Mark Scheme

Q1.

Question Number:	Answer	Mark
	D diode **The only correct answer is D** ***A*** *is not correct as for a thermistor, current would increase with potential difference from the origin* ***B*** *is not correct as current against p.d for a resistor gives a straight line from the origin* ***C*** *is not correct as current against p.d for a resistor gives a straight line from the origin*	**(1)** AO 1 1

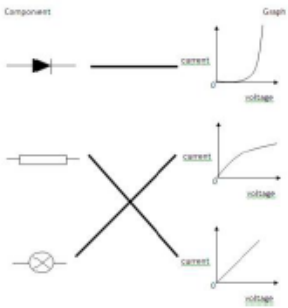
Q2.

Question Number	Answer	Mark
	 **The only correct answer is D** **A is incorrect** because that is the symbol for a diode **B is incorrect** because that is the symbol for a light dependent resistor **C is incorrect** because that is a symbol for a motor	**(1)**

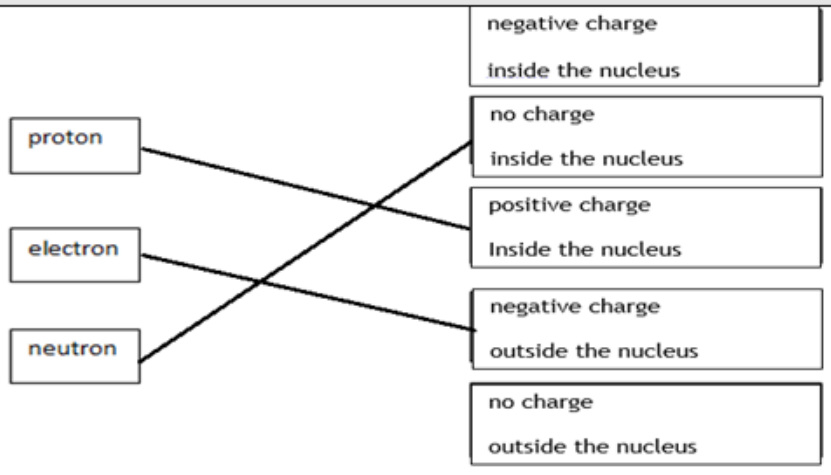
Q3.

Question Number	Answer	Additional guidance	Mark
	2.5(A)	Accept $2\frac{1}{2}$ (A)	**(1)**

Q4.

Question Number	Answer	Acceptable answers	Mark
	Connecting lines as shown  (2)	all 3 for 2 marks allow one mark if one or two lines correct more than one line from any component or to any graph is incorrect, so a maximum of 1 mark is possible	**(2)**

Q5.

Question Number	Answer	Mark
	 One mark for each correct line. More than one line from a box on the left loses the mark for that box.	**(3)**

Q6.

Question Number	Answer	Acceptable answers	Mark
	Conversion to correct units: 120 seen anywhere (1) Substitution: 0.08 x 120 (1) Evaluation: 9.6 (C) (1) accept 10 C	Allow full marks for correct answer with no working seen. 0.08 x 2 gains 1 mark for sub of their time into correct eq'n 0.16 (C) gains 2 marks (only mistake is not converting time to seconds) accept any power of 10 error for 2 marks e.g. 960 (C)	**(3)**

Q7.

Question Number:	**Answer**	**Additional guidance**	**Mark**
	a comment that makes reference to any three of the following points: • idea that the current increases with the p.d. /voltage (1) • until (current) reaches a constant value (1) • the current is not directly proportional to p.d. (1) • uses idea that the values do not go up in equal steps / does not show doubling	(staying) at 0.13(A)	**(3)** AO 3 2a AO 3 2b

Q8.

Question Number	Answer	Additional guidance	Mark
	substitution (1) (Q=)0.9 x 50 evaluation (1) 45 unit (1) coulomb	 award 2 marks for the correct answer without working If no substitution seen 4.5 or 450 scores 1 mark only independent mark C, c, As Accept recognisable spellings of coulomb	**(3)**

Q9.

Question Number	Answer	Additional guidance	Mark
(i)	substitution (1) (ΔQ) = 1.5 x 4200 x 50 evaluation (1) 320 000 (J)	 accept 315 000 (J) 310 000 (J) award full marks for the correct answer without working 320 000 000 315 000 000 310 000 000 score 1 mark (mass in grams)	**(2)**

Question Number	Answer	Additional guidance	Mark
(ii)	substitution (1) $3500 = \frac{670\,000}{t}$ rearrangement (1) $(t=) \frac{670\,000}{3500}$ evaluation (1) 190(s)	accept substitution and rearrangement in either order accept any answer that round to 190(s) power of ten error award 2 marks maximum award full marks for the correct answer without working	(3)

Q10.

