A Level · OCR · Physics

22 mins 2 questions

Structured Questions

# Refraction & Reflection

Refraction / Total Internal Reflection / Wave Phenomena

| | |
|---|---|
| Medium (1 question) | /7 |
| Hard (1 question) | /15 |
| **Total Marks** | **/22** |

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# Medium Questions

**1 (a)** 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.

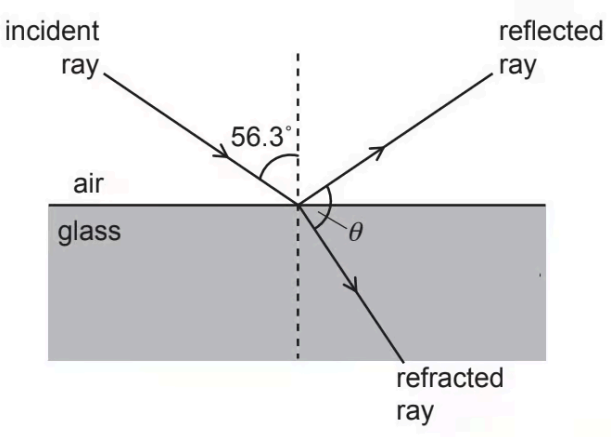


**Fig. 18 (not to scale)**

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°.

Show that the angle $\theta$ between the refracted ray in the glass and the reflected ray in the air is 90.0°.

.....

.....

.....

**(3 marks)**

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

.....

**(2 marks)**

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

*t* = ..... s

**(2 marks)**

# Hard Questions

**1 (a)** This question is about waves.

The **period** of a progressive wave can be determined from Fig. 16.1. Add a correct label to the horizontal axis so that the period can be found.

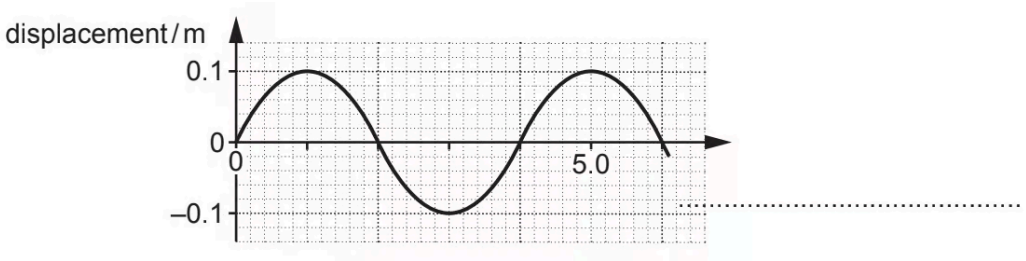


**Fig. 16.1**

.....

**(1 mark)**

**(b)** A progressive wave has wavelength $\lambda$, frequency $f$ and period $T$.

Show that the speed $v$ of the wave is given by the equation $v = f\lambda$.

.....

.....

**(2 marks)**

**(c)** A scientist is investigating the interference of light using very thin transparent material.

A sample of the transparent material is placed in a vacuum.

Fig. 16.2 shows the path of two identical rays of light **L** and **M** from a laser.

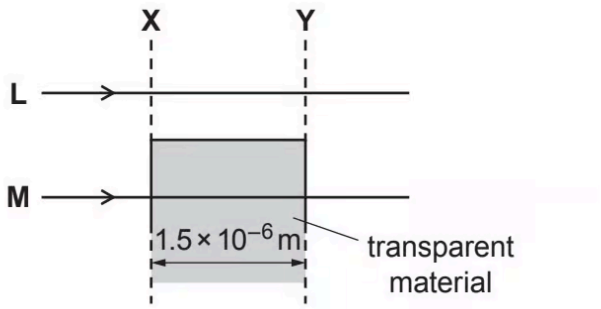


**Fig. 16.2**

The refractive index of the material is 1.20. The thickness of the material is $1.5 \times 10^{-6}$ m.

The wavelength of the light in vacuum is $6.0 \times 10^{-7}$ m.

i) Show that the difference in time *t* for the two rays to travel between the dashed lines **X** and **Y** is $1.0 \times 10^{-15}$ s.

*t* = ..... s **[3]**

ii) Calculate the period *T* of the light wave.

*T* = ..... s **[2]**

iii) The rays of light are in phase at the dashed line **X**.

Use your two answers above to state the phase difference $\varphi$ in degrees between the light rays at **Y**.

$\varphi$ = ..... ° **[1]**

**(6 marks)**

**(d)** The speed $v$ of surface water waves in shallow water of depth $d$ is given by the equation $v = \sqrt{gd}$, where $g$ is the acceleration of free fall.

The speed $v$ is about $1 ms^{-1}$ for a depth of about 10cm.

You are provided with a rectangular plastic tray, supply of water and other equipment available in the laboratory.

Describe how an experiment can be conducted in the laboratory to test the validity of the equation above and how the data can be analysed to determine a value for $g$.

**(6 marks)**