


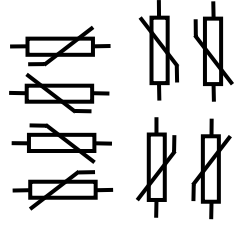
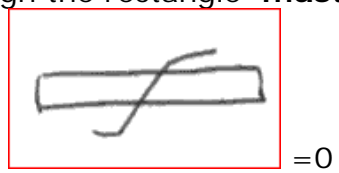
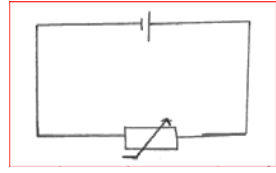

Question number	Answer	Notes	Marks
1 (a) (i)	voltage = current x resistance	ACCEPT equivalent rearrangement ACCEPT suitable abbreviations e.g. $V = I \times R$ REJECT $V = I \times$ REJECT equation 'triangles' alone	1
	(ii) 1.2 x 4.0; 4.8 (V);		2
	(iii) 12 – 4.8; 7.2 (V);	ECF on (ii)	2
	(iv) $E = VIt$ (NO MARK) time conversion to seconds (5.0×60); $7.2 \times 1.2 \times (5.0 \times 60)$; 2600 (J);	ECF on (iii) Allow 2592 or 2590 ALLOW 2500/2520 (J) for full marks (using 7 V) ALLOW 42 (J) or 43.2 (J) for 2 marks (using 5 mins)	3
	(v) idea of energy losses rate of energy loss = rate of energy supply (at steady temp)	NB this statement alone scores (2) as it includes idea of energy loss	2

Question number	Answer	Notes	Marks
1 (b) (i)	X – series, Y – parallel	BOTH REQUIRED for the mark	1
(ii)	THREE SUITABLE, e.g.- series advantage – fewer wires; series advantage – lower resistance values; series disadvantage – one fails, circuit fails; series disadvantage – no independent control;	ALLOW REVERSE ARGUMENTS in terms of parallel circuits but do not award the same mark twice IGNORE refs to efficiency ACCEPT correct answers that link to battery voltage / current, etc	Max 3

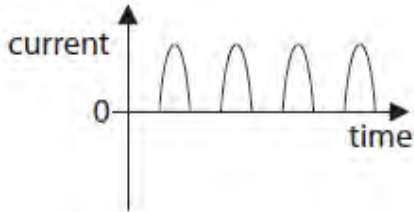
Question number	Answer	Notes	Marks
2 (a)	any 2 of: MP1. so that lamps work independently; MP2. so that they all get mains/same voltage/230V; MP3. so that different areas/rooms can have different brightness/power/light intensities of lamps;	so that can light some rooms without all being on or off/each lamp has its own switch/if 1 lamp blows the others will still work allow no reduction in light output for main voltage allow different currents	2
(b)	D 1.38 A;		1
(c)	any 3 of: MP1. current increases over max value of fuse; MP2. fuse wire melts; MP3. cuts off current; MP4. prevents wire(s) in circuit from overheating;	allow current gets too high blows/breaks breaks circuit ignore 'stops electricity' ignore electric shocks	3
(d) (i)	power = voltage x current	allow in standard symbols or in words	1
(ii)	substitution into correct equation; evaluation; e. 0.26 X 230 60 (W)	allow 240 V for mains but not incorrect current (62.4 W) allow 59.8 (W) condone 317(.4) (W) for 1 mark	2
(iii)	answer from (d)(ii) x 180 ; evaluation; unit; e. 60 X 180 11000 joules/J	accept correct use of $E = V \times I \times t$ allow ecf from (d)(ii) mark independently allow 10800, 10764	3