Question Number	Answer	Additional guidance	Mark
(i)	recall and substitution into V = IR (1) 5.0 = 0.26 x R rearrangement (1) (R =) $\frac{5.0}{0.26}$ evaluation (1) 19 (Ω)	accept substitution and rearrangement in either order (R =) $\frac{V}{I}$ $\frac{5.0}{0.26}$ scores 2 marks accept answers that round to 19 (Ω) (e.g. 19.23) accept answer written in table if not written on answer line. award full marks for the correct answer without working	(3)

Question Number	Answer	Additional guidance	Mark
(ii)	a comment that includes the following points idea that resistance increases with potential difference (1) idea that doubling the potential difference does not result in doubling of resistance (1) **OR** V = constant x R is not supported by this data (1) correct processing of data from the table to support either of the above mark points (1)	idea that equal increments of potential difference do not cause equal increments of resistance reverse argument e.g. if student was correct then equal increments of p.d. would cause equal increment of resistance if student was correct then current would be constant ignore simple quoting of data for this mark	**(3)**

Q11.

Question Number	Answer	Mark
	Answers will be credited according to candidate's deployment of knowledge and understanding of the material in relation to the qualities and skills outlined in the generic mark scheme. The indicative content below is not prescriptive and candidates are not required to include all the material which is indicated as relevant. Additional content included in the response must be scientific and relevant. • the batteries store energy as chemical energy • the energy is transferred to electrons to make them flow/move • the current is a flow of electrons • the electrons flow through the metal/filament • the electrons collide with the ions in the lattice • the collisions make the ions vibrate more • the increased vibrations makes the lattice/filament hotter • the heat energy is dissipated to the surroundings • the ions give out/emit light	**(6)**

Descriptor
• No rewardable material.
• Demonstrates elements of physics understanding, some of which is inaccurate. Understanding of scientific ideas lacks detail. (AO1) • Presents an explanation with some structure and coherence. (AO1)
• Demonstrates physics understanding, which is mostly relevant but may include some inaccuracies. Understanding of scientific ideas is not fully detailed and/or developed. (AO1) • Presents an explanation that has a structure which is mostly clear, coherent and logical. (AO1)
• Demonstrates accurate and relevant physics understanding throughout. Understanding of the scientific ideas is detailed and fully developed. (AO1) • Presents an explanation that has a well-developed structure which is clear, coherent and logical. (AO1)

Level	Mark	Additional Guidance	General additional guidance – the decision within levels Eg - At each level, as well as content, the scientific coherency of what is stated will help place the answer at the top, or the bottom, of that level.
	0	No rewardable material.	
Level 1	1–2	Additional guidance unlinked statements	Possible candidate responses Particles move through the wire Batteries store energy Lamp gives off heat
Level 2	3–4	Additional guidance Limited explanation **linking** facts about particles OR **linking** facts about energy transfers	Possible candidate responses Electrons move through the wire/lamp OR The particles moving in the wire are electrons OR Particles collide in the wire OR Chemical energy (stored) in battery OR Energy dissipated / {released as light or thermal} energy in surroundings OR Energy is transferred electrically (from battery to lamp)

Q12.

Question Number:	Answer	Additional guidance	Mark
(i)	substitution (1) (P)= 0.12 x 0.24 evaluation (1) 0.029 (W)	 accept 0.03 (W), 0.0288(W) 0.028 (W) power of ten error is awarded 1 mark award full marks for the correct answer without working	**(2)** AO 2 1

Question Number:	Answer	Additional guidance	Mark
(ii)	chooses /uses (1) E= V x I x t evaluation (1) 1.4 (J)	E =0.3 x0.13 x35 accept an answer that rounds to 1.4 (J) e.g. 1.365(J) a maximum of 1 mark is awarded in the case of a power of ten error award full marks for the correct answer without working	**(2)** AO 2 1

Question Number:	Answer	Additional guidance	Mark
(iii)	substitution (1) (Q)=0.13 x 35 evaluation (1) 4.6 (C)	 accept an answer that rounds to 4.6 e.g. 4.55 or in this context allow 4.5 power of ten error is awarded 1 mark award full marks for the correct answer without working	**(2)** AO 2 1

Q13.

