

Light

Mark Scheme 6

Level	IGCSE
Subject	Physics
ExamBoard	CIE
Topic	Properties of Waves including Light and Sound
Sub-Topic	Light
Paper Type	(Extended) Theory Paper
Booklet	Mark Scheme 6

Time Allowed: 46 minutes

Score: /38

Percentage: /100

- 1 (a) incident ray in (more) dense medium)
 angle of incidence greater than critical angle/ 42°) any 3 B1 \times 3
 no light refracted)
 reflected with $i = r$)
- (b) reflection at Q only, no further reflections B2
 (allow B1 only, if there is one further reflection at lower surface)
 (give B0 for more than one further reflection) **[Total: 5]**
- 2 (a) refracts/bends/changes direction NOT curves
 Ignore converges/reflection)
 downwards/inwards/towards F_1 /focal point/normal)
 speed change/reduces on entering glass OR change of n) any 3 B1 \times 3
 OR change of density)
 idea of meets surface at an angle/one part of wave hits surface first)
 splits into colours)
- (b) all 3 rays through F_1 M1
 all refractions correct A1
and either all at lens centre line or all at both surfaces
- (ii) straight line through F_1 and F_2 B1
- (c) X between vertical line through F_1 and vertical line through F_2 B1
- (ii) virtual)
 upright)
 enlarged) any 3 B2
 same side (of lens as object)) - 1 e.e.o.o.
 further from lens (than object))

[Total: 9]

- 3 (a) (i) reduced B1
(ii) reduced B1
- (b) $n = \frac{\text{speed in air/vacuum}}{\text{speed in medium/glass}}$ in any form B1
 $2.0/2.03 \times 10^8 \text{ m/s}$ B1
- (c) reflection shown M1
angle correct, by eye A1

[Total: 6]

- 4 (a) medium A because angle in air is bigger OR angle in A is smaller OR refracts / bends away from normal / angle of refraction greater than angle of incidence / total internal reflection only occurs in denser medium B1
- (b) air: light travels faster in less dense medium OR air: air is less dense / rarer B1
- (c) $42^\circ\text{--}43^\circ$ B1
- (d) total internal reflection B1
- (e) $n = \sin i / \sin r$ OR $n = \sin r / \sin i$ OR $1.49 = \sin i / \sin 35$ C1
(allow 1.49 or refractive index instead of n in any of above)
 58.719° to at least 2 s.f. Allow 58.71° A1
- (f) $n = \text{speed in air} / \text{speed in medium}$ in any arrangement
OR $1.49 = 3.0 \times 10^8 / \text{speed in medium A}$ C1
 $2.01343 \times 10^8 \text{ m/s}$ to at least 2 s.f. A1 [8]

- 5 (a) 2 cm (by eye) vertical object somewhere between F_2 and lens
(condone no O, if clear) B1
- (b) any two standard rays correctly drawn (no extrapolation needed) B1
 correct rays extrapolated back to intersect B1
 virtual image drawn at candidate's intersection of extrapolated rays
 (condone no I, if clear) B1
- [4]**
- 6 (a) (for all rays, ignore any arrows, -1 for each incorrect extra ray)
 correct ray through $F_1 \pm 1\text{mm}$ on axis)
 correct ray through $F_2 \pm 1\text{mm}$ on axis) any 2 B1, B1
 ray through lens centre $\pm 1\text{mm}$ on axis)
 image drawn between his intersection and axis B1
- (b) virtual upright/erect magnified/enlarged further (from lens) any 3 B1 \times 3
[6]