2 (e) (i)	<table border="1" data-bbox="440 151 902 478"> <thead> <tr> <th>S₁ position</th> <th>S₂ position</th> <th>lamp is lit</th> </tr> </thead> <tbody> <tr> <td>W</td> <td>X</td> <td>(yes)✓</td> </tr> <tr> <td>W</td> <td>Y</td> <td>(no) ×</td> </tr> <tr> <td>Z</td> <td>X</td> <td>(no) ×</td> </tr> <tr> <td>Z</td> <td>Y</td> <td>(yes)✓</td> </tr> </tbody> </table> <p data-bbox="315 513 557 580">any three correct; all 4 correct;;</p>	S ₁ position	S ₂ position	lamp is lit	W	X	(yes)✓	W	Y	(no) ×	Z	X	(no) ×	Z	Y	(yes)✓	<p data-bbox="1052 151 1365 253">allow 1 mark when middle two rows blank, but otherwise correct</p> <p data-bbox="1052 288 1360 390">allow 1 mark when top and bottom rows blank but otherwise correct</p>	2
S ₁ position	S ₂ position	lamp is lit																
W	X	(yes)✓																
W	Y	(no) ×																
Z	X	(no) ×																
Z	Y	(yes)✓																
(ii)	<p data-bbox="315 635 883 874">any sensible suggestion of 2 way switching; e. on a corridor on stairs basement/cellar bedroom/kitchen light room with 2 doorways</p>	<p data-bbox="1052 635 1382 737">allow clear description of 2 switches controlling the same light</p>	1															

Total 15 marks

Question number	Answer	Notes	Marks
3 (a)	 <p>Symbol can be in any orientation, e.g.</p> 	<p>the line through the rectangle must be correct</p>  <p>Ignore the size Ignore the rest of the circuit</p>  <p>e.g. =0 as the line through is incorrect</p> <p>Allow without the connection leads</p> 	1
(b)	<p>(i) Voltage = current x resistance;</p> <p>(ii) Convert milliamps to amps OR kilo-ohms to ohms; Substitution into <i>correct</i> equation & rearrangement; Calculation to greater than 1SF;</p> <p>2.6 mA = 0.0026 A</p> $(R) = \frac{13.2}{0.0026}$ $= 5077 (\Omega)$	<p>Allow $V = IR$ Allow rearrangements ignore a bald 'triangle'</p> <p>'show that' question, working must be shown for full mark</p> <p>Allow 5080, 5076 (truncation) 5.080 with working is worth 2 marks 5.08 with no working is worth 1 mark</p>	1 3

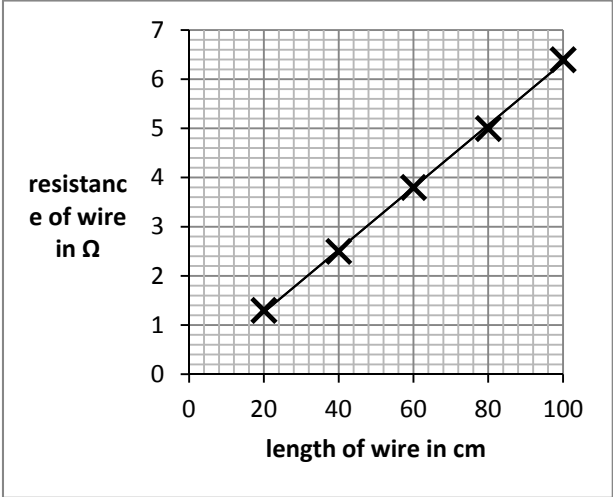
Question number	Answer	Notes	Marks
3 (c)	<p>Any five of <i>ABOUT A</i></p> <ol style="list-style-type: none"> 1. Resistance of A decreases with temperature; 2. For A, {largest slope / rate of change} is at lower temperature ORA {smallest slope /rate of change} is at higher temperature; 3. A is a thermistor (ntc); <p><i>ABOUT B</i></p> <ol style="list-style-type: none"> 4. Resistance of B increases with temperature; 5. For B, {largest slope / rate of change} is at higher temperature(s) ORA {smallest slope /rate of change} is at lower temperature; 6. For B, resistance is constant below 50 °C; <p><i>ABOUT BOTH</i></p> <ol style="list-style-type: none"> 7. More results for B/ fewer results for A; 8. stated both relationships are non-linear; 9. Range of (temperature/resistance) values for both is similar; 10.data comparison e.g. both have the same resistance at 80 °C; 	<p>Accept</p> <ul style="list-style-type: none"> • (MP1) for A, when the temperature is low, the resistance is high, ORA • (MP4) for B, when the temperature is low, the resistance is low, ORA <p>Allow component B is a ptc thermistor ORA Up to 60 °C</p> <p>Ignore: inversely proportional positive/negative correlation</p> <p>Do not take implication of MP8 when MP 1,2,4,5 is given</p>	5
		Total	10

