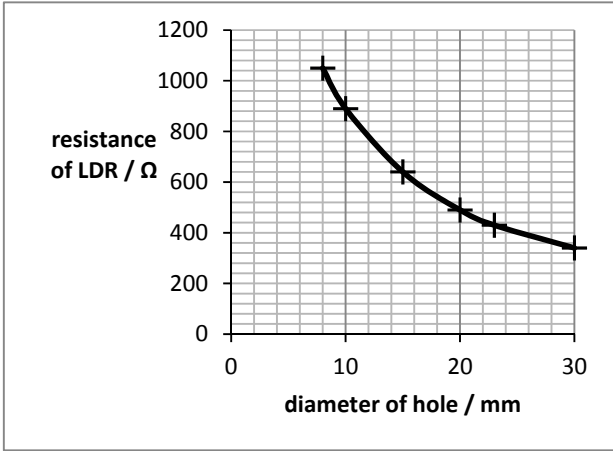




Question number	Answer	Notes	Marks
1 (a)	(i) Voltmeter connected in parallel with a component; component is LDR;	not in parallel with wire	2
	(ii) measure current / take current reading; divide voltage (reading) by current (reading);	accept <ul style="list-style-type: none">• number of amps for current• p.d. or number of volts for voltage• $R = V/I$ Ignore triangle mnemonics	2
(b)	(i) B – the diameter of the hole;		1
	(ii) C – the distance from the card to the LDR;		1
	(iii) Any one of - Move ruler to cover half the hole/halfway down the hole; Draw guide lines; Use set square;	idea of measuring across/over the diameter at right angles to ruler Placed against ruler Ignore: move ruler nearer the hole/start from 0 on the ruler	1

Continued



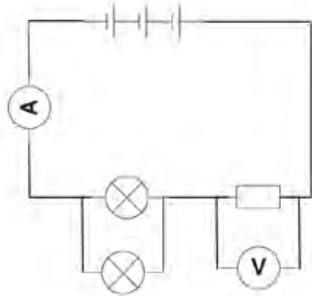
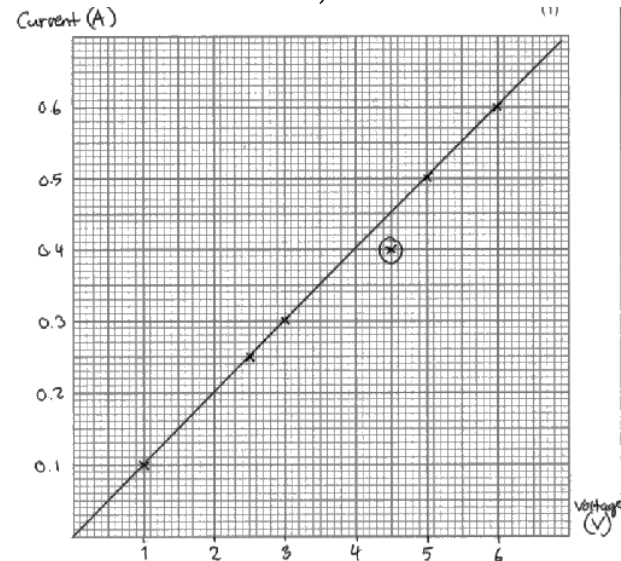
Question number	Answer	Notes	Marks														
1 (c) (i)	suitable scales; axes labelled; Plotting of points; ;	Must use > half width and half height of grid units on axis labels ignore orientation of graph to nearest ½ square, up to two marks available for this, -1 each error reject dot to dot allow a reasonably smooth curve, points should be evenly distributed about the line	4														
(ii)	line of best fit;	 <table border="1" data-bbox="1118 878 1352 1146"> <thead> <tr> <th>diameter / mm</th> <th>resistance / Ω</th> </tr> </thead> <tbody> <tr> <td>8</td> <td>1050</td> </tr> <tr> <td>10</td> <td>890</td> </tr> <tr> <td>15</td> <td>640</td> </tr> <tr> <td>20</td> <td>490</td> </tr> <tr> <td>23</td> <td>430</td> </tr> <tr> <td>30</td> <td>340</td> </tr> </tbody> </table>	diameter / mm	resistance / Ω	8	1050	10	890	15	640	20	490	23	430	30	340	1
diameter / mm	resistance / Ω																
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(iii)	MP1 Idea of an inverse relationship; OR Pattern sentence linking resistance and diameter; MP2 Idea of a non-linear relationship;	ignore 'negative correlation' e.g. "the bigger the diameter, the lower the resistance" allow exponential decrease	2														

Total 14 marks

Question number	Answer	Notes	Marks
2 (a) (i)	$P = I \times V;$	accept standard symbols or in words or rearranged	1
(ii)	substitution and rearrangement; evaluation; e.g. (I =) 110/230 (I =) 0.48 (A)	allow 0.5, 0.47826 (A) condone 0.47, 0.4782	2
(b) (i)	any suitable suggestion; e.g. carries a high(er) <u>current</u> has low(er) <u>resistance</u>	ignore references to cable overheating/melting	1
(ii)	L or live;		1
(iii)	any suitable suggestion; e.g. double insulated does not have a metal case / has a plastic case	case is not a conductor / is an insulator	1
(c)	substitution into a suitable equation; time in correct units; evaluation; e.g. ($E = I \times V \times t$) (E =) 0.17 x 230 x 55.....1 mark (E =) 0.17 x 230 x 55 x 60...2 marks (E =) 130 000 (J).....3 marks OR ($E = P \times t$) (E =) 40 x 55.....1 mark (E =) 40 x 55 x 60.....2 marks (E =) 130 000 (J).....3 marks	no mark for the equation as given in the paper allow if x60 / 3300 seen anywhere in working 129 030 (J) allow 131 835 for use of $V = 235V$ 132 000(J) total marks = 9	3

