

Diameter of a plano – convex lens is 6 cm and thickness at the centre is 3 mm. If speed of light in material of lens is 2×10^8 m/s, the focal length of the lens is:

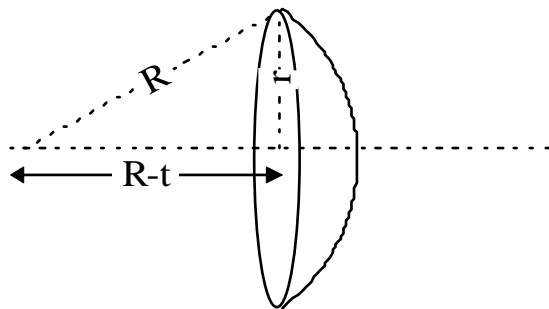
- (1) 15 cm (2) 20 cm (3) 30 cm (4) 10 cm

[JEE Main 2013]

Solution

$$r = \frac{\text{diameter}}{2} = 3\text{cm}$$

$$t = 3 \text{ mm} = 0.3 \text{ cm}$$



$$R^2 = r^2 + (R-t)^2$$

$$\Rightarrow R^2 = r^2 + R^2 + t^2 - 2Rt$$

$$\Rightarrow R = \frac{r^2 + t^2}{2t} \approx \frac{r^2}{2t} = \frac{9}{2 \times 0.3} = 15\text{cm}$$

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

$$\therefore \frac{1}{f} = \left(\frac{3 \times 10^8}{2 \times 10^8} - 1 \right) \left(\frac{1}{\infty} - \frac{1}{-15} \right)$$

$$\therefore \frac{1}{f} = 0.5 \left(\frac{1}{15} \right)$$

$$\therefore f = 30\text{cm}$$

Hence, (3).