

Question

A prism of refractive index $\sqrt{2}$ has refracting angle 60° . In order that a ray suffers minimum deviation it should be incident at an angle:

A 45°

B 90°

C 30°

D none

Solution

Correct option is A)

Given: A prism of refractive index $\sqrt{2}$ has refracting angle 60° .

To find the angle of incidence in order that a ray suffers minimum deviation

Solution:

As per the given criteria,

refractive index of the prism, $\mu = \sqrt{2}$

Angle of the prism, $A = 60^\circ$

For minimum angle of deviation we have angle of incidence is equal to angle of emergence, i.e., $i = e$

Hence, $i = \frac{A + \delta_m}{2}$, where δ_m is the minimum deviation angle.

We know,

$$\mu = \frac{\sin\left(\frac{A + \delta_m}{2}\right)}{\sin\frac{A}{2}}$$

$$\Rightarrow \sqrt{2} = \frac{\sin i}{\sin\frac{60}{2}}$$

$$\Rightarrow \sin i = \sqrt{2} \times \sin(30)$$

$$\Rightarrow \sin i = \sqrt{2} \times \frac{1}{2}$$

Multiply and divide by $\sqrt{2}$, we get

$$\sin i = \frac{1}{\sqrt{2}}$$

$$\Rightarrow i = 45^\circ$$

In order that a ray suffers minimum deviation it should be incident at an angle 45°