

Name of the Student: _____

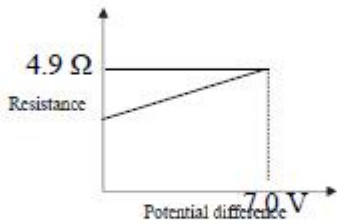
Max. Marks : 25 Marks

Time : 25 Minutes

Mark Schemes

Q1.

Question Number	Acceptable answers	Additional guidance	Mark
(a)	<ul style="list-style-type: none"> Use of $R = V/I$ using pair of points from the graph (1) $R = 4.9 \Omega$ (1) 	<u>Example of calculation</u> $R = 7.00 \text{ V} / 1.44 \text{ A}$ $R = 4.86 \Omega$	2

Question Number	Acceptable answers	Additional guidance	Mark
(b)	<ul style="list-style-type: none"> Calculated resistance point plotted correctly at $(4.9 \Omega, 7.0 \text{ V})$ (1) Resistance increases (constantly) with potential difference (1) Positive intercept with y-axis (less than value from (a)) (1) 	 <p>MP3 conditional on MP2 being awarded.</p>	3

Question Number	Acceptable answers	Additional guidance	Mark																												
* (c)	<p>This question assesses a student's ability to show a coherent and logically structured answer with linkages 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 structure and lines of reasoning</p> <table border="1"> <thead> <tr> <th>Number of indicative points seen in answer</th> <th>Number of marks awarded for indicative points</th> </tr> </thead> <tbody> <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> </tbody> </table> <p>Indicative content</p> <ul style="list-style-type: none"> • (As V increases) acceleration/velocity/energy of electrons increases • greater energy transfer in collisions with lattice / ions • increasing the temperature of metal/filament/ions • amplitude of vibrations of lattice/ ions increases • collision (rate) between lattice /ions and electrons increases Or shorter distance between collisions Or greater chance of collision • due to the increase in resistance, current doesn't increase in proportion to potential difference Or due to the increase in resistance the ratio of I/V decreases 	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 border="1"> <thead> <tr> <th></th> <th>Number of marks awarded for structure and lines of reasoning</th> </tr> </thead> <tbody> <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> </tbody> </table> <p>Accept charge carriers for electrons and only penalise once for omission of charge carriers or lattice ions</p> <p>Linkage marks</p> <table border="1"> <thead> <tr> <th>Number of indicative content points awarded</th> <th>Possible linkage marks</th> </tr> </thead> <tbody> <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> </tbody> </table> <p>MP1 don't award for 'increased rate of flow'</p> <p>MP2 to award mark there must be the idea of increased/greater energy transfer between electrons and ions</p>		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 indicative content points awarded	Possible linkage marks	0, 1	0	2, 3	1	4, 5, 6	2	6
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Q2.

Question Number	Acceptable Answer	Additional guidance	Mark
(a)(i)	<p>An explanation that makes reference to the following points:</p> <ul style="list-style-type: none"> total resistance of strand decreases (1) this increases the current in the strand <u>OR</u> remaining bulbs are brighter (1) greater power / energy consumption with blown bulbs <u>OR</u> reduces the life of the remaining bulbs (1) 		(3)

Question Number	Acceptable Answer	Additional guidance	Mark
(a)(ii)	<ul style="list-style-type: none"> use of $V = IR$ and addition of resistances in series to determine current in strand with 5 blown bulbs (1) <p><u>OR</u></p> <ul style="list-style-type: none"> use of $V = IR$ and addition of resistances in series to determine current in healthy strands <p><u>OR</u></p> <ul style="list-style-type: none"> use of resistance in parallel and series to determine total resistance <ul style="list-style-type: none"> $I = 2.9 \text{ A}$ (1) $2.9 \text{ A} < 3 \text{ A}$ so fuse does not blow (1) 	<p><u>Example of calculation:</u> Total current = sum of current in the four healthy strands + current in the unhealthy strand</p> $I = 4 \left(\frac{230 \text{ V}}{50 \times 8.0 \Omega} \right) + \left(\frac{230 \text{ V}}{(45 \times 8.0 \Omega) + (5 \times 3.0 \Omega)} \right)$ $I = 2.9 \text{ A}$	(3)
		Allow credit for a consistent conclusion from an incorrect calculation of current	

Question Number	Acceptable Answer	Additional guidance	Mark
(b)(i)	• use a micrometer	(1)	
	• $A = \pi\left(\frac{d}{2}\right)^2$ OR $A = \pi r^2$ and $r = \frac{d}{2}$	(1)	
	• repeats readings in different planes/positions	(1)	
			(3)

Question Number	Acceptable Answer	Additional guidance	Mark
(b)(ii)	• current directly proportional to cross-sectional area		(1)

Question Number	Acceptable Answer	Additional guidance	Mark
(b)(iii)	• calculates area = 0.13 (mm ²)	(1)	
	• use of $y = mx + c$	(1)	
	• $I = 2.8 \text{ A}$	(1)	
	• $2.8 \text{ A} < 3 \text{ A}$ so the wire is suitable to use as a fuse wire	(1)	
		<p><u>Example of calculation:</u> $A = \pi\left(\frac{0.4 \text{ mm}}{2}\right)^2 = 0.13 \text{ mm}^2$</p> $I = \frac{1.28 \text{ A} \times 0.13 \text{ mm}^2}{0.06 \text{ mm}^2} = 2.8 \text{ A}$ <p>Wire is suitable as $I < 3 \text{ A}$</p> <p>Allow credit for a consistent conclusion from an incorrect calculation of current</p> <p>Accept converse working to find diameter of 3 A fuse wire</p>	(4)