



A Level Physics A

H556/02 Exploring physics

Question Set 15

1 A narrow beam of unpolarised light is incident at the boundary between air and glass.

Fig. 18 shows the incident ray, the reflected ray and the refracted ray at the air-glass boundary.

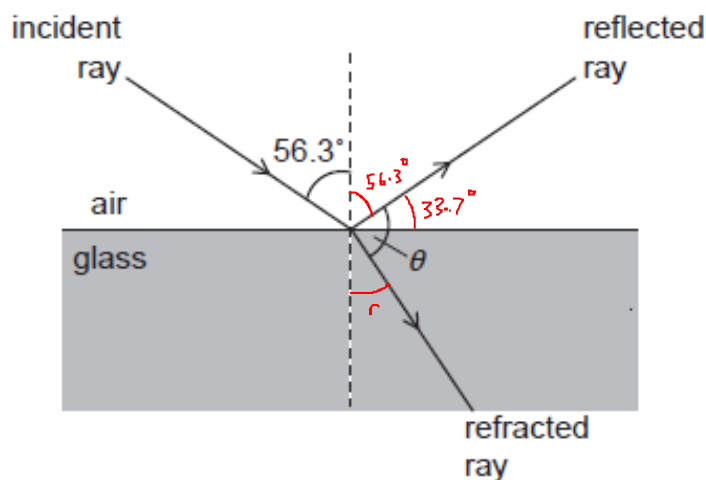


Fig. 18 (not to scale)

The refractive index of air is 1.00 and the refractive index of the glass is 1.50.
The angle of incidence of the light is 56.3° .

(a) Show that the angle θ between the refracted ray in the glass and the reflected ray in the air is 90.0° .

$$n_1 \sin i = n_2 \sin r \Rightarrow r = \arcsin\left(\frac{\sin 56.3}{1.5}\right) = 33.7^\circ$$

$$\theta = (90 - r) + 33.7^\circ = 90^\circ \quad [3]$$

(b) Describe how you can demonstrate in the laboratory that the reflected light is plane polarised.

Use a polaroid filter and show that rotation changes intensity [2]

(c) Calculate the time t taken for the refracted light to travel a **depth** of 6.0 cm of glass.

$$\text{Distance along ray} \Rightarrow \frac{6}{\cos 33.7} = 7.2 \text{ cm}$$

$$\text{Speed of ray} \Rightarrow \frac{3 \times 10^8}{1.5} = 2 \times 10^8$$

$$\text{Time} = \frac{\text{Distance}}{\text{Speed}} = \frac{7.2 \times 10^{-2}}{2 \times 10^8} = 3.6 \times 10^{-10}$$

$$t = \dots\dots\dots 3.6 \times 10^{-10} \text{ s} \quad [2]$$

Total Marks for Question Set 15: 7

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