

Q- An object is placed 25 cm from a concave refracting surface. The surface has a radius of curvature of 5 cm, and the refractive index is 1.70. Determine the refracted image position and orientation.

The sign convention is

1. All distances are measured from the optical center of the lens or pole of the mirror or refracting surface.
2. The distances measured in the direction of the incident rays are taken positive and in the direction opposite to that of incident rays are taken negative.
3. The lengths (object or image) measured above the principle axis are taken positive and in lower half plane are negative.
4. The focal length of converging lens is positive.

When light is refracted from one medium of refractive index μ_1 to the another medium of refractive index μ_2 through a curved surface of radius of curvature R, the object distance u, image distance v and the radius of curvature are related as

$$\frac{\mu_2}{v} - \frac{\mu_1}{u} = \left(\frac{\mu_2 - \mu_1}{R} \right)$$

Here object distance	$u = -25 \text{ cm}$
Radius of curvature	$R = -5 \text{ cm}$
Refractive index fro first medium	$\mu_1 = 1$
Refractive index for second medium	$\mu_2 = 1.70$

Hence substituting in above equation we have

$$\frac{1.70}{v} - \frac{1}{-25} = \left(\frac{1.7 - 1}{-5} \right)$$

Or $\frac{1.70}{v} = -\frac{1}{25} - \frac{7}{50}$

Or $\frac{1.70}{v} = -\frac{9}{50}$

Gives $v = -\frac{1.70 * 50}{9} = -9.44 \text{ cm}$

Hence the image of the object will be in front (object side) of the curved surface at a distance of 9.44 cm.

Magnification of the image is given by

$$M = v/u = -9.44/(-25) = 0.38$$

The image is diminished and as the sign of the magnification is positive, the image is erect and virtual.

