OCR GCSE GATEWAY PHYSICS A · J249

# PHYSICS



## MARK SCHEME

### P3.1 STATIC AND CHARGE

| SCORE | PERCENTAGE |
| --- | --- |
| /80 | % |

STEMUP

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| Question | | | Answer/Indicative content | Marks | Guidance |
|---|---|---|---|---|---|
| 1 | | i | (The car seat becomes) **positive(ly) / +** (charged because it loses) **electron(s)** [1] | 1 | **both required for one mark**<br>**not** positive electrons<br><br>**Examiner's Comments**<br><br>Mostly correct with the seat becoming positively charged because it loses electrons. Occasionally one of neutrons, protons or charges was substituted instead of electrons. |
| | | ii | (idea that) antistatic sprays are made of a conducting (polymer) material / contains a substance that is a good conductor [1]<br><br>Car seat (now) conducts [1] | 1 | **ignore** charge cannot build up<br><br>**allow** enables charge to move / leak to earth [1]<br><br>**Examiner's Comments**<br><br>Few candidates mentioned conduction. Most thought that the spray stopped the flow of electrons or reduced friction forces, etc. Others thought it neutralised change. Good answers referred to it providing a conducting layer' [1]. |
| | | iii | (idea that the strip provides earthing but as the car moves) the strip is not always in contact with the road [1] | 1 | **allow** (idea that) the car is already earthed because there is graphite in the tyres so this additional earthing does not make a difference [1]<br><br>**ignore** strip breaks / gets damaged / falls off<br><br>**Examiner's Comments**<br><br>About a third of answers correctly referred to the strip losing contact with the ground (because of uneven ground or the wind lifting it up). Some just thought it would break or it was not thick enough to carry electrons away. |
| | | | **Total** | 3 | |

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| Question | | | Answer/Indicative content | Marks | Guidance |
|---|---|---|---|---|---|
| 2 | | | **any three from**<br><br>the balloon is an insulator [1]<br><br>balloon is charged/ gains or loses electrons [1]<br><br>opposite charges attract [1]<br><br>water is attracted [1] | 3 | **ignore** water bends<br><br>**allow** the idea that the balloon and water (closest to the balloon) are oppositely charged [2]<br><br>**ignore** pulling<br><br>**allow** higher level answers about induction<br><br>**Examiner's Comments**<br><br>This question was about electrostatics.<br><br>Most scored at least one mark (usually for attraction) but very few, even amongst higher ability candidates scored 3 marks |
| | | | **Total** | 3 | |
| 3 | | | (charge carriers are) not neutrons they are electrons [1]<br><br>(resistance does not stay the same) it changes / increases [1] | 2 | **allow mistakes indicated on the text**<br><br>**not** resistance decreases<br><br>**Examiner's Comments**<br><br>It was encouraging to see that most could recognise the faults in the description of current as flow of neutrons, and that resistance was not independent of temperature. The most common incorrect correction was stating that resistance decreases with increasing temperature. |
| | | | **Total** | 2 | |

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| Question | | | Answer/Indicative content | Marks | Guidance |
|---|---|---|---|---|---|
| 4 | | | **any three from**<br><br>spread of (paint) spray less for normal paint gun / spread of (paint) spray morefor electrostatic paint gun [1]<br><br>(idea that) paint (droplets) in normal paint gun uncharged [1]<br><br>(idea that) paint droplets in electrostatic gun have the same charge [1]<br><br>(idea that) like charged (paint) particles repel (so spreading the paint further) [1]<br><br>(idea that) object is charged (oppositely to paint) [1]<br><br>(idea that) in electrostatic gun paint droplets are attracted to object [1] | 3 | **allow marking points from labels on the diagrams**<br><br>**allow** (paint) spray identified as spreading once it leaves the paint gun [1]<br><br>**Examiner's Comments**<br><br>This question on Spray painting was accessible by most candidates who often scored at least [1] mark. The best answers included a detailed description of how the electrostatic paint spreads more, due to the like charged paint particles repelling. Weaker candidates often simply described the attraction between the paint and the object |
| | | | **Total** | **3** | |
| 5 | | | he **gains** negative charge (from the carpet) (1)<br><br>**but**<br><br>he **gains electrons** (from the carpet) (2) | 2 | Any mention of **positive electrons** [0]<br>Any mention of **moving** positive charge [0]<br><br>if no other marks scored **allow** idea that there is a transfer of electrons (1)<br><br>**Examiner's Comments**<br><br>There were some (but fewer) references to 'positive electrons' [1] this year. Most answers clearly stated the movement of electrons from the carpet to Patrick [2]. |
| | | | **Total** | **2** | |

