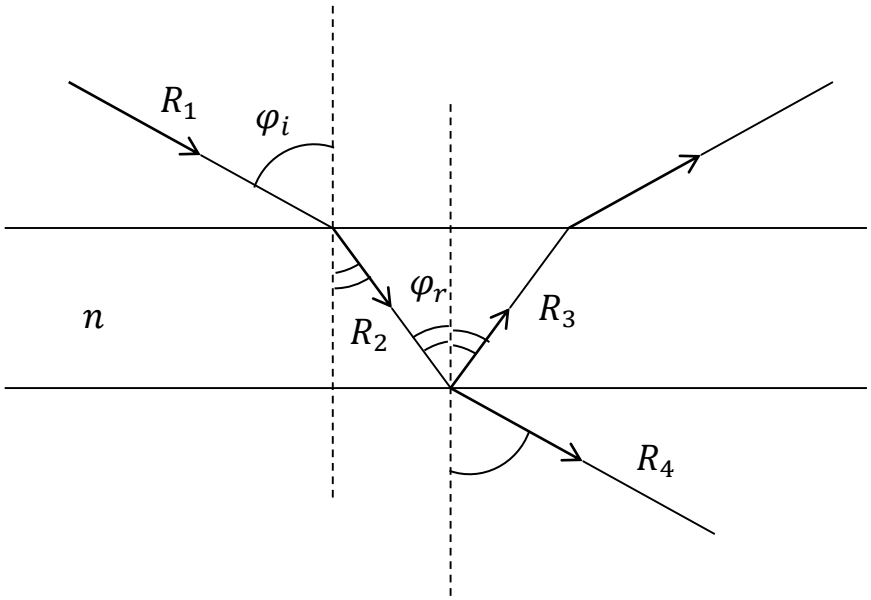
Answer on Question#52557 - Physics - Optics

A ray R_1 is incident of the plane surface of the glass slab (kept in air) of refractive index $\sqrt{2}$ at angle of incidence equal to the critical angle for this air glass system. The refractive ray R_2 undergoes partial reflection and refraction at the other surface. Find the angle between reflected ray R_3 and the refracted ray R_4 at the surface?

Solution:



Since angle of incidence φ_i is equal to the critical for this air glass system, we obtain

$$\sin\varphi_i = \frac{1}{n} = \frac{1}{\sqrt{2}} \quad => \quad \varphi_i = \frac{\pi}{4}$$

According to the law of refraction:

$$\sin\varphi_i = n \cdot \sin\varphi_r$$

Therefore,

$$\sin\varphi_r = \frac{\sin\varphi_i}{n} = \frac{1}{2} \quad => \quad \varphi_r = \frac{\pi}{6}$$

The angle θ between rays R_3 and R_4 is given by

$$\theta = \pi - (\varphi_i + \varphi_r) = \pi - \left(\frac{\pi}{4} + \frac{\pi}{6}\right) = \frac{7\pi}{12}$$

Answer: $\frac{7\pi}{12}$.