Answer on Question #42273-Physics-Optics
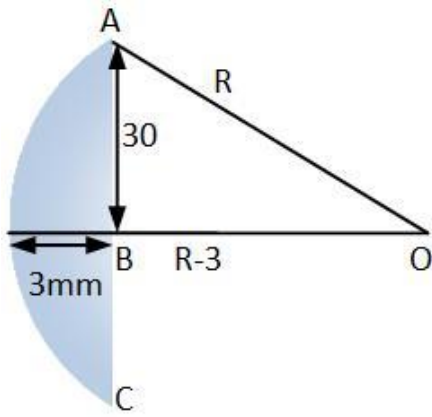
Diameter of a plane–convex lens is 6 cm. and its thickness at the center is 3 mm. What is the focal length of the lens? If the speed of light in the material of lens is 2 × 108 m/s :-

(1) 30 cm (2) 20 cm (3) 10 cm (4) 40 cm

Solution

$$v = 2 \cdot 10^8 \frac{m}{s}, c = 3 \cdot 10^8 \frac{m}{s}, \mu = \frac{c}{v} = 1.5, D = 6 \ cm = 60 \ mm, R = \frac{D}{2} = 30 \ mm.$$

Here we have to find the radius of the surface of the lens. O is the center of the circle. So AC is the chord of the circle. By Pythagoras's theorem

$$R^2 = 30^2 + (R - 3)^2 \rightarrow R^2 = 900 + R^2 - 6R + 9 \rightarrow R = 15 \ cm.$$

By lens makers formula for a plane–convex lens

$$\frac{1}{f} = (\mu - 1) \cdot \frac{1}{R} \rightarrow f = \frac{R}{(\mu - 1)} = \frac{15 \ cm}{1.5 - 1} = 30 \ cm.$$

Answer: 30 cm.