

Question number	Answer	Additional guidance	Mark
2(a)	An explanation that combines identification via a judgement (1 mark) to reach a conclusion via justification/reasoning (1 mark): <ul style="list-style-type: none"> <li>a negative ion must have more electrons than protons in the particle (1)</li> <li>therefore Z will have a 2- charge (1)</li> </ul>	Do not allow any comparison involving neutrons.	(2)

Question number	Answer	Additional guidance	Mark
2(b)	$40 + 2 \times (14 + 16 \times 3)$ (1) = 164 (1)	Award full marks for correct numerical answer without working.	(2)

Question number	Answer	Mark
2(c)	<ul style="list-style-type: none"> <li>Li ion with empty outer shell (1)</li> <li>1+ charge on Li (1)</li> <li>8 electrons on outer shell of F (1)</li> <li>1- charge on F (1)</li> </ul>	(4)

Question number	Answer	Mark
3(a)(i)	C	(1)

Question number	Answer	Mark
3(a)(ii)	C	(1)

Question number	Answer	Mark
3(b)	Any two of the following points. For the acid, use the same: <ul style="list-style-type: none"> <li>volume (1)</li> <li>concentration (1)</li> <li>temperature (1)</li> </ul>	(2)

Question number	Answer	Mark
3(c)(i)	electrolysis (1)	(1)

Question number	Answer	Mark
3(c)(ii)	An answer that combines identification- knowledge (1 mark) and understanding (1 mark) and reasoning/justification- understanding (1 mark) <ul style="list-style-type: none"> <li>aluminium compounds are more stable than iron compounds (1)</li> <li>so carbon is not a strong enough reducing agent to produce aluminium from its ore (1)</li> </ul>	(2)

Question Number	Answer	Acceptable answers	Mark
2(a)(i)	both (pure forms of) carbon / both giant molecular		(1)

Question Number	Answer	Acceptable answers	Mark
2(a)(ii)	<p>An explanation linking <b>three</b> of the following points</p> <ul style="list-style-type: none"> <li>• (every) carbon atom forms four bonds (1)</li> <li>• strong bonds / hard to separate atoms from lattice (1)</li> <li>• covalent bonds (1)</li> <li>• no weaknesses in molecule (1)</li> </ul>		(3)

Question Number	Answer	Acceptable answers	Mark
2(a)(iii)	<p>An explanation linking the following</p> <ul style="list-style-type: none"> <li>• (in) layers (1)</li> <li>• weak forces between layers (1)</li> </ul>		(2)

Question Number	Answer	Acceptable answers	Mark
2(b)	C		(1)

Question Number	Answer	Acceptable answers	Mark
2(c)	<ul style="list-style-type: none"> <li>• four bonding pairs shown (1)</li> <li>• six non bonded electrons on each fluorine atom (1)</li> </ul>		(2)

Question Number	Answer	Acceptable answers	Mark
<b>4(b)(iv)</b>	HO	OH, O <sub>1</sub> H <sub>1</sub> , H <sub>1</sub> O <sub>1</sub>	<b>(1)</b>

Question Number	Answer	Acceptable answers	Mark
<b>5(a)(i)</b>	shared pair of electrons (between two atoms)	two shared electrons reject between two or more atoms	<b>(1)</b>

Question Number	Answer	Acceptable answers	Mark
<b>5(a)(ii)</b>	<b>D</b> it has a low boiling point		<b>(1)</b>

Question Number	Answer	Acceptable answers	Mark
<b>5(b)</b>	<p>An description including <b>three</b> of the following points</p> <ul style="list-style-type: none"> <li>• cool (to about -200 °C) / liquefy (air) (1)</li> <li>• fractional distillation (1)</li> <li>• allow to warm / heat (1)</li> <li>• {nitrogen / lower boiling point} obtained from top of column (1)</li> <li>• {oxygen / higher boiling point} obtained from bottom of column (1)</li> </ul>	<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>	<b>(3)</b>

