

Answer on Question 33267, Physics, Optics

Question:

A ray of light travels from air to glass. The incident ray makes an angle 45° while the refracted ray makes an angle of 30° with the normal to the interface. The speed of light in air is $3.0 \cdot 10^8 \text{ m/s}$. What is the speed of light in glass?

- a) $2.12 \cdot 10^8 \text{ m/s}$
- b) $4.24 \cdot 10^8 \text{ m/s}$
- c) $3.73 \cdot 10^8 \text{ m/s}$
- d) $3.0 \cdot 10^8 \text{ m/s}$

Solution:

From the Snell's law we have:

$$\frac{\sin\theta_1}{\sin\theta_2} = \frac{n_2}{n_1} = \frac{v_1}{v_2},$$

where, $\theta_1 = 45^\circ$ is the angle of incidence, $\theta_2 = 30^\circ$ is the angle of refraction, v_1 is the speed of light in air, v_2 is the speed of light in glass, n_1 is the refractive index of air, n_2 is the refractive index of glass.

Thus, we can find the speed of light in glass:

$$v_2 = v_1 \frac{\sin\theta_2}{\sin\theta_1} = 3.0 \cdot 10^8 \frac{\text{m}}{\text{s}} \cdot \frac{\sin 30^\circ}{\sin 45^\circ} = 3.0 \cdot 10^8 \frac{\text{m}}{\text{s}} \cdot \frac{0.5}{0.707} = 2.12 \cdot 10^8 \frac{\text{m}}{\text{s}}.$$

Answer:

- a) $2.12 \cdot 10^8 \frac{\text{m}}{\text{s}}$