

Question Number	Answer	Acceptable answers	Mark
1(a)	Any one from the following points <ul style="list-style-type: none"> • (overheating) in a computer (1) • (waste heat) in a light bulb (1) • (sparks/heat) in an electric motor (1) 	Note: any applicable example where dissipation of thermal energy is a clear disadvantage (charge flowing) in a resistor	(1)

Question Number	Answer	Acceptable answers	Mark
1(b)	substitution (1) 500 = I x 230 transposition (1) 500/230 evaluation (1) 2.2 (A)	substitution and transposition in either order 2.17 (A) / 2 (A) give full marks for correct answer, no working	(3)

Question Number	Answer	Acceptable answers	Mark
13(c)	joules per coulomb		(1)

Question Number	Answer	Acceptable answers	Mark
1(d)	An explanation linking two of the following points <ul style="list-style-type: none"> • electron collision (1) • (in the/and the) lattice (1) 	allow hit, bump into for collide atoms/electrons/molecules/ions not between atoms	(2)

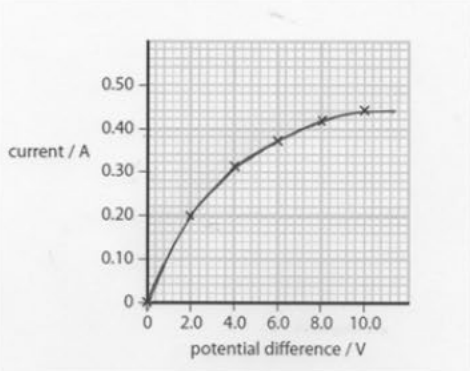
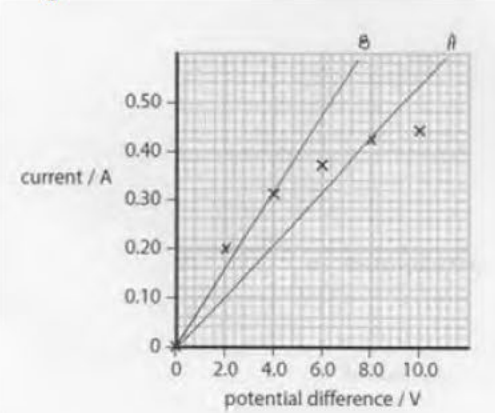
Question Number	Answer	Acceptable answers	Mark
1(e)	(Resistance =) 20 000 Ω (from graph) (1) substitution (1) 0.0006 x 20 000 evaluation (1) 12 (V)	ecf if clear misread of R from graph ignore powers of ten until evaluation Give full marks for correct answer, no working	(3)

Question Number	Answer	Acceptable answers	Mark
2(a)(i)	D variable resistor		(1)

Question Number	Answer	Acceptable answers	Mark
2(a)(ii)	B in parallel with the lamp		(1)

Question Number	Answer	Acceptable answers	Mark
2(a)(iii)	<p>A description including</p> <ul style="list-style-type: none"> • resistance changed (1) • reduced/decreased/lowered (1) <p>OR</p> <ul style="list-style-type: none"> • voltage/p.d /EMF (of supply) changed (1) • increased /turned up/higher(1) 	<p>remove (variable) resistor /component X (2)</p> <p>number of batteries/number of cells</p> <p><u>add</u> another cell/battery/battery pack/power pack/power supply (2)</p>	(2)

Question Number	Answer	Acceptable answers	Mark
2(b)(i)	both points correct (1)	allow + / - half square	(1)

Question Number	Answer	Acceptable answers	Mark
2(b)(ii)	<p>curve of best fit judged by eye (1)</p> 	<p>Must pass through zero and two other points. 5th point can be either (8.0,0.42) or (8.0, 0.44)</p> <p>straight line of best fit through origin tolerance between lines A and B shown on the diagram</p>  <p>5th point can be either (8.0,0.42) or (8.0, 0.44)</p>	(1)

Question Number	Answer	Acceptable answers	Mark
2(c)	substitution (1) 10/0.44 or 250/11 evaluation (1) 23 (ohms)	give full marks for correct answer, no working 22.7(ohms),22.73 (ohms), 22.72(ohms) Ignore excessive decimal places.	(2)

Question Number	Answer	Acceptable answers	Mark
2(d)(i)	an explanation linking two of the following points <ul style="list-style-type: none"> • electric(al)(energy) (1) • (is converted) to heat / thermal (energy) (1) • (is converted) to light (1) 	electricity	(2)

Total marks forquestion3 =10

Question Number	Answer	Acceptable answers	Mark
3(a)(i)	11x 0.4 (substitution) (1) 4.4 (V) (1)	Full marks for correct answer with no calculation	(2)

Question Number	Answer	Acceptable answers	Mark
3(a)(ii)	0.6 - 0.4 (A) (1)	0.2 or 1/5 (A)	(1)

Question Number	Answer	Acceptable answers	Mark
3(a)(iii)	B		(1)

Question Number	Answer	Acceptable answers	Mark
3(b)	An explanation linking: electrons (1) {colliding with / bumping into} ions in the lattice /atoms in the metal (1)	colliding with other electrons If no other marks scored, allow for 1 mark for "electrical energy {transferred/changed} into thermal/heat energy" <u>do not allow</u> energy being created or produced	(2)

