

| Question Number | Answer | Acceptable answers | Mark |
|-----------------|---------------------------------------|--------------------|------------|
| 1(a) | D : Ca(NO ₃) ₂ | | (1) |

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| 1(b) | C : 8 | | (1) |

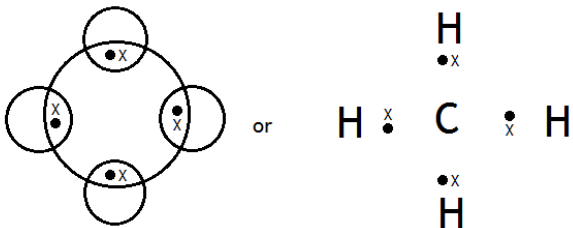
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|-----------------|--|---|------------|
| 1(c) | <p>Description including four of the following</p> <p>sodium - 2.8.1 / 1 electron in outer shell (1) sodium (atoms) lose electrons (1) one per atom (1) (forms) Na⁺ (1) sulphur - 2.8.6 / 6 electrons in outer shell (1) sulfur (atoms) gain electrons (1) two per atom (1) (forms) S²⁻ (1) two sodium atoms / ions combine with one sulfur atom / ion (1) formula is Na₂S (1)</p> | <p>Marks can be gained using diagrams</p> <p>mention of shared electrons / covalent bonding in words or diagram = max 2 marks</p> | (4) |

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|-----------------|--------------|---|------------|
| QWC | *1(d) | <p>A description including some of the following points</p> <p>solid {regular arrangement/ lattice} (of ions) sodium/Na⁺ ions chloride /Cl⁻ ions (held together by) strong (ionic) bonds strong (electrostatic) forces of attraction between oppositely charged ions / positive and negatively charged ions closely packed together (when solid) does not conduct because ions cannot move</p> <p>molten heat energy {overcomes/breaks} (strong ionic) bonds strong (electrostatic) forces of attraction between oppositely charged ions / positive and negatively charged ions ions can move (therefore) conducts when molten</p> | (6) |
| Level | 0 | No rewardable content | |
| 1 | 1 - 2 | <p>a limited explanation e.g. does not conduct when solid e.g. does conduct when molten the answer communicates ideas using simple language and uses limited scientific terminology spelling, punctuation and grammar are used with limited accuracy</p> | |
| 2 | 3 - 4 | <p>a simple explanation e.g. does not conduct when solid, does conduct when molten because {ions / particles / atoms} can move 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</p> | |
| 3 | 5 - 6 | <p>a detailed explanation e.g. solid has strong ionic bonds (between oppositely charged ions), does not conduct when solid because ions cannot move, does conduct when molten because ions can move the answer communicates ideas clearly and coherently uses a range of scientific terminology accurately spelling, punctuation and grammar are used with few errors</p> | |

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| 2(a)(i) | 4 | | (1) |

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| 2(a)(ii) | D they both have high melting points | | (1) |

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| 2(a)(iii) | <p>An explanation linking</p> <ul style="list-style-type: none"> layers can slide / move/slip (over each other) (1) (because) weak forces between layers (of atoms) (1) | <p>Any mention of ions (0)</p> <p>Ignore can be rubbed off</p> <p>Accept weak bonds for weak forces</p> <p>Accept sheets for layers</p> <p>Ignore mention of {intermolecular /intramolecular} forces/bonds</p> <p>Ignore weak forces between molecules</p> | (2) |

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| 2(b) | <p>Diagram showing</p>  <p>or</p> <ul style="list-style-type: none"> 1 shared pair between C and H (1) rest of diagram correct (1) | <p>Ignore inner electrons, even if incorrect</p> <p>Accept electrons on/in ring (if ring drawn)</p> <p>Accept all dots or all crosses</p> <p>Accept circles touching and electrons shown where they touch</p> | (2) |

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| QWC | <p data-bbox="272 286 391 323">*2(c)</p> <p data-bbox="403 286 1203 323">An explanation including some of the following points</p> <p data-bbox="403 358 678 395">Sodium chloride</p> <ul data-bbox="453 395 1342 825" style="list-style-type: none"> • contains {charged particles/ ions} • contains Na^+ and Cl^- • (regular) giant structure/lattice (hence crystalline) • strong (electrostatic) forces (of attraction) between {ions/particles}/ strong bonds between {ions/particles}/strong ionic bonds • a lot of (heat) energy is needed to separate the {ions/particles}/ a lot of (heat) energy is needed to {overcome/ break } the {forces/ bonds/ lattice} (hence high melting point) • {ions/ charged particles} free to move (so it conducts electricity) when molten/ dissolved in water <p data-bbox="403 860 512 897">Water</p> <ul data-bbox="453 897 1385 1360" style="list-style-type: none"> • covalent bonds between (hydrogen and oxygen) atoms/ (pair of) electrons shared between atoms • contains molecules • H_2O • simple molecular/ simple covalent • weak intermolecular forces/ weak {forces/ bonds} between {molecules/ particles} • not much energy needed to separate the {molecules/ particles}/ not much energy is needed to break the {forces/ bonds between particles} (hence liquid at room temperature) • does not contain any charged particles/ ions/ {delocalised/ free} electrons (hence does not conduct electricity) | (6) |

| | | |
|--------------|--------------|---|
| Level | 0 | No rewardable content |
| 1 | 1 - 2 | <ul style="list-style-type: none"> • a limited explanation of one or two points e.g. water contains molecules. • 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 of at least three points from sodium chloride or water OR a combination of three or four points from sodium chloride and water e.g. sodium chloride contains ions and water contains H₂O molecules. • 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 of at least five points, including at least one point from sodium chloride and at least one point from water e.g. sodium chloride contains ions held together by strong forces and it has a high melting point as lot of energy is needed to separate the ions, water contains molecules and has a low melting point as there are weak forces between the molecules • the answer communicates ideas clearly and coherently uses a range of scientific terminology accurately. • spelling, punctuation and grammar are used with few errors. |