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| Question | | | Answer/Indicative content | Marks | Guidance |
|---|---|---|---|---|---|
| 6 | | | become charged / loses or gains electrons [1]<br><br>(then) become earthed / charge or electrons transferred to make object neutral [1] | 2 | **allow** examples of becoming charged e.g. (insulating) materials rubbing together / taking sweater off / walking on carpet [1]<br><br>**allow** when touching something that is earthed [1]<br><br>**BUT**<br><br>**allow** touching charged object causes current to flow to earth [2]<br><br>**Examiner's Comments**<br><br>The explanation of electron movement and earthing was poorly described by most candidates. Very few achieved [2] marks. |
| | | | Total | 2 | |

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| Question | | | Answer/Indicative content | Marks | Guidance |
|---|---|---|---|---|---|
| 7 | | i | (electrostatic) voltage increases with distance / AW [1]<br><br>(idea of) voltage related to charge / electrons [1]<br><br>the increase in (electrostatic) voltage is faster at the start / increases slower at the end / the increase is not linear [1] | 2 | **allow** the (electrostatic) voltage increases as more electrons are transferred (1)<br><br>**Eg**. the (electrostatic) voltage increases with distance as he gains more (negative) charge or electrons [2]<br><br>**allow** there is a steeper gradient at the start (1)<br>**allow** trend shown with data from the graph: e.g. (electrostatic) voltage rises from 0 to 6kV in 2 metres but by only 2 in the next 3 metres [2]<br><br>Examiner's Comments<br><br>This question asked candidates to interpret and make conclusions from a graph of electrostatic voltage. Some answers failed to mention distance at all. Most though described the voltage increasing with distance [1] with rather fewer describing the reduced build up at higher distances or voltage. Also included were many part a) type answers talking about friction or transfer of electrons. |

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| Question | | | Answer/Indicative content | Marks | Guidance |
|---|---|---|---|---|---|
| | | ii | **more moisture** in air / surroundings / clothing / shoes / carpet [1]<br><br>**idea of more conductive** air / surroundings / clothing / shoes / carpet [1]<br><br>less friction / rubbing [1] | 1 | **Eg**. Wet day / wet shoes [1]<br><br>**allow** idea of less insulated [1]<br>**allow** more charge has leaked away (to earth) [1]<br>allow bare feet / use of anti-static spray [1]<br><br>**allow** idea that feet are picked up or feet are not dragged along the carpet (1)<br>**ignore** speed of walking [1]<br><br>Examiner's Comments<br><br>Some candidates gave insufficient or incorrect detail to score. Some simply described the difference in the pattern to day 1 – eg 'it's a lower voltage'. The concept of 'wet' was rare with the majority of responses correctly explaining it in terms of 'less friction' or wearing less insulating shoes. |
| | | | Total | 3 | |