Question Number	Indic	Mark
QWC	*)	
		(6)
Level	0	No rewardable content
1	1 - 2	<ul style="list-style-type: none"> a limited explanation linking light affecting LDR AND heat affecting thermistor OR a correct relationship for one device, e.g. thermistors change resistance when the temperature changes and LDRs change resistance when it gets dark OR the {resistance decreases/ current increases} of a LDR when the light gets brighter the answer communicates ideas using simple language and uses limited scientific terminology spelling, punctuation and grammar are used with limited accuracy
2	3 - 4	<ul style="list-style-type: none"> a simple explanation correctly linking the temperature and light with resistance or current for both devices OR a correct relationship for one device with a link to the way this affects the current and resistance. e.g. the resistance of a LDR increases when the light gets dimmer and when the temperature lowers the resistance of a thermistor increases OR the resistance of a LDR decreases when the light gets brighter and this increases the current the answer communicates ideas showing some evidence of clarity and organisation and uses scientific terminology appropriately spelling, punctuation and grammar are used with some accuracy
3	5 - 6	<ul style="list-style-type: none"> a detailed explanation including the qualitative relationships for both devices and a link to the way resistance change affects the current in BOTH of them, e.g. the resistance of a LDR is less when the light gets brighter which increases the current. When the temperature lowers the resistance of a thermistor increases. This means that the current will decrease as the thermistor cools down. the answer communicates ideas clearly and coherently uses a range of scientific terminology accurately spelling, punctuation and grammar are used with few errors

Total for question 5 = 12 marks

Question Number	Answer	Acceptable answers	Mark
4(a)(i)	D decrease the resistance of the variable resistor		(1)

Question Number	Answer	Acceptable answers	Mark
4(b)(i)	<p>correct symbol for ammeter or voltmeter (seen anywhere) (1)</p> <p>one meter connected in parallel with lamp/variable resistor/supply and one meter in series with lamp(1)</p> <p>both meters correctly connected (ammeter in series and voltmeter in parallel with lamp) (1)</p>	<p>Ignore gaps, lines through symbols and wire connected to side of variable resistor</p> <p>Symbols do not have to be correct for this mark voltmeter connected across both components is same as voltmeter connected across supply</p> <p>Symbols do not have to be correct for this mark</p> <p>any shape, labelled ammeter, in series with lamp AND any shape, labelled voltmeter, in parallel with lamp gains marking points 2 and 3</p>	(3)

Question Number	Answer	Acceptable answers	Mark
4(b)(ii)	<p>substitution (1) 0.5 x 8</p> <p>evaluation (1) 4 (V)</p>	<p>bad 4.0 x 10ⁿ gains 1 mark eg bad 40 or 0.4 = 1 mark (BOD for correct substitution)</p> <p>give full marks for correct numerical answer, 4 (V) even if no working</p>	(2)

Question Number	Answer	Acceptable answers	Mark
4(c)	<p>An explanation linking the following points</p> <p>Heat/thermal energy is produced (1)</p> <p>In the lamp/bulb / variable resistor / connecting wires (1)</p>	<p>Ignore sound (energy) and 'it is inefficient'</p> <p>Accept 'it' as meaning the lamp Eg 'it also produces heat' gains both marks</p> <p>Idea that (some) energy is wasted/lost in the lamp/variable resistor/wires gains maximum of 1 mark</p>	(2)

Question Number	Answer	Acceptable answers	Mark
4(d)	<p>substitution (1) 0.4 x 5</p> <p>evaluation (1) 2 (W)</p>	<p>bald 2.0×10^n gains 1 mark eg bald 20 or 0.2 = 1 mark (BOD for correct substitution)</p> <p>give full marks for correct numerical answer, 2 (W) no working</p>	(2)

Question Number	Answer	Mark
5(a)(i)	B	(1)

Question Number	Answer	Acceptable answers	Mark
5(a)(ii)	substitution (1) $V = 0.5 \times 12$ evaluation (1) $V = 6$ (V)	Correct answer with no working shown gains two marks.	(2)

Question Number	Answer	Acceptable answers	Mark
5(a)(iii)	<ul style="list-style-type: none"> P / ammeter reading would increase. (1) Q / voltmeter reading would increase (1) 	They(both) would increase for two marks	(2)

Question Number	Answer	Acceptable answers	Mark
5(a)(iv)	(current/it) would decrease (1)	smaller/lower/reduce/less Ignore slowing down	(1)

Question Number	Answer	Acceptable answers	Mark								
5(b)	<table border="1" style="width: 100%; height: 100%;"> <thead> <tr> <th style="width: 50%; text-align: center;">component symbol</th> <th style="width: 50%; text-align: center;">graph</th> </tr> </thead> <tbody> <tr> <td style="height: 40px;"></td> <td style="height: 40px;"></td> </tr> <tr> <td style="height: 40px;"></td> <td style="height: 40px;"></td> </tr> <tr> <td style="height: 40px;"></td> <td style="height: 40px;"></td> </tr> </tbody> </table>	component symbol	graph							<p>All three lines correct for 2 marks</p> <p>One or two lines correct for 1 mark</p> <p>More than one line against any box cannot score more than 1 mark in total.</p>	(2)
component symbol	graph										