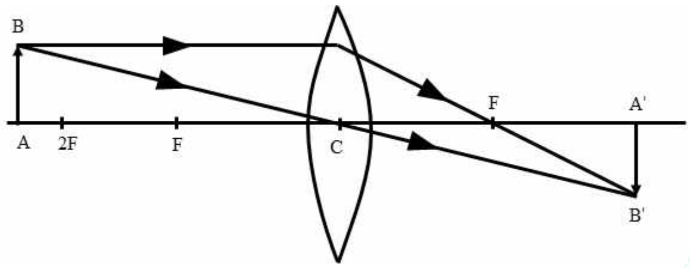
$$-\frac{1}{u}+\frac{1}{v}=\frac{1}{f}$$

## 06. Image Formed by a Convex Lens

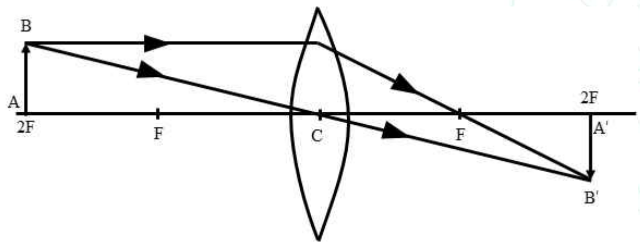
(i) **When object lies at infinity** :– *Image will be* ***real, inverted and point in size***.



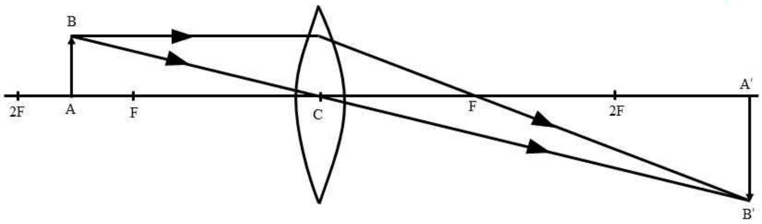
(ii) **When object lies beyond 2 F** :– Image will be formed ***between F and 2 F*** and will be ***real, inverted and smaller in size.***



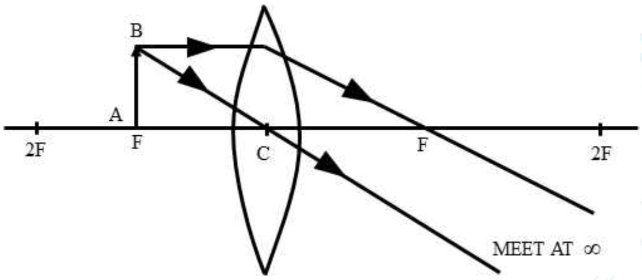

(iii) **When object lies at 2 F** – Image will be formed ***at 2 F*** and will be ***real, inverted and equal in size***.



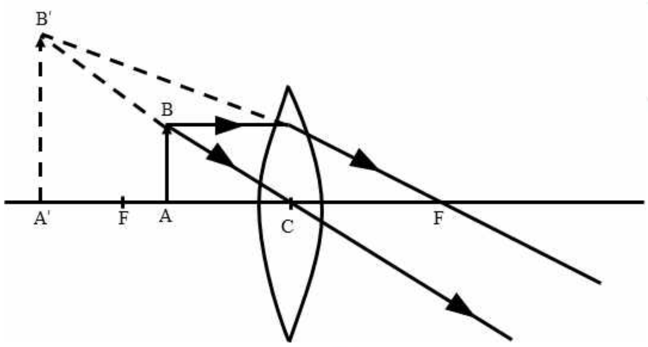

(iv) **When object lies between F and 2 F** – Image will be formed ***beyond 2 F*** and will be ***real, inverted and larger in size.***




(v) **When object lies at F** – Image will be formed ***at infinity*** and will be ***real, inverted and highly magnified.***

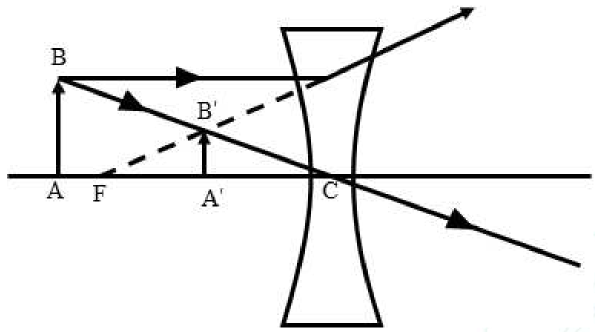



(vi) **When object lies between F and C** – Image will be formed beyond F on the same side of the lens. Further, the image will be ***virtual, erect and magnified.***



## 07. Image Formed by a Concave Lens

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




## 08. Power of Lens

*The ability of a lens, to converge or diverge the rays of light incident on it, is called the* ***power of the lens.***

$$P = \frac{1}{f(metre)}$$

$$F = \frac{1}{1m} = 1m^{-1} = 1\,\text{dioptre}(\text{D})$$

The power of a lens is said to be one dioptre, if its focal length is one metre.
The power of ***converging lens*** is ***positive*** and that of a ***diverging lens is negative.***