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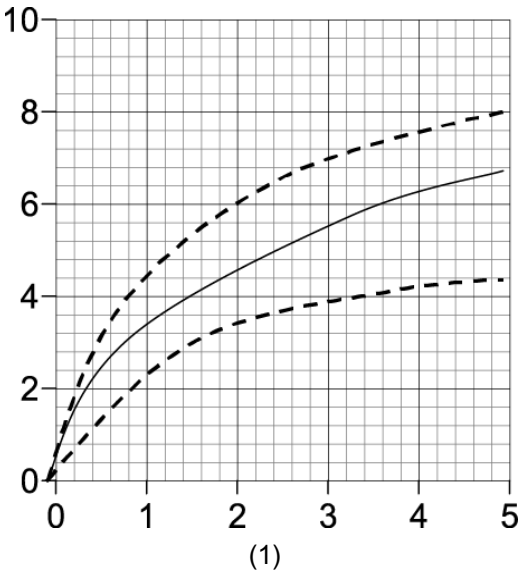
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| Question | | | Answer/Indicative content | Marks | Guidance |
|---|---|---|---|---|---|
| 8 | a | | **any one from**<br><br>gains charge from the carpet (1)<br><br>idea of friction (between carpet and feet (1)<br><br>the carpet is an insulator or his shoes are an insulator (1)<br><br>he gains electrons / he loses electrons (1)<br><br>**any one from**<br>he touches another person (1)<br><br>he touches something metal (1)<br><br>(idea that) he is earthed (1)<br><br>(idea that) he is discharged (1) | 2 | **NOT** Positive electrons<br>Ignore ions<br><br>Examiner's Comments<br><br>??This context about charging while walking across a nylon carpet is familiar. Many scored one mark for the idea of friction leading to charging but as in 2014 the explanation of electron movement and most candidates poorly described earthing. |
| | b | i | electrostatic voltage or charge increases (with distance) AW (1)<br><br>(idea of) voltage related to charge / electrons [1]<br><br>**but**<br><br>the increase in electrostatic voltage is faster at the start / increases slower at the end / the increase is not linear (2) | 2 | **eg**. the electrostatic voltage increases (with distance) as he gains (negative) charge or electrons [2]<br><br>**allow** there is a steeper gradient at the start (1)<br><br>**allow** trend shown with data from the graph: e.g. electrostatic voltage rises to 6kV in 2 metres but by only 2 in the next 3 metres [2]<br><br>Examiner's Comments<br><br>Most scored one mark for the simple relationship shown in the graph but very few achieved two marks and were not able to describe how the rate of charging with distance reduced. |

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| Question | | | Answer/Indicative content | Marks | Guidance |
|---|---|---|---|---|---|
| | | ii | (idea that) greater voltage (gained) when there is less humidity / ORA<br><br>Or<br><br>idea that increase is more when there is less humidity / ORA (1) | 1 | **answer needs to be comparative with reference to humidity**<br><br>**allow** more charge leaks away on a humid day (1)<br><br>Examiner's Comments<br><br>Most could correctly use the graph to compare charging on days with differing levels of humidity [1]. |
| | | iii | curved line starting a (0,0) with similar shape to those on graph but between the two lines (1) | 1 | **allow** any curved line starting at (0,0) and between the two lines on graph e.g.<br><br><br>(1)<br><br>**BUT** any line that touches either of the two original lines after the start scores (0)<br><br>Examiner's Comments<br><br>It was very pleasing that nearly all candidates could interpolate the data to sketch the line for an intermediate level of humidity. |

| Question | | | Answer/Indicative content | Marks | Guidance |
|---|---|---|---|---|---|
| | | | Total | 6 | |
| 9 | | | **Level 3: (5–6 marks)**<br>**Detailed explanation of results**<br>**AND**<br>**useful and nuisance given.**<br>Quality of written communication does not impede communication of science at this level.<br><br>**Level 2: (3–4 marks)**<br>**Simple explanation of results**<br>**AND**<br>**useful and nuisance given.**<br>Quality of written communication partly impedes communication of science at this level.<br><br>**Level 1: (1–2 marks)**<br>**Simple description of results**<br>**OR**<br>**useful**<br>**OR**<br>**nuisance given.**<br>Quality of written communication impedes the communication of science at this level<br><br>**Level 0: (0 marks)**<br>Insufficient or irrelevant science. Not worthy of credit. | 6 | This question is targeted up to grade C<br><br>Indicative scientific points may include (but are not limited to) the following:<br><br>**explanation of results**<br><br>• **insulating** materials rubbed together attract paper / **conducting** materials do not attract paper<br>• unlike charges attract / the rod is a different charge to the paper for them to attract<br>• **electrons** are transferred for attraction / no electrons are transferred for copper and steel wool<br>• electrons are negative<br><br>**description of results**<br><br>• some rubbed materials attract paper / some rubbed materials do not attract paper<br>• non metals attract paper / metals do not attract the paper<br><br>**useful static electricity**<br><br>• dusting<br>• removing soot in chimneys<br>• spray painting<br>• crop spraying<br>• defibrillators / restarting the heart<br><br>**nuisance static electricity**<br><br>• electrostatic shock<br>• clothes cling<br>• dust on TV screen |
| | | | Total | 6 | |

