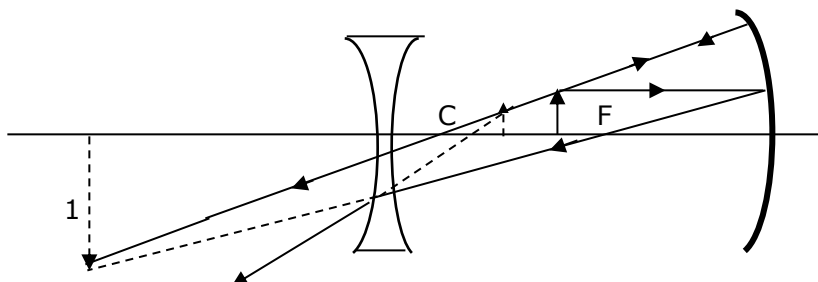


Q- An object is midway between the biconcave lens (with focal length 15 cm) and the concave mirror (with radius of curvature 20 cm). The mirror-lens distance is 25 cm . Considering only the light that leaves the object and travels first toward the mirror, locate the final image formed by this system. Is this image real or virtual? Is it upright or inverted? What is the overall magnification?



The image 1 formed by the mirror will behave as a virtual object for the lens.

Using the sign convention, the distances from the pole of a mirror or optical center of a lens in the direction of incident rays are positive, for the reflection at mirror

Object distance $u = -12.5\text{ cm}$, $f = R/2 = -10\text{ cm}$ the image distance is given by the mirror formula

$$\frac{1}{f} = \frac{1}{u} + \frac{1}{v} \quad \text{or} \quad \frac{1}{f} - \frac{1}{u} = \frac{1}{v} \quad \text{or} \quad \frac{1}{-10} - \frac{1}{-12.5} = \frac{1}{v}$$

gives $v = -50\text{ cm}$

means that the image is on the same side of the object at a distance of 50 cm from the pole of the mirror.

Now this image will behave as an virtual object for the lens and hence as the direction of the rays incident on the lens is reversed, for the lens we have

$u = (50 - 25) = 25\text{ cm}$ (for virtual objects object distance may be positive), $f = -15\text{ cm}$, using lens formula

$$\frac{1}{f} = \frac{1}{v} - \frac{1}{u} \quad \text{or} \quad \frac{1}{f} + \frac{1}{u} = \frac{1}{v} \quad \text{or} \quad \frac{1}{-15} + \frac{1}{25} = \frac{1}{v}$$

gives $v = -11.5\text{ cm}$

Negative sign shows that the image is between the lens and the mirror and at v distance from the lens.