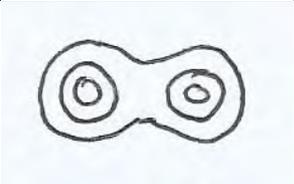
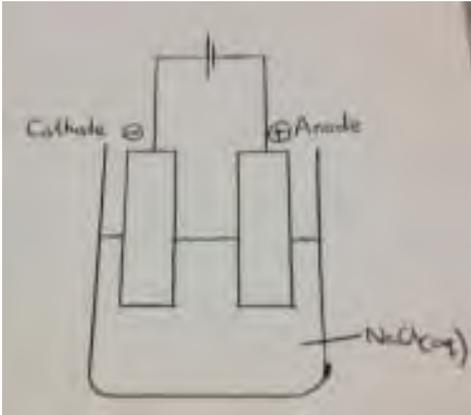


Question Number	Acceptable Answers	Reject	Mark
<b>1(a)</b>	 <p>Drawing must have at least 1 circle around each chlorine atom</p> <p>OR</p>  <p>Random dots to indicate electron density around both chlorine atoms and a concentrated area between the atoms</p>		<b>1</b>

Question Number	Acceptable Answers	Reject	Mark
<b>1(b)</b>	<p>(Electrostatic) <b>attraction</b> between oppositely charged ions</p> <p>IGNORE comments on the formation of ions</p>		<b>1</b>

Question Number	Acceptable Answers	Reject	Mark
<b>1(c)</b>	<p><b>Marking point 1</b>            Either</p> <p>Diagram of U-tube / beaker with electrodes and sodium chloride solution</p> <p>OR</p> <p>Diagram of microscope slide with electrodes attached and either filter paper soaked in sodium chloride solution or dampened/wet filter paper on the top of the slide with the sample added (in the centre)</p> <p style="text-align: right;">(1)</p> <p><b>Marking point 2</b>            Suitable circuit</p> <p style="text-align: right;">(1)</p> <p>If electrodes labelled <math>\pm</math> or named they must be consistent with the cell            For example the following would not score this marking point:</p>  <p><b>Marking point 3</b>            Ammeter/ light bulb showing conductivity            OR            Chlorine (gas) evolved/ Test for chlorine/hydrogen (gas) evolved/Test for hydrogen</p> <p style="text-align: right;">(1)</p> <p>ALLOW any other reasonable electrolysis apparatus that would work to show ionic bonding.</p> <p>For MP3 if the electrode at which the gas is</p>	<p>Sodium electrode</p> <p>Sodium formed</p>	<p><b>3</b></p>

	evolved is stated then it must have the correct sign or charge, although it is not necessary to name or give a sign for the electrode, ie chlorine at the electrode with a positive sign and hydrogen at the electrode with a negative sign.		
	Use of other ionic compounds can only score MP2		

Question Number	Acceptable Answers	Reject	Mark
<b>1(d)(i)</b>	Correct dot and cross diagram with charge  Example $\left[ \begin{array}{c} \text{XX} \\ \text{XX Cl X}\bullet \\ \text{XX} \end{array} \right]^-$  ALLOW all dots or all crosses  IGNORE any sodium dot and cross diagram		<b>1</b>

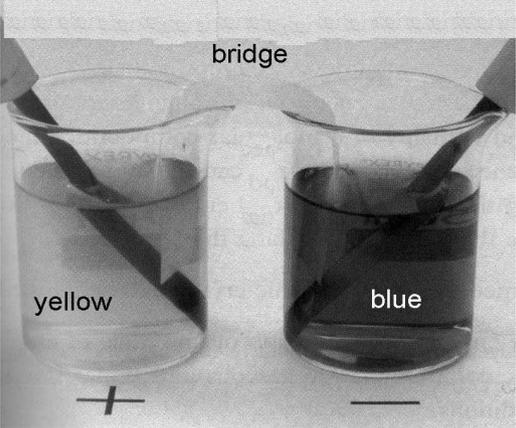
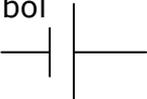
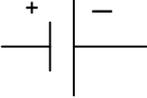
Question Number	Acceptable Answers	Reject	Mark
<b>1(d)(ii)</b>	(Isoelectronic example) $S^{2-}/S^{-2}/P^{3-}/P^{-3}$	$Si^{4+}/K^{+}/Ca^{2+}/Ar$	<b>1</b>

