Mark scheme – Static and Charge (H)

Question			Answer/Indicative content	Marks	Guidance
1			A ✓	1 (AO2.1)	**Examiner's Comments** About 80% of candidates gave the correct answer A. Common incorrect answers were randomly selected form the other distractors.
			Total	**1**	
2			C ✓	1 (AO1.1)	**Examiner's Comments** A number of candidates chose A, assuming that the current was the same in each resistor, or B, assuming that the 10.0 A was equally shared. Candidates should be encouraged to read all of the question without guessing what the question is asking. Many candidates helpfully wrote tables to the right comparing currents and potential differences in series and parallel circuits. Some candidates helpfully wrote 10 – 2.5 and in some cases, this was added to the diagram. It is helpful in these types of question to underline quantities as the question is read.
			Total	**1**	
3			D ✓	1 (AO1.1)	**Examiner's Comments** This was generally well answered. Candidates who did not gain the correct answer often chose C indicating that the direction of the electric field was not fully understood.
			Total	**1**	
4	a	i	potential difference ✓ closed or complete circuit ✓	2 (AO2 × 1.1)	**IGNORE** ions / charge **ALLOW** voltage **ALLOW** higher level answers eg. must have delocalised electrons / electrons that are free to move **Examiner's Comments** Only about 10% here gained both marks. Delocalised electrons was a common

					correct answer for 1 mark. Less often seen were a potential difference [1] and a complete circuit [1].
		ii	**FIRST CHECK THE ANSWERON ANSWER LINE** **If answer = 1500 (C) award 4 marks** Q = It ✓ t = 5 × 60 = 300 (s) ✓ Q = 5 × 300 ✓ Q = 1500 (C) ✓	4 (AO1.1) (AO2.1) (AO2.1) (AO2.1)	**Examiner's Comments** This was reasonably well answered and about two thirds of candidates gained 3 marks for 1500. Some forgot to convert minutes to seconds but were credited some reward for their working.
	b		Rod **attracts** water ✓ • Opposite charges attract ✓ • water has both + and − charges / idea of polarisation / AW ✓	3 (AO3 × 1.2)	**IGNORE** positive electrons / movement of protons / ions for this answer. **ALLOW** Water bends or moves towards rod **OR** for candidates that have misinterpreted the diagram as repulsion of water then **ALLOW** Rod **repels** water / water bends or moves away from rod ✓ • Like charges repel ✓ • water has both + and − charges / idea of polarisation / AW ✓ **Examiner's Comments** The diagram was interpreted differently by candidates. Some thought it attracted (ideal scenario) and others thought it repelled. However marks were made available for both lines of thought as both interpretations were valid from the diagram. It gave a full range of marks and discriminated well with about 10% gaining full marks by including the idea of polarisation. The ideas of repulsion of water and opposite charges repelling were credited 2 marks.
			Total	**9**	
5	a	i	LED / cells connected the wrong way around OR ✓ Voltmeter is across the battery/cells OR voltmeter should be across the LED ✓	2 (AO2x3.2a)	**ALLOW** diode **IGNORE** voltmeter in wrong place **Examiner's Comments**

