


Question Number	Answer	Acceptable answers	Mark
1(a)	transformer	Step-u transformer Step-down transformer	(1)

Question Number	Answer	Acceptable answers	Mark
1(b)	<p>A suggestion to include any 2 of the following</p> <ul style="list-style-type: none"> • (LED) turns on and off • as voltage/current { changes direction/from +ve to -ve/ twice each second } (1) • (LED) on for (+ve) part of cycle (1) • (LED) off for (-ve) part of cycle (1) 	<p>Flash(es) / flicker(s) (on and off)</p> <p>current changes every 0.25 s /4 times each second Turns on twice each second = 2 marks</p> <p>Only on when voltage/current is +ve gains both marks</p>	(2)

Question Number	Answer	Acceptable answers	Mark
1(c)	<p>substitute (1) $3 = I \times 12$</p> <p>transformation (1) $I = 3 \div 12$</p> <p>evaluation (1) 0.25 (A)</p> <p>Ignore any unit given by candidate</p>	<p>Subst. and transform. either order 1 mark only can be scored for correct substitution after incorrect transposition.</p> <p>Accept any number of sig. figs. that rounds to 0.25 (A)</p> <p>250 <u>m</u>A gains 3 marks</p> <p>give full marks for correct answer, no working 2.5 x any other power of ten = 2 marks eg 25 (A) gains 2 marks</p>	(3)

Question Number		Indicative Content	Mark
QWC	*)	<p>A discussion including some of the following points</p> <ul style="list-style-type: none"> • improved lighting levels for LEDs • energy savings per year for LEDs or calculation of payback time • calculation of energy savings over lifetime of LEDs or calculation of monetary savings by using LEDs per year • link to savings in fossil fuels for LEDs or link to reduced CO₂ produced for LEDs and reduced global warming • comparison of lifetimes and maintenance cost 	(6)
Level	0	No rewardable content	
1	1 - 2	<ul style="list-style-type: none"> • a limited discussion of benefits using some pieces of the information provided, e.g. LEDs last 40 000 hours longer and the lighting levels are 200% 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 discussion of benefits using some pieces of the information and processing one of them OR 2 processed pieces of information. e.g. LEDs save 3000 kW h of energy each year and are much brighter. The money they save each year compared to fluorescents is £420. OR The payback time for the LEDs is about 5 years and in that time they would have to pay for the fluorescent lights to be replaced 5 times. • 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 discussion of benefits using processed information covering more than half of the data points in the table e.g. LEDs use less energy each year and this means that fossil fuel reserves are not used up as quickly. The LEDs save £420 each year and have a payback time of about 5 years. • the answer communicates ideas clearly and coherently uses a range of scientific terminology accurately • spelling, punctuation and grammar are used with few errors 	

Question Number	Answer	Acceptable answers	Mark
2 (a)	<input checked="" type="checkbox"/> D a variable resistor		(1)

Question Number	Answer	Acceptable answers	Mark
2(b)(i)	 connected in parallel with lamp (1)	recognisable symbol such as a box with letter V inside or box with the word voltmeter inside it accept voltmeter across both lamp and ammeter	(1)

Question Number	Answer	Acceptable answers	Mark
2(b)(ii)	Substitution $R = 6.0 / 0.26$ (1) Evaluation $= 23$ (1)	An answer which rounds to 23 Give full marks for correct answer no working	(2)

Question Number	Answer	Acceptable answers	Mark
2(c)(i)	point correctly plotted at 2.0, 0.14 to within half a small square (1) smooth curve of best fit connecting all given points within half a small square (1)	Judge curve by eye. If more than one line present then ignore any that appear to be erased or deleted. Ignore any part of line which goes beyond given points. If plotted point is incorrect then allow ecf for line	(2)

Question Number	Answer	Acceptable answers	Mark
3(c)(ii)	<p>a description including two of the following:</p> <ul style="list-style-type: none"> • current increases as voltage increases (1) • current is not proportional to the pd (1) • gradient gets less (1) 	<p>Allow reverse argument</p> <p>positive correlation (between them)</p> <p>graph is not a straight line not in equal steps</p> <p>current does not increase as much (as it gets higher)</p> <p>accept resistance has increased with increase in current for two marks</p>	(2)