Question Number	Acceptable Answers	Reject	Mark
<b>11(e)</b>	<p style="text-align: center;"><b>Marking point 1</b></p> Sodium conducts when solid (and liquid/molten) (1) <p style="text-align: center;"><b>Marking point 2</b></p> Sodium chloride conducts when molten (and in solution but not as a solid) (1) <p style="text-align: center;"><b>Marking point 3</b></p> Charge carriers in sodium are (delocalised) electrons but ions in sodium chloride  OR  Conductivity in sodium due to the movement of (delocalised) electrons but the movement of ions in sodium chloride (1)	Sodium in solution/dissolved	<b>3</b>

Question Number	Acceptable Answers	Reject	Mark
<b>2 (a)</b>	<p><b>(i) Structure</b> Lattice /close-packed <b>(1)</b></p> <p>(or a diagram with at least 3 rows)</p> <p>positive ions or cations (allow metal ions) <b>(1)</b></p> <p>delocalized electrons / sea of electrons <b>(1)</b></p> <p><b>(ii) Bond</b> (Electrostatic) <b>attraction</b> between positive ions / cations (allow metal ions) and delocalized electrons / sea of electrons <b>(1)</b></p>	layers protons 'free' electrons	<b>4</b>

Question Number	Acceptable Answers	Reject	Mark
<b>2 (b)</b>	<p>Any three from</p> <ol style="list-style-type: none"> <li>1. Magnesium ion / <math>Mg^{2+}</math> (allow magnesium) has a larger charge (density) than the sodium ion (allow sodium) / <math>Na^+</math> some comparison of the ions is required <b>(1)</b></li> <li>2. magnesium ions / <math>Mg^{2+}</math> smaller than sodium ions <b>(1)</b></li> <li>3. Magnesium / <math>Mg^{2+}</math> contributes two / more electrons (per atom) to the "sea" of electrons <b>(1)</b></li> <li>4. magnesium ions / <math>Mg^{2+}</math> have greater attraction for the delocalized "sea" of electrons <b>(1)</b></li> </ol> <p>Ignore reference to number of outer electrons in Mg / Na Any references to the bonding being ionic, covalent or intermolecular (max 2)</p> <p>Reverse argument can gain full marks</p>	<p>Just <math>Mg^{2+}</math> and <math>Na^+</math></p> <p>More bonds</p>	<b>3</b>

Question Number	Acceptable Answers	Reject	Mark
<b>2 (c)</b>	The delocalized electrons / sea of electrons <b>(1)</b>  Flow (allow move / free to move) <b>(1)</b> (When a potential difference/voltage is applied)  'Carry the current' is not sufficient for the mark	'free' electrons	<b>2</b>

Question Number	Acceptable Answers	Reject	Mark
3(a)	<p><b>First mark:</b>  <b>Diagram</b> showing U-tube OR filter paper on a microscope slide OR electrodes in a beaker OR other feasible set-up such as</p>  <p><b>but a + and a – sign must be shown somewhere on the diagram by signs or words, positive and negative.</b></p> <p><b>NOTES</b>  If set-up in the picture above is used, in addition to the + and – signs a bridge between the two beakers must also be shown.  External circuits do not have to be complete (e.g. wires can be shown attached to a slide, provided the + and – labels included).</p> <p><b>If</b> the words cathode and/or anode are included, for the first mark to be awarded the cathode must be shown as –ve and/or the anode as +ve</p> <p><b>If</b> a battery symbol</p>  <p>shown, IGNORE any incorrect polarities, that is</p>  <p><b>IGNORE</b> any electrode materials <b>EXCEPT</b> <math>\text{Cu}^{2+}</math> and/or <math>\text{CrO}_4^{2-}</math> <b>(1)</b></p>		4

