



Interactive Example Candidate Responses

Paper 4 (May / June 2016), Question 7

Cambridge IGCSE™
Physics 0625



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7 (a) Explain what is meant by

(i) total internal reflection,

All of the light is reflected inside the glass prism/block without any (continue below) [1]
refraction of light

(ii) critical angle.

The angle at which the refracted ray is perpendicular to the normal (continue below) [1]
parallel to the surface of the block

(b) Fig. 7.1 shows a ray of light, travelling in air, incident on a glass prism.

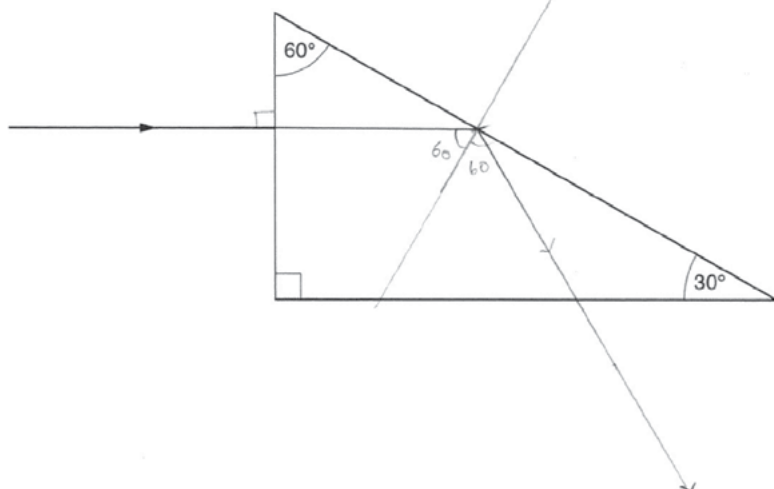


Fig. 7.1

(i) The speed of light in air is 3.0×10^8 m/s. Its speed in the glass is 2.0×10^8 m/s.

Calculate the refractive index of the glass.

$$\text{Refractive index} = \frac{\text{speed of light in air}}{\text{speed of light in object}}$$

$$= \frac{3 \times 10^8}{2 \times 10^8} = 1.5$$

refractive index = 1.5 [2]

Select
page

Your
Mark

7(a)(i)

7(a)(ii)

7(b)(i)

7(b)(ii)

7(b)(iii)

Q7 Mark scheme

(a)(i)	Reflection in a more dense material where there is no refracted ray owtte OR All light in a more dense material is reflected owtte
(a)(ii)	e.g. The greatest angle of incidence (in the material) at which refraction occurs OR The angle of incidence (in the material) at which the refracted ray travels along the boundary/angle of refraction is 90° OR The angle of incidence/(in the material) above which total internal reflection occurs
(b)(i)	(refractive index =) speed of light in air/speed of light in glass OR $3.0 \times 10^8 / 2.0 \times 10^8$ = 1.5
(b)(ii)	$\sin c = 1/n$ OR $1/1.5$ seen ($c = 42^\circ$)
(b)(iii)	No change of direction at first face Total internal reflection at hypotenuse with $i = r$ by eye Refraction with r greater than i at lower face

- (ii) Show that the critical angle for the glass-air boundary is 42° .

Refractive index = $\frac{\sin 90^\circ}{\sin c}$ $c = \sin^{-1}\left(\frac{1}{1.5}\right)$
 $1.5 = \frac{1}{\sin c}$ $\sin c = \frac{1}{1.5}$
 $\sin c = 0.667$ $c = 41.8^\circ$
 $c = 42^\circ$ [1]

- (iii) On Fig. 7.1, draw carefully, without calculation, the continuation of the ray through the prism and into the air. [3]

[Total: 8]

Select page

Your Mark

7(a)(i)

7(a)(ii)

7(b)(i)

7(b)(ii)

7(b)(iii)

Q7	Mark scheme
(a)(i)	Reflection in a more dense material where there is no refracted ray owtte OR All light in a more dense material is reflected owtte
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(b)(iii)	No change of direction at first face Total internal reflection at hypotenuse with $i = r$ by eye Refraction with r greater than i at lower face

7 (a) Explain what is meant by

(i) total internal reflection,

the angle of incidence more than critical angle
.....[1]

(ii) critical angle.