					The majority of the candidates gained at least one mark. Vague answers such as "voltmeter is in the wrong place" did not gain credit. Higher ability candidates stated for one of the errors that the LED (or cells) were connected the wrong way around or the LED (or cells) needed to be reversed. For the other error, it was expected that the candidates would indicate that the voltmeter was not measuring the potential difference across just the LED, but across the battery. Candidates gained a mark for this error by suggesting connecting the voltmeter across the LED. Incorrect answers given by many candidates included the ammeter being in the wrong place or the variable resistor being in the wrong place. Often candidates incorrectly suggested that the order of the components mattered.
		ii	**Any one from:** Control/change/alter the current (in the circuit) ✓ Control/change/alter the potential difference/voltage(across the LED) ✓	1 (AO1.2)	**DO NOT ALLOW** to vary the resistan **Examiner's Comments** A large number of candidates answered this question by stating that the component was a variable resistor or to vary the resistance of the circuit. Few candidates answered the question in term of the purpose of the variable resistor was to vary the potential difference across the LED or vary the current through the LED (by varying the resistance in the circuit).
	b	i	**FIRST CHECK THE ANSWER ON ANSWER LINE** **If answer = 100 (Ω) award 3 marks** Resistance = potential difference ÷ current / R = V ÷ I ✓ R = 3.0 ÷ 0.03 ✓ R = 100 (Ω) ✓	3 (AO1.2) (AO2.1) (AO2.1)	**Examiner's Comments** The majority of the candidates were able to rearrange the given equation and substitute into the rearranged equation the correct values to give an answer of 100 Ω. A very small minority of candidates used 0.3 A rather than 0.03 A. Candidates often underline the quantities in the question, which was good practice.
		ii	**FIRST CHECK THE ANSWER ON ANSWER LINE** **If answer = 4.5 (C) award 4 marks** Charge flow = current × time / Q = I × t ✓ t = 2.5 minutes = 150 seconds ✓ Q = 0.03 x 150 ✓	4 (AO1.2) (AO1.2) (AO2.1)	**ALLOW** 3 marks for an answer of 0.075 (C) (time not converted to seconds) ✓✓✓ **Examiner's Comments** In this question, higher ability candidates who did not obtain the correct answer, but showed their working, could still gain marks from their working.

			Q = 4.5 (C) ✓	(AO2.1)	In this case, the equation for charge flow needed to be recalled and the time of 2.5 minutes needs to be changed to 150 seconds, before the answer could be calculated.
		iii	**FIRST CHECK THE ANSWER ON ANSWER LINE** **If answer = 13.5 (J) award 2 marks** E = 4.5 x 3.0 ✓ E = 13.5 (J) ✓	2 (AO2.1) (AO2.1)	**ECF** from **(ii)** **ALLOW** 14(J) **Examiner's Comments** Most candidates were able to multiply their answer to (ii) by 3.0 to gain the correct answer.
			Total	**12**	
6	a	i	(Ruler has) equal numbers of protons and electrons / ORA ✓ So (effects of positive charges and negative charges) cancel out / AW / ORA ✓	2 (AO2 x 1.1)	**ALLOW** equal numbers of positive and negative charges/opposite charges / ORA **ALLOW** ruler has not lost/gained electrons / ORA **ALLOW** ruler is/atoms are neutral unless there is a loss/gain of electrons / ORA **ALLOW** if the ruler had been charged, movement of electrons (to/from the air) would discharge it **ALLOW** overall/net charge is zero/neutral / ORA **IGNORE** just charge is neutral
		ii	Electrons are transferred (from/to the ruler or from/to the cloth) / ORA ✓ **And any one from:** Charges are no longer equal / AW ✓ Different numbers of protons and electrons / AW ✓ Effects no longer cancel out / AW ✓	2 (AO2 × 1.1)	**ALLOW** electrons are lost/gained **DO NOT ALLOW** protons/positive charges move **ALLOW** ruler becomes negative/positive with correct movement of electrons ✓✓
	b	i	They must be opposite/unlike charges / one is positive and one is negative / one is a proton and one is an electron ✓ **And any two from:** They are being attracted ✓ The arrows show a force on the positive (charge)/(charge) B ✓ Forces/field (lines) go from positive to	3 (AO3 x 1.2)	**ALLOW** A is positive and B is negative for this mark only

			negative ✓ (Charge) A is negative AND (charge) B is positive ✓		**ALLOW** forces/field (lines) go from B to A **ALLOW** maximum of 1 mark if described as opposite poles / positive and negative poles
		ii	**Any one from:** North and South (poles) (replace positive and negative charges) ✓ The arrows/field lines go from North to South (as opposed to positive to negative) ✓ They have similar shape field (patterns) ✓ Closeness of field lines represents strength of field (in each case) ✓ Opposite <u>poles</u> (and opposite charges) attract ✓ Both show direction of field (lines)/forces ✓	1 (AO1.1)	
			Total	**8**	