	<p><b>Second mark:</b> Description to include the idea that the <b>ions move/ions are mobile/ions migrate</b> <b>MUST BE IN WORDS</b></p> <p>ALLOW if description focuses on the movement of one of the ions to the oppositely-charged electrode <b>(1)</b></p> <p><b>Third mark:</b> Yellow ion/yellow (colour)/<math>\text{CrO}_4^{2-}</math> moves towards the/+ve (electrode)/anode <b>(1)</b></p> <p><b>Fourth mark:</b> Blue ion/blue (colour)/<math>\text{Cu}^{2+}</math> moves towards cathode /-ve (electrode) <b>(1)</b></p> <p>Mark CQ on candidate's cathode and anode signs for the <b>3<sup>rd</sup></b> and <b>4<sup>th</sup></b> marks</p>	<p><b>Just</b> ions are attracted to the electrodes of opposite charge</p>	
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Question Number	Acceptable Answers	Reject	Mark
<b>3(b)(i)</b>	(Forces of attraction between) oppositely-charged ions/positive and negative ions/cations and anions IGNORE comments about electron transfer	Just ionic bonds/ Just "electrostatic forces of attraction"	<b>1</b>

Question Number	Acceptable Answers	Reject	Mark
<b>3(b)(ii)</b>	<p><b>First mark:</b> Ions of the same charge (repel)/positive ions (repel)/negative ions (repel) <b>(1)</b></p> <p><b>Second mark:</b> Nuclei (of the ions repel) ALLOW 'protons' (in the ions repel) OR Electron clouds OR electrons (in the ions repel) <b>(1)</b></p>	<p><b>"Magnetic repulsion"</b> negates first mark</p> <p>"Electrons repel nuclei"</p>	<b>2</b>

Question Number	Acceptable Answers	Reject	Mark
<b>3(c)(i)</b>	$\text{Mg}^{2+}(\text{g})$ <b>(1)</b> $\text{O}^{2-}(\text{g})$ <b>(1)</b>  Penalise missing /incorrect state symbols once only  Max 1 if include "2e <sup>-</sup> "		<b>2</b>

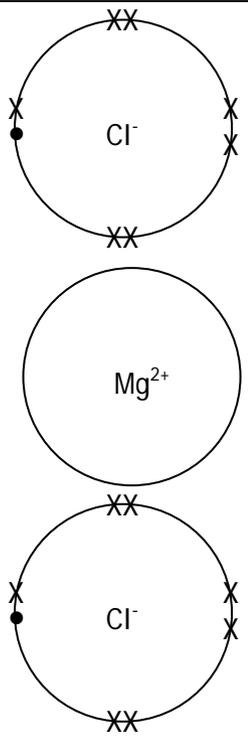
Question Number	Acceptable Answers	Reject	Mark
<b>3(c)(ii)</b>	<p>(<b>A</b> is enthalpy change of) <b>formation</b> (of MgO) <b>(1)</b>            ALLOW just "<math>\Delta H_f</math>"            ALLOW (enthalpy change of) combustion <b>of magnesium</b></p> <p>(<b>C</b> is) (sum of) first plus second ionization energies (of Mg) / <math>\text{IE}_1 + \text{IE}_2</math> (for Mg) <b>(1)</b></p> <p>ALLOW "first and second ionization energies (of Mg)"</p> <p>IGNORE references to "standard"</p>	<p>"(enthalpy change of) <b>reaction</b>"</p> <p>Just "ionization energy"/ "second ionization energy" (of Mg)</p>	<b>2</b>