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| 3(a)(i) | shared pair of electrons (between two atoms) | two shared electrons reject between two or more atoms | (1) |

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| 3(a)(ii) | D it has a low boiling point | | (1) |

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| 3(b) | <p>An description including three of the following points</p> <ul style="list-style-type: none"> • cool (to about -200 °C) / liquefy (air) (1) • fractional distillation (1) • allow to warm / heat (1) • {nitrogen / lower boiling point} obtained from top of column (1) • {oxygen / higher boiling point} obtained from bottom of column (1) | <p>mention of fractionating column/ fractionation</p> <p>ignore state of nitrogen</p> <p>ignore state of oxygen</p> <p>can be separated because they have different boiling points(1) alternative to last two points</p> | (3) |

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| QWC | *3(c) | <p>An explanation linking some of the following points</p> <ul style="list-style-type: none"> • carbon atoms joined by covalent bonds • each carbon atom bonded to three others • carbon atoms in hexagonal arrangement • layers • weak forces between layers • layers can slide (hence lubricant) • free electrons between layers • free electrons can move • and carry current (hence conduction of electricity) | (6) |
| Level | 0 | No rewardable content | |
| 1 | 1-2 | <ul style="list-style-type: none"> • a limited explanation e.g. the layers (of atoms) slide so used as lubricant • 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 e.g. the layers slide so used as lubricant and free electrons moveso conducts • 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 e.g. there are free electrons between the layers and these move to carry the current and weak forces between the layers allow them to slide over one another easily hence lubricant • the answer communicates ideas clearly and coherently uses a range of scientific terminology accurately • spelling, punctuation and grammar are used with few errors | |

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| 3(d) | electrode / brush electric motor / HT leads | | (1) |

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|-----------------|--|-----------------|---------------------|-----|---------------------|--|------|-----|------|-----|----------|--|--|--|----|--------|--|-----------------|----|--|------------|
| 4(a) | <table border="1"> <thead> <tr> <th rowspan="2"></th> <th colspan="2">symbol</th> <th colspan="2">number of electrons</th> </tr> <tr> <th>atom</th> <th>ion</th> <th>atom</th> <th>ion</th> </tr> </thead> <tbody> <tr> <td>chlorine</td> <td></td> <td></td> <td></td> <td>18</td> </tr> <tr> <td>sodium</td> <td></td> <td>Na⁺</td> <td>11</td> <td></td> </tr> </tbody> </table> | | symbol | | number of electrons | | atom | ion | atom | ion | chlorine | | | | 18 | sodium | | Na ⁺ | 11 | | (3) |
| | symbol | | number of electrons | | | | | | | | | | | | | | | | | | |
| | atom | ion | atom | ion | | | | | | | | | | | | | | | | | |
| chlorine | | | | 18 | | | | | | | | | | | | | | | | | |
| sodium | | Na ⁺ | 11 | | | | | | | | | | | | | | | | | | |

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| 4(b)(i) | $\text{NaCl} + \text{AgNO}_3 \rightarrow \text{NaNO}_3 + \text{AgCl}$ <ul style="list-style-type: none"> reactant formulae (1) product formulae (1) | $\text{Ag}^+ + \text{Cl}^- \rightarrow \text{AgCl}$ ignore state symbols do not give (2) if incorrectly balanced | (2) |

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| 4(b)(ii) | to remove other ions that would also form a white precipitate | | (1) |

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| QWC | *4(c) | <p>An explanation linking some of the following points</p> <p>For a sample to conduct electricity</p> <ul style="list-style-type: none"> • charged particles must be present • they must be free to move <p>water does not conduct because it</p> <ul style="list-style-type: none"> • is (simple molecular) covalent • exists as molecules • contains no/(very few) charged particles <p>solid sodium chloride does not conduct because</p> <ul style="list-style-type: none"> • although it contains ions / cations / anions • which are charged particles • they are not free to move • because they are held together • by strong • electrostatic forces/ ionic bonds • in lattice <p>sodium chloride solution conducts because</p> <ul style="list-style-type: none"> • ions / cations / anions are present • which are charged particles • they are free to move • because the water has cut down the forces between the ions • ions have separated • move to electrode of opposite charge | (6) |
| Level | 0 | No rewardable content | |
| 1 | 1- | <ul style="list-style-type: none"> • a limited explanation e.g. water is covalent and sodium chloride is ionic • the answer communicates ideas using simple language and uses limited scientific terminology • spelling, punctuation and grammar are used with limited accuracy | |
| 2 | 3- | <ul style="list-style-type: none"> • a simple explanation e.g. water is covalent and does not conduct because there are no charged particles: sodium chloride is ionic therefore solution conducts because ions move • 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- | <ul style="list-style-type: none"> • a detailed explanation e.g. in solid sodium chloride the ions are held in a lattice by strong forces but in sodium chloride solution the ions are free to move: water is covalent so contains no charged particles • the answer communicates ideas clearly and coherently uses a range of scientific terminology accurately • spelling, punctuation and grammar are used with few errors | |