Question Number	Answer	Acceptable answers	Mark
(a)(i)	**C** electrons (1)		**(1)**

Question Number	Answer	Acceptable answers	Mark
(a)(ii)	current (1) potential difference/voltage (1) Note: award one mark if these answers are in the wrong order	amps / A /mA/ amperage/ampage accept rate of flow of charge but, charge flowing is insufficient ignore electricity ie rate of flow of electricity does not score pd / p.d./ volts / V/ mV / kV etc can accept e.m.f / emf just potential is insufficient accept numerical responses with correct unit award one mark for: meter 1 = ammeter NOT ampmeter AND meter 2 = voltmeter NOT voltameter	**(2)**

Question Number	Answer	Acceptable answers	Mark
(b)	substitution 0.4 x 6 x 20 (1) evaluation 48 (J) (1) Ignore any unit given by the candidate	 Ignore power of 10 until evaluation e.g. 1 mark for 4.8 Give full marks for correct answer, no working	**(2)**

Question Number	Answer	Acceptable answers	Mark
(c)	p.d. for current of 0.3 A = 3.0 (V) (1) substitution 3.0 ÷ 0.3 (1) evaluation 10 (Ω) (1) Ignore any unit given by the candidate	3 (V) seen in any calculation is enough for a mark check graph if no other mark 3 ÷ 0.3 gains two marks 0.3 ÷ 3 (= 0.1) gains 1 mark (for 3 V) or bald 0.1 scores 1 mark (for 3V) Allow clear ecf from incorrect reading from graph for maximum 2 marks ie their reading ÷ 0.3 but 0.3 ÷ 0.3 does NOT score unless 0.3 written on graph Give full marks for correct answer, no working DO NOT award any marks for POT error where there is no working.	**(3)**

(Total for Question =8 marks)

Q14.

Question Number	Answer	Acceptable answers	Mark
(i)	(correct) voltmeter symbol seen anywhere (1) voltmeter symbol connected in parallel / across heater (1)	accept symbols that are attempts at circles. accept line through symbol accept for second mark: any symbol or diagram of meter or box provided it is just from one side of the heater to the other	**(2)**

Question Number	Answer	Acceptable answers	Mark
(ii)	Substitution (into V = I x R) V = 0.56 x 15 (1) Evaluation = 8.4 (V) (1)	Allow full marks for correct answer with no working shown accept any power of 10 error for 1 mark e.g. 84 (V) or 0.84 (V) scores 1 mark accept rounding to 8 (V) for both marks	**(2)**

Question Number	Answer	Acceptable answers	Mark
(iii)	Substitution Energy = 6.0 x 0.40 x 30 (1) Evaluation 72(J) (1)	accept any power of 10 error for 1 mark e.g. 720 or 7200 (J) scores 1 mark Allow full marks for correct answer with no working shown	**(2)**

Question Number	Answer	Acceptable answers	Mark
(iv)	An explanation linking any two from: (there is the same) current in the (variable) resistor/ wires (1) (so) energy is {transferred/used/goes to/ lost/ wasted} in the {(variable) resistor/wires} (1) (so) {(variable) resistor / wires} gains/loses thermal energy (1)	 accept there is a p.d. across the (variable) resistor or {p.d./voltage} across heater is different to battery {p.d./voltage} ignore references to voltmeter and heater ignore 'energy wasted as heat' without qualification accept {resistor/wires} {heats/warms} (up) gains 1 mark energy lost in (variable) {resistor/ wires} as heat gains both marks	**(2)**

Q15.

Question Number	Answer	Acceptable answers	Mark
(a)	repel (1) charge (1) positive (1) electrons (1)		**(4)**

Question Number	Answer	Acceptable answers	Mark
(b)(i)	An explanation linking any **three** from the following: • Droplets have same charge (1) • (droplets) repel (one another) (1) • (This produces) a fine spray/mist (1) • attraction between droplets and plant (1) • This improves coverage OR Spray covers whole [leaf /plant] top and underside of leaf/ gives a fine coating/ even coat (1) • Less spray used/wasted/ falls onto soil (so saves money) (1)	Ignore references to attracting or repelling insects. ignore droplets are positive /negative droplets spread out (produce an) even spray droplets attracted to negative/opposite charge (on plant) or spray will stick to leaves/plant better/more chance of spray landing on/hitting plant or spray (lands) evenly on plant none is wasted/Less will run off the leaves/Same amount of spray will cover a larger area(so saves money)	**(3)**

Question Number	Answer	Acceptable answers	Mark
(b)(ii)	10 minutes = 600 seconds (1) substitution 0.008 x 600 (1) evaluation 4.8 (C) (1) Ignore any unit given by the candidate	 ECF from their time eg 2 marks for 0.08 if their time is 10 0.8/8/8.0/80 gains 1 mark (bod POT error) Power of ten error max of 2 marks eg 480 gains 2 marks Award 3 marks for correct answer, no working No power of ten error mark if answer less than 0.008 as probably dividing Award 2 marks for 0.08, no working	**(3)**

(Total for Question =10 marks)