Light

Mark Scheme 4

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 4

Time Allowed: **50 minutes**

Score: **/41**

Percentage: **/100**

1	**(a)**	**(i)**	50°	B1	
		(ii)	<u>total internal</u> (reflection)	B1	[2]
	(b)		use of <u>sin</u> *i*/<u>sin</u> *r* = *n* OR 1/*n* in any form OR 1/<u>sin</u> *c* = *n* OR 1/*n*	C1	
			i = 40(°) and *r* = 90(°) OR vice versa ecf if measured from interface not normal	C1	
			n = (1/sin *i* = 1/0.643 =) 1.556 ecf from previous line	A1	[3]
	(c)		reflected ray drawn in same position as original reflected ray	B1	
			0° < angle of refracted ray from surface < 13°	B1	[2]
	(d)		prism drawn in correct orientation to give t.i.r.	B1	
			correct reflection of rays	B1	[2]
					[Total: 9]

2	**(a)**	**(i)**	Diagram to show – boundary, normal <u>and</u> ray bending towards normal	B1	
			Angle of incidence labelled i or 51°	B1	
			Angle of refraction labelled r or 29°	B1	
		(ii)	n = sin i / sin r OR n = sin 51 / sin 29	C1	
			n = 1.603 at least 2 s.f. *Unit penalty applies	A1	
	(b)		Ray is totally internally reflected / undergoes TIR	B1	
			Angle of incidence is more than / equal to the critical angle (of the glass)	B1	
			OR		
			Ray travels along the boundary	(B1)	
			Angle of incidence = critical angle (of the glass)	(B1)	
			OR		
			Critical angle calculated as 38.6° ecf from **(a)(ii)**	(B1)	
			Angle of incidence greater than critical angle (of the glass)	(B1)	**[7]**

3 **(a** ignore arrows on rays
if no scale quoted, mark as if drawn full size; accept scale diagram if clearly stated
one correct ray B1
second correct ray B1
basically correct rays extended back meet 5–7 cm from lens
AND some indication that this is image e.g. arrow/label I or image B1 [3]

(b) cannot be formed on a screen/rays diverge away from the image/
do not meet to form image B1 [1]

(ii) magnifying glass/lens/magnifier B1 [1]

4 **(a (i)** any two of these rays from top of object:
paraxial to lens and on through focal point
undeviated to centre of lens
as if from focal point to lens and then paraxial B2

traced back to locate image B1

(ii) any two of: virtual/upright/magnified/further from lens/dimmer B2

(b) (i) 3.4 – 3.6 cm *Unit penalty applies B1

(ii) magnifying glass/magnifier (**c.a.o.**) B **[7]**

*Apply unit penalty once onl

5	**(a)**	total (internal) reflection OR reflection but no refraction/doesn't emerge	B1	
		angle (of incidence} > critical angle	B1	
	(ii)	initial reflection + 0 or 1 further reflection only, not at lower surface must be straight and reach within 1cm of end	B1	
	(b)	bends easily/less likely to break (ignore stronger) OR smaller pixels/ more detail/greater resolution/see smaller objects/wider field of view	B1	
	(ii)	light travels down/along/through fibres	B1	
	(iii)	light/image returns up/along/through fibres ignore cameras	B1	[6]
6	**(a**	distance from (principal) focus/focal point to (the centre of) the lens	B1	
	(b)	image can be formed on a screen OR is formed by rays of light meeting OR is formed on the opposite side of the lens from the object	B1	
	(ii)	straight line ray from point A to point B AND lens at intersection of ray and axis.	B1	
		2. ray from A parallel to axis, bent at lens to pass through B. <u>F at intersection of ray and axis</u>. OR Ray from point A through nearer focus, <u>labelled F</u>, to lens, bent at lens, then parallel to axis, to point B	B1	
		3. any third ray from A to B, bent at lens	B1	
	(iii)	(distance from image to lens is) reduced	B1	
		(image is) smaller	B1	[7]