Question Number		Indicative content	Mark
<b>QWC</b>	<b>*5(c)</b>	<p>An explanation linking some of the following points</p> <ul style="list-style-type: none"> <li>• carbon atoms joined by covalent bonds</li> <li>• each carbon atom bonded to three others</li> <li>• carbon atoms in hexagonal arrangement</li> <li>• layers</li> <li>• weak forces between layers</li> <li>• layers can slide (hence lubricant)</li> <li>• free electrons between layers</li> <li>• free electrons can move</li> <li>• and carry current (hence conduction of electricity)</li> </ul>	<b>(6)</b>
<b>Level</b>	<b>0</b>	No rewardable content	
<b>1</b>	<b>1-2</b>	<ul style="list-style-type: none"> <li>• a limited explanation e.g. the layers (of atoms) slide so used as lubricant</li> <li>• the answer communicates ideas using simple language and uses limited scientific terminology</li> <li>• spelling, punctuation and grammar are used with limited accuracy</li> </ul>	
<b>2</b>	<b>3-4</b>	<ul style="list-style-type: none"> <li>• a simple explanation e.g. the layers slide so used as lubricant and free electrons moveso conducts</li> <li>• the answer communicates ideas showing some evidence of clarity and organisation and uses scientific terminology appropriately</li> <li>• spelling, punctuation and grammar are used with some accuracy</li> </ul>	
<b>3</b>	<b>5 -6</b>	<ul style="list-style-type: none"> <li>• 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</li> <li>• the answer communicates ideas clearly and coherently uses a range of scientific terminology accurately</li> <li>• spelling, punctuation and grammar are used with few errors</li> </ul>	

Question Number	Answer	Acceptable answers	Mark
<b>5(d)</b>	electrode / brush electric motor / HT leads		<b>(1)</b>

Question Number	Indicative content	Mark
<b>QWC</b>	<p><b>*6(c)</b> An explanation linking some of the following points</p> <p>For a sample to conduct electricity</p> <ul style="list-style-type: none"> <li>• charged particles must be present</li> <li>• they must be free to move</li> </ul> <p>water does not conduct because it</p> <ul style="list-style-type: none"> <li>• is (simple molecular) covalent</li> <li>• exists as molecules</li> <li>• contains no/(very few) charged particles</li> </ul> <p>solid sodium chloride does not conduct because</p> <ul style="list-style-type: none"> <li>• although it contains ions / cations / anions</li> <li>• which are charged particles</li> <li>• they are not free to move</li> <li>• because they are held together</li> <li>• by strong</li> <li>• electrostatic forces/ ionic bonds</li> <li>• in lattice</li> </ul> <p>sodium chloride solution conducts because</p> <ul style="list-style-type: none"> <li>• ions / cations / anions are present</li> <li>• which are charged particles</li> <li>• they are free to move</li> <li>• because the water has cut down the forces between the ions</li> <li>• ions have separated</li> <li>• move to electrode of opposite charge</li> </ul>	<b>(6)</b>
<b>Level</b>	<b>0</b>	No rewardable content
<b>1</b>	<b>1-2</b>	<ul style="list-style-type: none"> <li>• a limited explanation e.g. water is covalent and sodium chloride is ionic</li> <li>• the answer communicates ideas using simple language and uses limited scientific terminology</li> <li>• spelling, punctuation and grammar are used with limited accuracy</li> </ul>
<b>2</b>	<b>3-4</b>	<ul style="list-style-type: none"> <li>• 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</li> <li>• the answer communicates ideas showing some evidence of clarity and organisation and uses scientific terminology appropriately</li> <li>• spelling, punctuation and grammar are used with some accuracy</li> </ul>
<b>3</b>	<b>5-6</b>	<ul style="list-style-type: none"> <li>• 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</li> <li>• the answer communicates ideas clearly and coherently uses a range of scientific terminology accurately</li> <li>• spelling, punctuation and grammar are used with few errors</li> </ul>

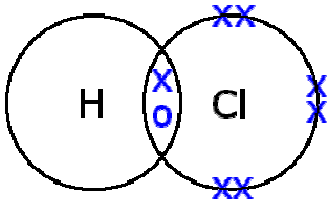
**GCSE Chemistry 5CH2H/01 Mark Scheme – November 2012**