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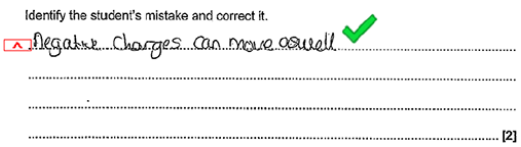
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| Question | | | Answer/Indicative content | Marks | Guidance |
|---|---|---|---|---|---|
| 10 | | | D ✓ | 1 (AO2.1) | Examiner's Comments<br><br>About two-thirds of the candidates got this question correct: the commonest wrong answer here was A, presumably looking at the symmetry in the bottom part of the diagram. |
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| Question | | | Answer/Indicative content | Marks | Guidance |
|---|---|---|---|---|---|
| 11 | | i | **Error**: only positive charges can move ✓<br><br>**Correction**: negative charges/electrons can move ✓ | 2<br>(AO3.2a)<br>(AO1.2) | **ALLOW** indication on the student's notebook<br><br>**Examiner's Comments**<br><br>A number of candidates provided the correct answer (that it is electrons that move) but did not identify that mistake in the student's homework (i.e. only positive charges can move). The two most common ways that candidates identified the student's mistake were: by putting a cross next to it on the homework sheet, or by writing that statement 4 was wrong in their answer. Over a third of candidates omitted to identify the student's mistake in their answer (see Exemplar 1 below). Candidates were instructed to do this in the stem of the question and identifying the error was the marking point for the first mark.<br><br>**AfL**<br><br>Underlining the command words can ensure that candidates answer the question that is being asked. In this example both 'identify' and 'correct' needed to be answered for both marks. Relying on the reader to assume that what the mistake is from the answer provided is testing the reader's knowledge and understanding not that of the candidate.<br><br>Exemplar 1<br><br><br><br>Exemplar 2 |

| Question | | | Answer/Indicative content | Marks | Guidance |
|---|---|---|---|---|---|
| | | | | | Identify the student's mistake and correct it.<br>not only positive charges have the ability to move<br>a negative charge is able to move<br>[2] |
| | | ii | 4A ✓ | 1<br>(AO1.2) | Examiner's Comments<br><br>Half of all candidates did know that the current must be the same both sides of the bulb. The most common misconception was attempts to calculate and answer using the data on the circuit diagram. |
| | | | **Total** | **3** | |
| 12 | | | A ✓ | 1<br>(AO2.1) | Examiner's Comments<br><br>About 80% of candidates gave the correct answer A. Common incorrect answers were randomly selected form the other distractors. |
| | | | **Total** | **1** | |

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| Question | | | Answer/Indicative content | Marks | Guidance |
|---|---|---|---|---|---|
| 13 | a | i | potential difference ✓<br><br>closed or complete circuit ✓ | 2<br>(AO2 × 1.1) | IGNORE ions / charge<br>ALLOW voltage<br><br>ALLOW higher level answers<br>eg. must have delocalised electrons / electrons that are free to move<br><br>Examiner's Comments<br><br>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<br><br>If answer = 1500 (C) award 4 marks<br><br>Q = It ✓<br><br>t = 5 × 60 = 300 (s) ✓<br><br>Q = 5 × 300 ✓<br><br>Q = 1500 (C) ✓ | 4<br><br><br><br>(AO1.1)<br><br>(AO2.1)<br><br>(AO2.1)<br><br>(AO2.1) | Examiner's Comments<br><br>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. |

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| Question | | | Answer/Indicative content | Marks | Guidance |
|---|---|---|---|---|---|
| | b | | Rod **attracts** water ✓<br><br>• Opposite charges attract ✓<br><br>• water has both + and – charges / idea of polarisation / AW ✓ | 3 (AO3 × 1.2) | **IGNORE** positive electrons / movement of protons / ions for this answer.<br>**ALLOW** Water bends or moves towards rod<br><br>**OR** for candidates that have misinterpreted the diagram as repulsion of water then **ALLOW**<br><br>Rod **repels** water / water bends or moves away from rod ✓<br><br>• Like charges repel ✓<br><br>• water has both + and – charges / idea of polarisation / AW ✓<br><br>Examiner's Comments<br><br>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 | |

