

A convex lens (of focal length 20 cm) and a concave mirror, having their principal axes along the same lines, are kept 80cm apart from each other. The concave mirror is to the right of the convex lens. When an object is kept at a distance of 30cm to the left of the convex lens, its image remains at the same position even if the concave mirror is removed. The maximum distance of the object for which this concave mirror, by itself would produce a virtual image would be :-

A 20cm

B 10cm

C 25cm

D 30cm

Solution

Correct option is

B)

Image formed by lens

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

$$\frac{1}{v} + \frac{1}{30} = \frac{1}{20}$$

$$v = +60 \text{ cm}$$

If image position does not change even when mirror is removed it means image formed by lens is formed at centre of curvature of spherical mirror.

Radius of curvature of mirror = $80 - 60 = 20\text{cm}$

\Rightarrow focal length of mirror $f = 10\text{cm}$ for virtual image, object is to be kept between focus and pole.

\Rightarrow maximum distance of object from spherical mirror for which virtual image is formed, is 10cm .