Refractive angle of refraction equal to 90°
.....[1]

(b) Fig. 7.1 shows a ray of light, travelling in air, incident on a glass prism.

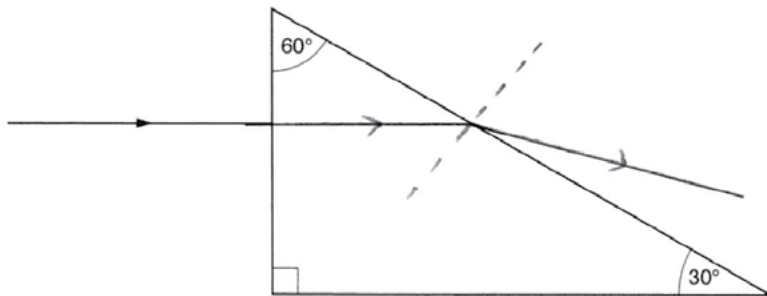


Fig. 7.1

(i) The speed of light in air is 3.0×10^8 m/s. Its speed in the glass is 2.0×10^8 m/s.

Calculate the refractive index of the glass.

$$n = \frac{3 \times 10^8}{2 \times 10^8} \\ = 1.5$$

refractive index = *1.5*.....[2]

Your
Mark

7(a)(i)

7(a)(ii)

7(b)(i)

7(b)(ii)

7(b)(iii)

Q7 Mark scheme

(a)(i)	Reflection in a more dense material where there is no refracted ray owtte OR All light in a more dense material is reflected owtte
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(b)(iii)	No change of direction at first face Total internal reflection at hypotenuse with $i = r$ by eye Refraction with r greater than i at lower face

- (ii) Show that the critical angle for the glass-air boundary is 42° .

$$\sin c = \frac{1}{1.5}$$

$$c = 41.8$$

$$c = 42^\circ$$

[1]

- (iii) On Fig. 7.1, draw carefully, without calculation, the continuation of the ray through the prism and into the air.

[3]

[Total: 8]

Select
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7(a)(ii)

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7(b)(ii)

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(b)(iii)	No change of direction at first face Total internal reflection at hypotenuse with $i = r$ by eye Refraction with r greater than i at lower face

7 (a) Explain what is meant by

(i) total internal reflection,

When the incident ray from a denser medium reflects back into the medium itself [1]

(ii) critical angle.

When the incident ray travels exactly along the surface of the medium [1]

(b) Fig. 7.1 shows a ray of light, travelling in air, incident on a glass prism.

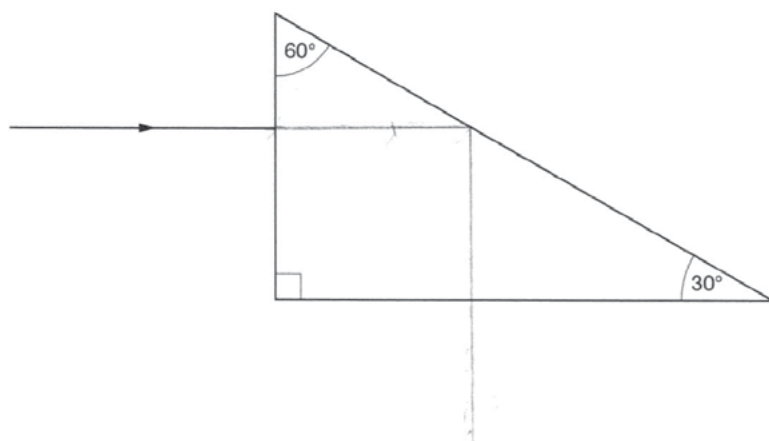


Fig. 7.1

(i) The speed of light in air is 3.0×10^8 m/s. Its speed in the glass is 2.0×10^8 m/s.

Calculate the refractive index of the glass.

$$n_1 \sin i = n_2 \sin r$$

refractive index = $\frac{3}{2}$ [2]

Select page

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7(a)(i)

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7(b)(i)

7(b)(ii)

7(b)(iii)

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(ii) Show that the critical angle for the glass-air boundary is 42° .

[1]

(iii) On Fig. 7.1, draw carefully, without calculation, the continuation of the ray through the prism and into the air.

[3]

[Total: 8]

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