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| Question | | | Answer/Indicative content | Marks | Guidance |
|---|---|---|---|---|---|
| 14 | | | C ✓ | 1 (AO1.1) | Examiner's Comments<br><br>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.<br><br>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.<br><br>It is helpful in these types of question to underline quantities as the question is read. |
| | | | Total | 1 | |
| 15 | | | D ✓ | 1 (AO1.1) | Examiner's Comments<br><br>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 | |

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| Question | | | Answer/Indicative content | Marks | Guidance |
|---|---|---|---|---|---|
| 16 | a | i | LED / cells connected the wrong way around OR ✓<br><br>Voltmeter is across the battery/cells OR voltmeter should be across the LED ✓ | 2 (AO2x3 .2a) | ALLOW diode<br><br>IGNORE voltmeter in wrong place<br><br>Examiner's Comments<br><br>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.<br><br>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:<br><br>Control/change/alter the current (in the circuit) ✓<br><br>Control/change/alter the potential difference/voltage (across the LED) ✓ | 1 (AO1.2) | DO NOT ALLOW to vary the resistan<br><br>Examiner's Comments<br><br>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). |

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| Question | | | Answer/Indicative content | Marks | Guidance |
|---|---|---|---|---|---|
| | b | i | FIRST CHECK THE ANSWER ON ANSWER LINE<br>**If answer = 100 (Ω) award 3 marks**<br><br>Resistance = potential difference ÷ current / R = V ÷ I ✓<br><br>R = 3.0 ÷ 0.03 ✓<br><br>R = 100 (Ω) ✓ | 3<br><br>(AO1.2)<br><br>(AO2.1)<br><br>(AO2.1) | <u>Examiner's Comments</u><br><br>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<br>**If answer = 4.5 (C) award 4 marks**<br><br>Charge flow = current × time / Q = I × t ✓<br><br>t = 2.5 minutes = 150 seconds ✓<br><br>Q = 0.03 x 150 ✓<br><br>Q = 4.5 (C) ✓ | 4<br><br>(AO1.2)<br><br>(AO1.2)<br><br>(AO2.1)<br><br>(AO2.1) | **ALLOW** 3 marks for an answer of 0.075 (C) (time not converted to seconds) ✓✓✓<br><br><u>Examiner's Comments</u><br><br>In this question, higher ability candidates who did not obtain the correct answer, but showed their working, could still gain marks from their working.<br><br>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<br>**If answer = 13.5 (J) award 2 marks**<br><br>E = 4.5 x 3.0 ✓<br><br>E = 13.5 (J) ✓ | 2<br><br>(AO2.1)<br><br>(AO2.1) | **ECF** from **(ii)**<br><br>**ALLOW** 14(J)<br><br><u>Examiner's Comments</u><br><br>Most candidates were able to multiply their answer to (ii) by 3.0 to gain the correct answer. |
| | | | **Total** | **12** | |
| 17 | | | **A** ✓ | 1 (AO1.1) | |
| | | | **Total** | **1** | |

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| Question | | | Answer/Indicative content | Marks | Guidance |
|---|---|---|---|---|---|
| 18 | | | C ✓ | 1 (AO1.1) | Examiner's Comments<br><br>The term 'source' was not clearly understood by some candidates. In this context a 'source of potential difference' is 'something which will give a voltage that pushes the flow of charge around the circuit.' |
| | | | Total | 1 | |
| 19 | | | FIRST CHECK THE ANSWER ON ANSWER LINE<br>If answer = 75 (C) award 3 marks | 3 | Mp1 can be assumed if correct substitution follows |
| | | | Charge flow = current × time / $Q = It$ ✓ | (AO1.2) | |
| | | | $Q$ = 2.5 x 30 ✓ | (AO2.1) | |
| | | | $Q$ = 75 (C) ✓ | (AO2.1) | No **ECF** from incorrect equation<br><br>Examiner's Comments<br><br>Although the concept of electrical charge is difficult for many GCSE candidates, and they were required to recall the equation the majority of candidates were credited with full marks here. |
| | | | Total | 3 | |

