

# Light

## Mark Scheme 1

<b>Level</b>	IGCSE
<b>Subject</b>	Physics
<b>Exam Board</b>	CIE
<b>Topic</b>	Properties of Waves. Including Light and Sound
<b>Sub-Topic</b>	Light
<b>Paper Type</b>	Alternative to Practical
<b>Booklet</b>	Mark Scheme 1

**Time Allowed:** 62 minutes

**Score:** /51

**Percentage:** /100

Question	Answer	Marks
1(a)	$u = 50, v = 21$	1
1(b)(i)	$U = 500, V = 210$ ecf from (a)	1
1(b)(ii)	$f_1 = 148$ or $150$ or $147.9$ (mm) ecf from (i) 2 or 3 significant figures	1 1
1(c)	$f_2$ 136 (mm) c.a.o.	1
1(d)	/ statement is correct, owtte  (6 mm) difference is very small / within limits of experimental error / Difference explained by uncertainty in her focal length measurement	1  1
1(e)	Any two from: Use of darkened room / brighter lamp Mark position of centre of lens on holder Place metre rule on bench (or clamp in position) Ensure object and (centre of) lens are same height (from the bench) Object and lens and screen perpendicular to bench Move <u>screen</u> (slowly) back and forth to obtain best image (owtte) Ensure rule is touching object / lens / holder / screen or look perpendicular to ruler	2
		<b>Total 9</b>

Question	Answer	Marks
2(a)	$m_1 = 2.94$	1
2(b)	$(m_2 = 0.329 \text{ OR } 0.33)$ $m_1$ <b>and</b> $m_2$ to 2 or 3 significant figures only <b>AND</b> both $m$ with no unit (accept $\times$ )	1
2(c)	Statement, expect YES. Must match results. e.c.f .allowed	1
	Justification to include idea of within (or beyond) limits of (experimental) accuracy	1
2(d)	Any two from: <ul style="list-style-type: none"> <li>• Use of darkened room/brighter lamp/no other lights</li> <li>• Mark position of centre of lens on holder</li> <li>• Place metre rule on bench (or clamp in position)</li> <li>• Ensure object and centre of lens are same height from the bench</li> <li>• Move <b>lens</b> slowly/to and fro (when focussing)</li> <li>• Lens, object, screen vertical/perpendicular to bench</li> <li>• Repeat with different D</li> <li>• Use of graph paper/cm scale on screen to measure image</li> </ul>	max 2
2(e)	image appears well focused over a (small) range of lens positions/not all of image focussed at same time/relevant reference to chromatic aberration	1

**Total: 7**

Question	Answer	Marks
3	<p><b>apparatus:</b>  <u>diagram</u> – <u>lens, (illuminated) object, screen</u> in suitable order for experiment</p> <p>in line on flat surface</p> <p><b>instructions:</b>            set/measure object distance, move screen to get image, measure image height,</p> <p>repeat for different object distances</p> <p><b>limiting factor for range of object distances – one from:</b></p> <ul style="list-style-type: none"> <li>• image virtual/too big for screen,</li> <li>• image too dim/too small to measure,</li> <li>• must be greater than focal length</li> </ul> <p><b>graph:</b>            image size/magnification against object distance</p> <p><b>precaution:</b>            any one suitable precaution <u>and</u> consequence of not taking it, e.g.</p> <ul style="list-style-type: none"> <li>• dark room/bright light – image might not be distinct,</li> <li>• lens and object at same height – image might not appear on screen,</li> <li>• lens, object and screen perpendicular – image might be distorted,</li> <li>• fix rule – may move and give incorrect distances</li> <li>• mark position of lens on holder – cannot judge correct measurements/owtte</li> <li>• detailed means of obtaining a sharp image – might not be correctly focused</li> <li>• means of measuring image height accurately – might be obscured</li> </ul>	<p>1</p> <p>1</p> <p>1</p> <p>1</p> <p>1</p> <p>1</p> <p>1</p>
		<b>Total: 7</b>

- 4 (a) (i) normal correct [1]
- (ii)  $\theta = 40^\circ$  [1]
- (b)  $P_1, P_2$  marked on line NM and separation  $> 5.0$  cm [1]
- (c) (i) thin lines all in correct place [1]
- $a = 8.1$  to  $8.3$  (cm) and  $b = 5.2$  to  $5.5$  (cm)
- (ii)  $n$  correctly calculated [1]
- 2/3 sig figs and no unit [1]
- (d) any two suitable precautions: [2]
- e.
- view pins from base/ensure pins upright,
  - large pin separations
  - use of thin pencil lines/sharp pencil/thin pins
  - repeat with different angles

[Total: 9]

- 5 (a) (i) normal at centre of AB and through block [1]
- (ii) GH parallel to AB AND 6 cm  $\pm$  2 mm above AB [1]
- (iii)  $i = 30^\circ \pm 2^\circ$  to left of normal [1]
- (b)  $P_1P_2$  distance  $\geq 5.0$  cm [1]
- (c) line KE correct, single and straight, emergent ray through  $P_3$  and  $P_4$  [1]
- (d)  $a = 3.3 - 3.7$  (cm);  $b = 6.8 - 7.2$  (cm);  $c = 4.0 - 4.4$  (cm);  $d = 1.4 - 1.8$  (cm) [1]
- $n$  in range 1.2–1.5, no unit, 2 or 3 significant figures [1]
- (e) any one from:
  - large pin separation
  - ensure pins are vertical
  - view bases of pins
  - drawing thin lines/use a sharp pencil
  - use thin pins[1]
- (f) ray box near start of incident ray or anywhere on incident ray; pointing in correct direction [1]

[Total: 9]

- 6 (a) normal labelled NL [1]
- (b)  $P_1P_2$  distance  $> 5$  cm,  $< 30$  cm [
- (c) (i) Graph:
- axes correctly labelled [1]
  - suitable scales [1]
  - all plots correct to  $\frac{1}{2}$  small square [1]
  - good line judgement [1]
  - thin, continuous line [1]
- (ii) no [1]
- line does not pass through origin [1]
- (iii) difficulty in aligning pins OR pins too thick OR thickness of mirror [1]

**[Total: 10]**