Question number	Answer	Notes	Marks
4 (a) (i)	MP1. series circuit containing lamp and some form of power supply; MP2. ammeter in series (with lamp/battery); MP3. voltmeter in parallel across lamp;	correct symbols only condone cell for battery	(3)
(ii)	$V = I.R;$	accept in words rearrangements NOT the 'triangle'	(1)
(iii)	current reading from graph; calculation; unit; e.g. 1.5 (A) 4 Ω /ohms	do not accept V/A for Ω	(3)
(iv)	correct shape; correct end position/size;		(2)
(b)	 <p>D ;</p>		(1)

Total for Question 4 = 10 marks

Question number	Answer	Notes	Marks
5	(a) CIRCUIT DIAGRAM – Correct symbols for ammeter, voltmeter and battery; Ammeter in series with cells;	ALLOW three separate cells in series	1
	Voltmeter in parallel with wire / as shown in photograph;	ALLOW anything reasonable for the wire (e.g. straight line, variable resistor, resistor)	1
	(b) (i)	BOTH NEEDED	1
	(ii)	IGNORE references to calculating resistance, plotting graphs –	5
	ANY FIVE APPROPRIATE, e.g. Connect the circuit / connect (crocodile) clip to wire; Read ammeter; Read voltmeter; For known /particular / quoted value length; measure length with a ruler; Repeat readings / average (in different places along the wire); Take readings for different lengths; Check meters for zero errors; Disconnect/switch off between readings; To avoid heating the wire;		

Question Number	Answer		Marks
5 (c) (i)	Voltage = current x resistance;	ALLOW standard symbols, $V = I \times R$ ALLOW correct rearrangements DO NOT ALLOW equation given as unit symbols ALLOW correct answer if it follows an equation given in unit symbols IGNORE s.f. BUT must be correctly rounded from 6.4285...	1
(ii)	6.4;		1

Question Number	Answer		Marks										
5 (d) (i)	<p>Sample graph –</p>  <p>scale; at least half the paper axes labelled including units; Plotting; Plotting; Best fit line;</p>	<table border="1" data-bbox="1285 324 1503 533"> <tbody> <tr> <td>20</td> <td>1.3</td> </tr> <tr> <td>40</td> <td>2.5</td> </tr> <tr> <td>60</td> <td>3.8</td> </tr> <tr> <td>80</td> <td>5.0</td> </tr> <tr> <td>100</td> <td>6.4</td> </tr> </tbody> </table> <p>Points to plot</p> <p>IF AXES REVERSED, LOSE THE AXES MARK Ignore (100 cm, 6.4) ALLOW as length increases resistance increases ALLOW conclusions in terms of resistance per metre etc</p>	20	1.3	40	2.5	60	3.8	80	5.0	100	6.4	5
20	1.3												
40	2.5												
60	3.8												
80	5.0												
100	6.4												

Question Number	Answer		Marks
5 (d) (ii)	MARK (ii) and (iii) together, credit points wherever seen (directly) proportional;	IGNORE 'as length increases current decreases' / conclusions relating to current	1
MARK tog With			
		ALLOW constant gradient ALLOW positive correlation	1
			1
		Total	19