

Question Number	Answer	Mark																																								
*17(a)	<p>This question assesses a student’s ability to show a coherent and logically structured answer with linkages and fully-sustained reasoning. Marks are awarded for indicative content and for how the answer is structured and shows lines of reasoning. The following table shows how the marks should be awarded for structure and lines of reasoning.</p> <table><tr><td></td><td>Number of marks awarded for structure of answer and sustained line of reasoning</td></tr><tr><td>Answer shows a coherent and logical structure with linkages 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 linkages between points and is unstructured</td><td>0</td></tr></table> <p>Total marks awarded is the sum of marks for indicative content and the marks for structure and lines of reasoning</p> <table><tr><th>IC points</th><th>IC mark</th><th>Max linkage mark</th><th>Max final mark</th></tr><tr><td>6</td><td>4</td><td>2</td><td>6</td></tr><tr><td>5</td><td>3</td><td>2</td><td>5</td></tr><tr><td>4</td><td>3</td><td>1</td><td>4</td></tr><tr><td>3</td><td>2</td><td>1</td><td>3</td></tr><tr><td>2</td><td>2</td><td>0</td><td>2</td></tr><tr><td>1</td><td>1</td><td>0</td><td>1</td></tr><tr><td>0</td><td>0</td><td>0</td><td>0</td></tr></table> <p><b>Indicative content</b></p> <p>IC1    <u>Photons</u> (of ultraviolet light)</p> <p>IC2    cause (photo)electrons to be emitted</p> <p>IC3    from (the surface of) the magnesium / ribbon</p> <p>IC4    as the (photon) energy is greater than the work function of magnesium <b>Or</b> as the frequency of the ultraviolet light is greater than the threshold frequency of magnesium</p> <p>IC5    The electrons are attracted to the positively charged gauze (and create the current).</p> <p>IC6    When the polarity is reversed the current is zero because the electrons no longer have enough kinetic energy to move across the gap <b>Or</b> When the polarity is reversed the current is zero because the work function of copper is larger than the photon energy <b>Or</b> When the polarity is reversed the current is zero because the threshold frequency of copper is larger than the frequency of ultraviolet light</p>		Number of marks awarded for structure of answer and sustained line of reasoning	Answer shows a coherent and logical structure with linkages and fully sustained lines of reasoning demonstrated throughout	2	Answer is partially structured with some linkages and lines of reasoning	1	Answer has no linkages between points and is unstructured	0	IC points	IC mark	Max linkage mark	Max final mark	6	4	2	6	5	3	2	5	4	3	1	4	3	2	1	3	2	2	0	2	1	1	0	1	0	0	0	0	
	Number of marks awarded for structure of answer and sustained line of reasoning																																									
Answer shows a coherent and logical structure with linkages and fully sustained lines of reasoning demonstrated throughout	2																																									
Answer is partially structured with some linkages and lines of reasoning	1																																									
Answer has no linkages between points and is unstructured	0																																									
IC points	IC mark	Max linkage mark	Max final mark																																							
6	4	2	6																																							
5	3	2	5																																							
4	3	1	4																																							
3	2	1	3																																							
2	2	0	2																																							
1	1	0	1																																							
0	0	0	0																																							

6

17(b)(i)	<p>Greater intensity increases the rate of photons emission from the lamp (1)</p> <p>This leads to an increased (emission) rate of (photo)electrons (crossing the airgap) (1)</p> <p>So greater rate of flow of charge (1)</p> <p><b>Or</b> increase in current (1)</p>	3
17(b)(ii)	<p>Use of <math>c = f\lambda</math> (1)</p> <p>Use of <math>E = hf</math> (1)</p> <p>Converts work function and photon energy to the same unit (1)</p> <p><math>E = 2.0</math> (eV)= which is less than <math>\phi</math> so photoelectric effect will not take place</p> <p><b>Or</b> <math>E = 3.1 \times 10^{-19}</math> (J) which is less than <math>5.9 \times 10^{-19}</math> (J) so photoelectric effect will not take place</p> <p><b>Or</b> threshold frequency (<math>f_0</math>) = <math>8.9 \times 10^{14}</math> (Hz) which is greater than <math>4.7 \times 10^{14}</math> (Hz) so photoelectric effect will not take place (1)</p> <p><u>Example of calculation</u></p> <p>Frequency of light = <math>3.0 \times 10^8 \text{ m s}^{-1} / 6.33 \times 10^{-7} \text{ m}</math></p> <p>= <math>4.74 \times 10^{14} \text{ Hz}</math></p> <p><math>E = 6.63 \times 10^{-34} \text{ J s} \times 4.74 \times 10^{14} \text{ s}^{-1}</math></p> <p>= <math>3.14 \times 10^{-19} \text{ J}</math></p> <p><math>\phi = 3.7 \text{ V} \times 1.6 \times 10^{-19} \text{ J V}^{-1}</math></p> <p>= <math>5.92 \times 10^{-19} \text{ J}</math></p>	4
	<b>Total for question 17</b>	<b>13</b>