Question Number	Answer	Acceptable answers	Mark
<b>1(a)</b>	C : copper sulfate and sodium chloride		<b>(1)</b>

Question Number	Answer	Acceptable answers	Mark
<b>1(b)</b>	copper sulfate (1) blue-green (1) or sodium chloride (1) yellow (1) colour mark consequential on correct metal (compound)	allow blue or green or green-blue  reject orange and yellow-orange	<b>(2)</b>

Question Number	Answer	Acceptable answers	Mark
<b>1(c)(i)</b>	An explanation linking  weak <b>inter</b> molecular forces / weak forces between <b>molecules</b> (1)  little {heat / energy} needed to separate (molecules) (1)	bonds / attractions in place of forces  intermolecular forces between {atoms / bonds} loses 1 <sup>st</sup> marking point  any answer in terms of covalent or ionic bonding scores zero	<b>(2)</b>

Question Number	Answer	Acceptable answers	Mark
<b>1(c)(ii)</b>	A description linking  use separating funnel (1)  run off lower {layer / liquid} / OWTTE (1)	alternative description of separating funnel eg funnel with a tap at the bottom suitable labelled diagram burette  allow layers / liquids to separate  ignore fractional distillation	<b>(2)</b>

Question Number	Answer	Acceptable answers	Mark
<b>1(d)</b>	 <p data-bbox="336 533 807 640">shared pair in molecule (1) rest of molecule consequent on first mark (1)</p>	<p data-bbox="869 349 1331 421">Allow a diagram without labels for 2 marks</p> <p data-bbox="869 600 1295 672">any symbols shown must be correct for the 2<sup>nd</sup> mark</p> <p data-bbox="869 707 1318 779">allow any combination of dots and crosses for electrons</p> <p data-bbox="869 815 1342 846">wrong compound = zero marks</p>	<b>(2)</b>

Question Number	Answer	Acceptable answers	Mark
<b>6(a)</b>	D : Ca(NO <sub>3</sub> ) <sub>2</sub>		<b>(1)</b>

Question Number	Answer	Acceptable answers	Mark
<b>6(b)</b>	C : 8		<b>(1)</b>

Question Number	Answer	Acceptable answers	Mark
<b>6(c)</b>	<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<sup>+</sup> (1)  sulphur - 2.8.6 / 6 electrons in outer shell (1)  sulfur (atoms) gain electrons (1)  two per atom (1)  (forms) S<sup>2-</sup> (1)  two sodium atoms / ions combine with one sulfur atom / ion (1)  formula is Na<sub>2</sub>S (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>	<b>(4)</b>

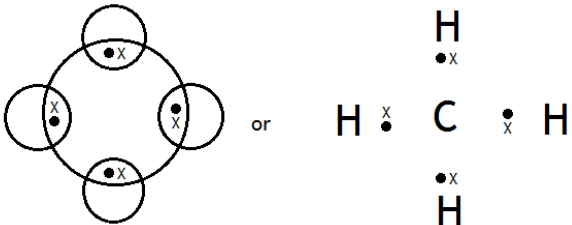


Question Number		Indicative Content	Mark
<b>QWC</b>	<b>*6(d)</b>	<p>A description including some of the following points</p> <p><b>solid</b>            {regular arrangement/ lattice} (of ions)            sodium/Na<sup>+</sup> ions            chloride /Cl<sup>-</sup> ions            (held together by)            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><b>molten</b>            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>	<b>(6)</b>
<b>Level I</b>	<b>0</b>	No rewardable content	
<b>1</b>	<b>1 - 2</b>	<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>	
<b>2</b>	<b>3 - 4</b>	<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>	
<b>3</b>	<b>5 - 6</b>	<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>	

Question Number	Answer	Acceptable answers	Mark
<b>6(a)(i)</b>	4		<b>(1)</b>

Question Number	Answer	Acceptable answers	Mark
<b>6(a)(ii)</b>	<b>D</b> they both have high melting points		<b>(1)</b>