Question Number	Answer	Acceptable answers	Mark
3(c)(iii)	<p>a suggestion to include:</p> <p>there is still a current (when control is at min position) (1)</p> <p>make the battery last longer (1)</p>	<p>to break the circuit to switch the current off accept flow of electricity/charge/electrons for current</p> <p>{ battery / energy } would be { drained /used up/ wasted } otherwise accept reverse arguments</p> <p>ignore reference to power / volts</p>	(2)

Question Number	Answer	Acceptable answers	Mark
3 (a) (i)	Correctly plotted point (1)	+/- ½ a small square	(1)

Question Number	Answer	Acceptable answers	Mark
3 (a)(ii)	Smooth line through most (at least 5) crosses / points (1)	Do not accept clearly dot-to-dot or excessive tramlining Ignore any part of line after 45	(1)

Question Number	Answer	Acceptable answers	Mark
3 (a) (iii)	Substitution: (1) $12 = 0.047 \times R$ Transposition: (1) $R = 12/0.047$ Evaluation: (1) $R = 260$	transposition and substitution in either order substitution mark can be scored when incorrectly transposed word/symbol equation is given 255.3, 255 give full marks for correct answer no working power of 10 errors with no working score max 1 mark	(3)

Question Number	Answer	Acceptable answers	Mark
3 (a) (iv)	An explanation linking <ul style="list-style-type: none"> current increases with temperature (1) with <ul style="list-style-type: none"> (so) resistance decreases(1) or <ul style="list-style-type: none"> the voltage is constant (1) with <ul style="list-style-type: none"> (so) resistance decreases (with temperature increase)(1) 	(for this first MP) ignore faster/slower (charge/current) ignore references to heat, current flows more can score both marks by quoting two suitable pairs of values from graph For full marks, there must be a reference to change of either I or R with temperature	(2)

Question Number	Answer	Acceptable answers	Mark
3 (b)(i)	<p>An explanation linking</p> <ul style="list-style-type: none"> • {electrons / negative charges} (1) • collide with {ions/lattice/electrons} (1) 	<p>atoms / nuclei</p> <p>allow for 1 mark, electrical energy transferred to {thermal/heat} energy if no other scored</p>	(2)

Question Number	Answer	Acceptable answers	Mark
3 (b) (ii)	<p>A suggestion including</p> <p>energy transfer in {the thermistor/ any component part of the electrical circuit} causes a rise in temperature of thermistor (above surroundings)(1)</p>	<p>thermistor/resistor {gets hot/is heated}</p>	(1)

Question Number	Answer	Mark
4(a)(i)	<p>lamp</p> <p>fixed resistor</p>	(2)

Question Number	Answer	Acceptable answers	Mark
4(a)(ii)	<p>ammeter in series (1) voltmeter in parallel (1)</p>	<p>'A' clearly in series with wire and cell anywhere on a complete circuit diagram</p> <p>'V' in parallel with wire only / wire and 'A'</p>	(2)

Question Number	Answer	Acceptable answers	Mark
4(b)(i)	straight line drawn through origin and most points	line no thicker than half a cross – no tramlining ignore line after given four points	(1)

Question Number	Answer	Acceptable answers	Mark
4(b)(ii)	point plotted within ½ a small square		(1)

Question Number	Answer	Acceptable answers	Mark
4(b)(iii)	<p>An explanation linking one of the following pairs</p> <p>Either</p> <ul style="list-style-type: none"> taking reading between 0 and 4 V (1) to check the straight line (1) <p>Or</p> <ul style="list-style-type: none"> taking reading between 4 and 7 V (1) to check straight line / confirm curve/find out what happens between 4 and 7 (1) <p>Or</p> <ul style="list-style-type: none"> taking reading greater than 7 V (1) to extend range (1) <p>Or</p> <ul style="list-style-type: none"> repeating reading for 7 V / anomalous result (1) to check that no mistake was made (1) 	<p>read secondary source / compare with other people (1)</p>	(2)

Question Number	Answer	Acceptable answers	Mark
4(b)(iv)	<p>voltage value from graph (1) 3.0</p> <p>substitution (1) 3.0 /1.5</p> <p>evaluation (1) 2.0 (Ω)</p>	<p>3</p> <p>3/1.5</p> <p>2 give full marks for correct answer, no working accept 1.6 for 2 marks (ecf if 2.5 from graph)</p>	(3)