Question number	Answer	Notes	Marks
3 (a) (i)	Voltmeter connected in parallel with any circuit component; Component chosen is the thermistor;	Ignore a line through the voltmeter symbol	2
(ii)	(because voltage is) a controlled variable;	Allow idea of fair test	1
(iii)	Any one of - MP1. Idea of adjustment (of current or circuit resistance); MP2. To control the current;		1
(b)	Any three of - references to the data: MP1. (yes it works) when the temps are high, the current almost matches the temperature; MP2. (no it's not OK) when the temps are lower, the current value does not match the temperature; MP3. It is only right at 10 (and 100); Practicality ideas: MP4. The current cannot be negative when the temperature is negative; MP5. Idea that Voltage will not be constant/ voltage has to be adjusted to keep it constant; line ideas MP6. Line/ graph is curved /eq; MP7. Line/ graph does not pass through the origin;	however expressed e.g. About t same from 80 °C to 100 °C; e.g. not equal at 20mA 20 °C allow (graph shows that) current not directly proportional to temperature allow 0,0	3

Total 7 marks

Question number	Answer	Notes	Marks														
4 (a)	<p>mark each of these independently:</p> <p>MP1. a resistor in series with the lamp only;</p> <p>MP2. a second lamp in parallel with the first lamp;</p> <p>MP3. a voltmeter that measures the voltage across the resistor;</p> <p>MP4. an ammeter that measures the total current in the circuit;</p>	<p>circuit symbols used must be correct (no square voltmeter/ammeter etc.)</p> 	4														
(b) (i)	<p>labels on axes including units;</p> <p>scales on axes;</p> <p>plotting;;</p>	<p>axes can be either way round</p> <p>must occupy >50% in each direction</p> <p>-1 for each error</p>	4														
(ii)	$I = 0.4, V = 4.5$ clearly indicated;		1														
(iii)	<p>Suitable line of best fit;</p> 	<table border="1"> <thead> <tr> <th>Voltage in V</th> <th>Current in A</th> </tr> </thead> <tbody> <tr> <td>1.0</td> <td>0.10</td> </tr> <tr> <td>2.5</td> <td>0.25</td> </tr> <tr> <td>3.0</td> <td>0.30</td> </tr> <tr> <td>4.5</td> <td>0.40</td> </tr> <tr> <td>5.0</td> <td>0.50</td> </tr> <tr> <td>6.0</td> <td>0.60</td> </tr> </tbody> </table>	Voltage in V	Current in A	1.0	0.10	2.5	0.25	3.0	0.30	4.5	0.40	5.0	0.50	6.0	0.60	1
Voltage in V	Current in A																
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6.0	0.60																
(iv)	voltage = current x resistance;	in words or standard symbols	1														
(v)	<p>substitution into correct equation using any suitable pair of values taken from the graph line or table;</p> <p>evaluation of $R = 10 (\Omega)$;</p>	allow (0.1,1), (0.6,6) etc	2														

Total 13 marks

Question number	Answer	Notes	Marks
5 a	<p>MP1. series circuit containing lamp and some form of power supply;</p> <p>MP2. ammeter in series with lamp;</p> <p>MP3. voltmeter in parallel across lamp;</p> <p>MP4. variable resistor in series OR use of variable power supply;</p>	<p>incorrect symbols or substantial gaps = -1 ONCE</p> <p>allow either symbol for lamp</p> <p>ignore other components e.g. switch</p>	4
b i	<p>idea that gradient changes;</p> <p>e.g.</p> <p>voltage increases more rapidly than the current</p>	<p>look for a rate change expressed in student terms</p> <p>Accept</p> <ul style="list-style-type: none"> • line is curved • not a straight line • V is not proportional to I 	1
ii	<p>MP1. Lamp heats up;</p> <p>MP2. Greater chance of electron collisions;</p> <p>MP3. (hence) resistance increases;</p>	<p>do not award marks for a description of the shape of the graph</p>	3

(Total for question 5 = 8 marks)

Question number	Answer	Notes	Marks
6 (a) i	MP1 Any circuit including correct circuit symbols for <ul style="list-style-type: none"> • battery /cell / d.c. power supply • ammeter • voltmeter ; 	ignore other components for MP1	3
ii	MP2 ammeter clearly measures current through the wire; MP3 voltmeter clearly across wire; Idea of measuring current through the wire; Idea of measuring voltage across the wire; Idea of a range of values (of I and V); e.g. alter variable resistor OR repeat for different voltages	allow even if voltmeter in series with ammeter allow circuit line drawn through meter allow voltmeter across a section of the test wire	3
(b) i	any one of resistance changes (with temperature) ;	Reject incorrect relationship between R and θ	1
ii	wire gets hot and melts/burns/catches fire/dangerous; V proportional to I only at constant temperature;	Ignore damage to wire Reject insulating the wire	1
(c)	Ohms Law is only true if temperature constant;	Allow to return to room temperature	
i	any one of putting the wire in a water bath ; taking the reading quickly; switching off between readings; using only small currents; voltage = current \times resistance ;	Allow $V = I \times R$ and rearrangements	
ii	horizontal line above axis;		1