Question Number	Answer	Acceptable answers	Mark
<b>6(a)(iii)</b>	<p>An explanation linking</p> <ul style="list-style-type: none"> <li>layers can slide / move/slip (over each other) <b>(1)</b></li> <li>(because) weak forces between layers (of atoms) <b>(1)</b></li> </ul>	<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>	<b>(2)</b>

Question Number	Answer	Acceptable answers	Mark
<b>6(b)</b>	<p>Diagram showing</p>  <ul style="list-style-type: none"> <li>1 shared pair between C and H <b>(1)</b></li> <li>rest of diagram correct <b>(1)</b></li> </ul>	<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>	<b>(2)</b>

Question Number	Indicative Content	Mark
<b>QWC</b>	<p data-bbox="236 275 355 315"><b>*6(c)</b></p> <p data-bbox="368 275 1166 315">An explanation including some of the following points</p> <p data-bbox="368 349 644 383"><b>Sodium chloride</b></p> <ul data-bbox="421 387 1307 813" style="list-style-type: none"> <li>• contains {charged particles/ ions}</li> <li>• contains Na<sup>+</sup> and Cl<sup>-</sup></li> <li>• (regular) giant structure/lattice (hence crystalline)</li> <li>• strong (electrostatic) forces (of attraction) between {ions/particles}/ strong bonds between {ions/particles}/strong ionic bonds</li> <li>• 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)</li> <li>• {ions/ charged particles} free to move (so it conducts electricity) when molten/ dissolved in water</li> </ul> <p data-bbox="368 846 477 880"><b>Water</b></p> <ul data-bbox="421 884 1350 1344" style="list-style-type: none"> <li>• covalent bonds between (hydrogen and oxygen) atoms/ (pair of) electrons shared between atoms</li> <li>• contains molecules</li> <li>• H<sub>2</sub>O</li> <li>• simple molecular/ simple covalent</li> <li>• weak intermolecular forces/ weak {forces/ bonds} between {molecules/ particles}</li> <li>• 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)</li> <li>• does not contain any charged particles/ ions/ {delocalised/ free} electrons (hence does not conduct electricity)</li> </ul>	<b>(6)</b>

Level	0	No rewardable content
1	1 - 2	<ul style="list-style-type: none"> <li>• a limited explanation of one or two points e.g. water contains molecules.</li> <li>• the answer communicates ideas using simple language and uses limited scientific terminology.</li> <li>• spelling, punctuation and grammar are used with limited accuracy.</li> </ul>
2	3 - 4	<ul style="list-style-type: none"> <li>• 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 H<sub>2</sub>O molecules.</li> <li>• the answer communicates ideas showing some evidence of clarity and organisation and uses scientific terminology appropriately.</li> <li>• spelling, punctuation and grammar are used with some accuracy.</li> </ul>
3	5 - 6	<ul style="list-style-type: none"> <li>• a detailed explanation of at least five points, including at least one point from sodium chloride <b>and</b> 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</li> <li>• the answer communicates ideas clearly and coherently uses a range of scientific terminology accurately.</li> <li>• spelling, punctuation and grammar are used with few errors.</li> </ul>

Total for Question 6 = 12 marks

Question Number	Answers	Acceptable Answers	Mark	
<b>5 (a)(i)</b>	chlorine-35	chlorine-37		
	number of protons	<b>17</b>		<b>17</b>
	number of neutrons	<b>18</b>		<b>20</b>
	number of electrons	<b>17</b>		<b>17</b>
	the four 17s (1)		<b>(2)</b>	
	the 18 and 20 (1)			

Question Number	Answers	Acceptable Answers	Mark
<b>5 (a)(ii)</b>	An explanation linking  M1 average (mass of atoms/isotopes present) (1)  M2 more chlorine-35 than chlorine-37 / higher {percentage / abundance} of Cl-35 / lower {percentage / abundance} of Cl-37 / (1)	mean ignore weight  75% chlorine-35 / 25% chlorine-37/ chlorine-35 and chlorine-37 in ratio 3:1 / correct calculation to obtain 35.5 (2) eg[(75x35) + (25x37)]/100	<b>(2)</b>

