

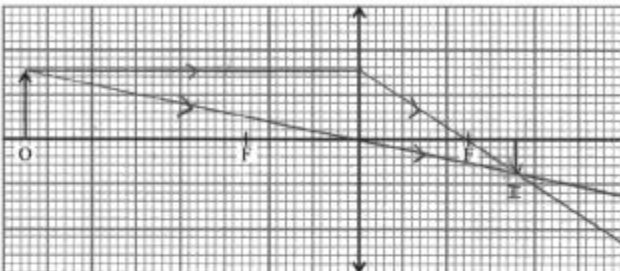
Name of the Student: _____

Max. Marks : 27 Marks

Time : 27 Minutes

Mark Schemes

Q1.

Question Number	Acceptable Answers	Additional guidance	
(i)	<ul style="list-style-type: none"> One ray correctly drawn (1) Second ray correctly drawn (1) Completes diagram with image at position 3.6 to 3.8 cm and height of 0.7 to 0.8 cm 		3
(ii)	<ul style="list-style-type: none"> Use of $m = \frac{v}{u}$ or $m = \frac{\text{image height}}{\text{object height}}$ using values from (a)(i) (1) Magnification of 0.47 to 0.53 (1) 	<u>Example of Calculation</u> $m = \frac{v}{u} = \frac{3.7}{7.5} = 0.5$	2
(iii)	<ul style="list-style-type: none"> Real and image on different side of converging lens to object Or rays pass through the image (1) 		1

Question Number	Acceptable answers	Additional guidance	Mark																												
	<p>This question assesses a student's ability to show a coherent and logical structured answer with linkage and fully-sustained reasoning.</p> <p>Marks are awarded for indicative content and for how the answer is structured and shows lines of reasoning.</p> <p>The following table shows how the marks should be awarded for indicative content.</p> <table><tr><th>Number of indicative points seen in answer</th><th>Number of marks awarded for indicative points</th></tr><tr><td>6</td><td>4</td></tr><tr><td>5-4</td><td>3</td></tr><tr><td>3-2</td><td>2</td></tr><tr><td>1</td><td>1</td></tr><tr><td>0</td><td>0</td></tr></table> <p>Indicative content</p> <ul style="list-style-type: none">• photon energy $E = hf$• photon energy must be greater than work function (of metal) for photon to provide enough energy for photoemission• UV photons have sufficient energy for photoemission but lab light photons do not• one photon interacts with one electron• with larger area more photons are absorbed/incident in a given time• more electrons are emitted in a given time (so the charge is lost more quickly)	Number of indicative points seen in answer	Number of marks awarded for indicative points	6	4	5-4	3	3-2	2	1	1	0	0	<p>The following table shows how the marks should be awarded for structure and lines of reasoning</p> <table><tr><th></th><th>Number of marks awarded for structure and lines of reasoning</th></tr><tr><td>Answer shows a coherent and logical structure with linkage and fully sustained lines of reasoning demonstrated throughout</td><td>2</td></tr><tr><td>Answer is partially structured with some linkages and lines of reasoning</td><td>1</td></tr><tr><td>Answer has no linkage between points and is unstructured</td><td>0</td></tr></table> <p>IC2 accept answers in terms of threshold frequency</p> <p>IC5 & 6 there must be the idea of 'rate' once</p> <table><tr><th>Number of IC points awarded</th><th>Possible linkage marks</th></tr><tr><td>0,1</td><td>0</td></tr><tr><td>2, 3</td><td>1</td></tr><tr><td>4, 5, 6</td><td>2</td></tr></table>		Number of marks awarded for structure and lines of reasoning	Answer shows a coherent and logical structure with linkage and fully sustained lines of reasoning demonstrated throughout	2	Answer is partially structured with some linkages and lines of reasoning	1	Answer has no linkage between points and is unstructured	0	Number of IC points awarded	Possible linkage marks	0,1	0	2, 3	1	4, 5, 6	2	
Number of indicative points seen in answer	Number of marks awarded for indicative points																														
6	4																														
5-4	3																														
3-2	2																														
1	1																														
0	0																														
	Number of marks awarded for structure and lines of reasoning																														
Answer shows a coherent and logical structure with linkage and fully sustained lines of reasoning demonstrated throughout	2																														
Answer is partially structured with some linkages and lines of reasoning	1																														
Answer has no linkage between points and is unstructured	0																														
Number of IC points awarded	Possible linkage marks																														
0,1	0																														
2, 3	1																														
4, 5, 6	2																														

6

Question Number	Acceptable Answer	Additional Guidance	Mark
(a)	<ul style="list-style-type: none"> laser light should not be aimed directly into the eye (1) 		(2)
	<ul style="list-style-type: none"> as concentrated beam can cause damage to the retina (1) 		

Question Number	Acceptable Answer	Additional Guidance	Mark
(b)(i)	<u>EITHER</u> <ul style="list-style-type: none"> all x values should be recorded to the same number of decimal places, so x_2 and x_4 are incorrectly recorded (1) <u>OR</u> <ul style="list-style-type: none"> all processed data should be recorded to the same number of significant figures, so $\sin \theta$ for x_1 is incorrectly recorded 	Do not award repeat readings, not appropriate in this experiment	(1)
(b)(ii)	<ul style="list-style-type: none"> use of $\tan \theta = \frac{x}{D}$ [$\theta = 22.9^\circ$] (1) $\sin \theta = 0.390$ (1) 	<u>Example of calculation:</u> $\tan \theta = \frac{0.741}{1.75} = 0.423$ $\therefore \theta = 22.9^\circ$ $\therefore \sin \theta = 0.3899$	(2)
(b)(iii)	point plotted correctly and best straight line drawn through points (1)		(1)

Question Number	Acceptable Answer	Additional Guidance	Mark
(b)(iv)	<ul style="list-style-type: none"> $\sin \theta = \frac{n\lambda}{d}$, so gradient = $\frac{\lambda}{d}$ (1) gradient = 0.194 (1) use of $d = 1/\text{number of lines per mm}$ (1) $d = 3.33 \times 10^{-6} \text{ (m)}$ (1) $\lambda = 6.5 \times 10^{-7} \text{ m}$ (1) 	<u>Example of calculation:</u> $d = \frac{1}{3 \times 10^5 \text{ m}^{-1}} = 3.33 \times 10^{-6} \text{ m}$ $\lambda = 3.33 \times 10^{-6} \text{ m} \times 0.194$ $= 6.47 \times 10^{-7} \text{ m}$	(5)

Question Number	Acceptable Answer	Additional Guidance	Mark
(c)	<p>An answer that makes reference to two of the following pairs:</p> <ul style="list-style-type: none"> • use a Vernier scale to record x (1) • so that data to the nearest 0.1 cm could be obtained to reduce the percentage uncertainty (1) • use a larger grating to screen distance (1) • so that all x values would be greater to reduce the percentage uncertainty (1) • measure from nth order on one side to nth order on the other side (1) • so that the distance measured is larger hence reducing the percentage uncertainty in x (1) • use a grating with more lines per mm (1) • so that values of x will be greater to reduce the percentage uncertainty (1) 	Do not award repeat readings, not appropriate in this experiment	(4)