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| Question | | | Answer/Indicative content | Marks | Guidance |
|---|---|---|---|---|---|
| 20 | a | i | (Ruler has) equal numbers of protons and electrons / ORA ✓<br><br>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<br>**ALLOW** ruler has not lost/gained electrons / ORA<br>**ALLOW** ruler is/atoms are neutral unless there is a loss/gain of electrons / ORA<br>**ALLOW** if the ruler had been charged, movement of electrons (to/from the air) would discharge it<br><br>**ALLOW** overall/net charge is zero/neutral / ORA<br>**IGNORE** just charge is neutral |
| | | ii | Electrons are transferred (from/to the ruler or from/to the cloth) / ORA ✓<br><br>**And any one from:**<br>Charges are no longer equal / AW ✓<br><br>Different numbers of protons and electrons / AW ✓<br><br>Effects no longer cancel out / AW ✓ | 2 (AO2 × 1.1) | **ALLOW** electrons are lost/gained<br>**DO NOT ALLOW** protons/positive charges move<br><br>**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 ✓<br><br>**And any two from:**<br>They are being attracted ✓<br><br>The arrows show a force on the positive (charge)/(charge) B ✓<br><br>Forces/field (lines) go from positive to negative ✓<br><br>(Charge) A is negative AND (charge) B is positive ✓ | 3 (AO3 x 1.2) | **ALLOW** A is positive and B is negative for this mark only<br><br>**ALLOW** forces/field (lines) go from B to A<br><br>**ALLOW** maximum of 1 mark if described as opposite poles / positive and negative poles |

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| Question | | | Answer/Indicative content | Marks | Guidance |
|---|---|---|---|---|---|
| | | ii | **Any one from:**<br>North and South (poles) (replace positive and negative charges) ✓<br><br>The arrows/field lines go from North to South (as opposed to positive to negative) ✓<br><br>They have similar shape field (patterns) ✓<br><br>Closeness of field lines represents strength of field (in each case) ✓<br><br>Opposite <u>poles</u> (and opposite charges) attract ✓<br><br>Both show direction of field (lines)/forces ✓ | 1<br>(AO1.1) | |
| | | | **Total** | 8 | |
| 21 | | | A | 1<br>(AO2.1) | |
| | | | **Total** | 1 | |

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| Question | | | Answer/Indicative content | Marks | Guidance |
|---|---|---|---|---|---|
| 22 | a | i | (Ruler has) equal numbers of protons and electrons / ORA✓<br><br>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<br>**ALLOW** ruler has not lost/gained electrons / ORA<br>**ALLOW** ruler is / atoms are neutral unless they lose/gain electrons / ORA<br>**ALLOW** if the ruler had been charged, movement of electrons (to/from the air) would discharge it<br><br>**ALLOW** overall/net charge is zero/neutral / ORA<br>**IGNORE** just charge is neutral |
| | | ii | Electrons are transferred (from/to the ruler or from/to the cloth) / ORA ✓<br><br>**And any one from:**<br>Charges are no longer equal / AW ✓<br><br>Different numbers of protons and electrons / AW ✓<br><br>Effects no longer cancel out / AW ✓ | 2 (AO2 x 1.1) | **ALLOW** electrons are lost/gained<br>**DO NOT ALLOW** protons/positive charges move<br><br>**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 ✓<br><br>**And any two from:**<br>They are being attracted ✓<br><br>The arrows show a force on the positive (charge)/(charge) B ✓<br><br>Forces / field (lines) go from positive to negative ✓<br><br>(Charge) A is negative **AND** (charge) B is positive✓ | 3 (AO3 x 1.2) | **ALLOW** A is positive and B is negative for this mark only<br><br>**ALLOW** forces / field (lines) go from B to A<br><br>**ALLOW** maximum of 1 mark if described as positive and negative poles |

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| Question | | | Answer/Indicative content | Marks | Guidance |
|---|---|---|---|---|---|
| | | ii | **Any one from:**<br>North and South (poles) (replace positive and negative charges) ✓<br><br>The arrows/field lines go from North to South (as opposed to positive to negative) ✓<br><br>They have similar shape field (patterns) ✓<br><br>Closeness of field lines represents strength of field (in each case) ✓<br><br>Opposite <u>poles</u> (and opposite charges) attract ✓<br><br>Both show direction of field (lines) / forces ✓ | 1<br>(AO1.1) | |
| | | | **Total** | 8 | |

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