Question Number	Answers	Acceptable Answers	Mark
<b>5 (b)</b>	Diagram showing one carbon and four chlorines  four pairs of electrons shared between the carbon and chlorine atoms (1)  fully correct (1)	use of dots or crosses or mixture of both  ignore inner shells even if incorrect ignore symbols	<b>(2)</b>

Question Number	Indicative Content	Mark
<b>QWC</b>	<p data-bbox="277 184 375 216"><b>*5(c)</b></p> <p data-bbox="402 184 1094 216">A response including some of the following points</p> <p data-bbox="402 247 1221 279">Note: (carbon to carbon) strong bonds is given in question</p> <p data-bbox="402 310 542 342">Diamond:</p> <p data-bbox="402 380 683 411">Uses and Properties</p> <ul data-bbox="451 449 857 646" style="list-style-type: none"> <li>•! in cutting tools/engraving</li> <li>•! drill bit</li> <li>•! jewellery</li> <li>•! diamond very hard/strong</li> <li>•! attractive/lustrous</li> <li>•! high melting point</li> </ul> <p data-bbox="402 716 581 747">Explanations</p> <ul data-bbox="451 785 1240 947" style="list-style-type: none"> <li>•! giant molecular/covalent</li> <li>•! each carbon atom bonded to four other carbon atoms</li> <li>•! three dimensional structure</li> <li>•! to break it lots of bonds would need to be broken</li> <li>•! would need lot of energy/force</li> </ul> <p data-bbox="402 1016 537 1047">Graphite:</p> <p data-bbox="402 1085 691 1117">Uses and Properties</p> <ul data-bbox="451 1155 886 1352" style="list-style-type: none"> <li>•! to make electrodes</li> <li>•! a lubricant</li> <li>•! sporting equipment</li> <li>•! in pencils/drawing</li> <li>•! graphite conducts electricity</li> <li>•! soft</li> </ul> <p data-bbox="402 1383 581 1415">Explanations</p> <ul data-bbox="451 1453 1256 1719" style="list-style-type: none"> <li>•! giant molecular/covalent</li> <li>•! each carbon atom bonded to three other carbon atoms</li> <li>•! each carbon atom has a free electron</li> <li>•! delocalised electrons</li> <li>•! (delocalised) electrons move to carry current</li> <li>•! layers of carbon atoms</li> <li>•! weak forces/bonds between layers/sheets</li> <li>•! so layers/sheets can slide/rub off or over each other</li> </ul>	<b>(6)</b>

**(total for Question 5 = 12 marks)**

<b>Level</b>	<b>0</b>	No rewardable content
<b>1</b>	<b>1 - 2</b>	<ul style="list-style-type: none"> <li>•! a limited description eg for either diamond <b>or</b> graphite states a correct Use <b>or</b> Property</li> <li>•! the answer communicates ideas using simple language and uses limited scientific terminology</li> <li>•! spelling, punctuation and grammar are used with limited accuracy</li> </ul>
<b>2</b>	<b>3 - 4</b>	<ul style="list-style-type: none"> <li>•! a simple description/explanation  eg for <b>both</b> diamond <b>and</b> graphite states a correct Use <b>or</b> Property linked with at least <b>one relevant</b> explanation point  <b>OR</b>  for <b>either</b> diamond <b>or</b> graphite States a correct Use or Property linked to at least <b>two relevant</b> explanation points</li> <li>•! the answer communicates ideas showing some evidence of clarity and organisation and uses scientific terminology appropriately</li> <li>•! spelling, punctuation and grammar are used with some accuracy</li> </ul>
<b>3</b>	<b>5 - 6</b>	<ul style="list-style-type: none"> <li>•! a detailed explanation eg for <b>both</b> diamond <b>and</b> graphite States a correct Use or Property linked to at least <b>three relevant</b> explanation points (in total) <b>OR</b> for <b>either</b> diamond <b>or</b> graphite States a correct Use or Property linked to at least <b>four relevant</b> explanation points (in total)</li> <li>•! the answer communicates ideas clearly and coherently uses a range of scientific terminology accurately</li> <li>•! spelling, punctuation and grammar are used with few errors</li> </ul>