

B.Sc Part-II

Q Two glasses have dispersive powers in the ratio of 2:3. These glasses to be used in manufacture of an achromatic objective of focal length 20cm. What are the focal length of the lenses.

A

$$F = 20\text{cm}$$

$$f_1 = ?$$

$$f_2 = ?$$

$$\frac{\omega_1}{\omega_2} = \frac{2}{3}$$

For achromatism

$$\frac{\omega_1}{f_1} + \frac{\omega_2}{f_2} = 0$$

$$\frac{\omega_1}{f_1} = -\frac{\omega_2}{f_2}$$

$$\frac{1}{f_1} = -\frac{\omega_2}{\omega_1} \times \frac{1}{f_2}$$

$$\frac{1}{f_1} = -\frac{3}{2} \times \frac{1}{f_2} \quad \text{--- (i)}$$

$$\frac{1}{F} = \frac{1}{f_1} + \frac{1}{f_2}$$

$$\frac{1}{F} = \frac{-3}{2f_2} + \frac{1}{f_2}$$

$$\frac{1}{20} = \frac{1}{f_2} \left(\frac{-3}{2} + 1 \right)$$

$$\frac{1}{20} = \frac{1}{f_2} \left(-\frac{1}{2} \right)$$

$$f_2 = -10\text{cm}$$

$$\frac{1}{f_1} = \frac{-3}{2} \times \frac{1}{f_2}$$

$$\frac{1}{f_1} = -\frac{3}{9} \times \frac{1}{-10}$$

$$\frac{1}{f_1} = \frac{3}{20}$$

$$f_1 = \frac{20}{3} = 6.67 \text{ cm}$$