Question Number	Acceptable Answers	Reject	Mark
<b>3(c)(iii)</b>	<p>(<b>F</b> =) A - B - C - D - E            NOTE: These letters may be in any order, but the signs <b>MUST</b> be correct</p> <p>ALLOW answers when the enthalpy changes are identified correctly in words or symbols in lieu of the letters</p>		<b>1</b>

Question Number	Acceptable Answers	Reject	Mark
<b>3(d)(i)</b>	<p><b>First mark:</b>  <b>Mg<sup>2+</sup> AND O<sup>2-</sup></b> higher charge /  <b>Mg<sup>2+</sup> AND O<sup>2-</sup></b> higher charge density (than Mg<sup>+</sup> and O<sup>-</sup>)            NOTE: <b>both</b> ions needed <b>(1)</b></p> <p><b>Second mark:</b>            Mg<sup>2+</sup> smaller (than Mg<sup>+</sup>) <b>(1)</b></p> <p>IGNORE comparisons of the relative sizes of O<sup>-</sup> with O<sup>2-</sup> even if INCORRECT</p> <p>IGNORE any references to polarization (of ions) and/or covalent character</p>	Any mention of 'intermolecular forces' scores <b>(0)</b> overall for this question	<b>2</b>

Question Number	Acceptable Answers	Reject	Mark
<b>3(d)(ii)</b>	<p>(Lattice energy of Mg<sup>2+</sup>O<sup>2-</sup> is) more exothermic/more negative</p> <p>ALLOW greater/increased/higher/more/larger/bigger</p> <p>IGNORE "stronger lattice"</p>	"energy <b>required</b> " OR Lower/less/smaller	<b>1</b>

Question Number	Acceptable Answers	Reject	Mark
4 (a)	$(1s^2 2s^2) 2p^6 3s^2 3p^5$ (ignore repetition of $1s^2 2s^2$ ) <i>ALLOW</i> subscripts, correct use of $p_x$ , $p_y$ and $p_z$ orbitals or normal font for electrons	2 8 7	1

Question Number	Acceptable Answers	Reject	Mark
4 (b) (i)	 <p>Correct number of outer electrons (ignore whether dots and / or crosses) drawn <b>and also</b> ratio of magnesium : chloride ions is 1:2 (1)</p> <p>Correct formulae and charges of the ions shown somewhere (1)</p> <p><b>NOTE:</b> Diagram for <math>Mg^{2+}</math> showing the outermost shell with <math>8e^-</math> (dots and/or crosses) and/or <math>Cl^-</math> shown with a 2 in front or 2 as a subscript would also score both marks</p> <p><b>Mark the two points independently</b></p>	Covalent bonding (0)	2

Question Number	Acceptable Answers	Reject	Mark
4 (b) (ii)	<p>4 shared pairs of electrons around the carbon labelled C (1)</p> <p>ALL outer electrons, including lone pairs, are correctly shown on each of the four chlorine atoms labelled Cl (1)</p> <p><i>ALLOW</i> versions without circles</p> <p><i>IGNORE</i> lines between the shared electrons</p> <p><b>Mark two points independently</b></p>	Ionic bonding (0)	2

Question Number	Acceptable Answers	Reject	Mark
4 (b) (iii)	<p>(Comparison of) charges: <math>O^{2-}</math> ions whereas <math>Cl^{-}</math> ions</p> <p>OR</p> <p>Statement to the effect that oxide ion has a greater (negative) charge / greater charge density than the chloride ion (1)</p> <p>(so the force of) attraction between <b>ions</b> is stronger in MgO (than <math>MgCl_2</math>) / stronger <b>ionic</b> bonding in MgO (than <math>MgCl_2</math>) (1)</p> <p>More <b>energy</b> is required to separate the ions in MgO (than <math>MgCl_2</math>) / more <b>energy</b> is required to break (ionic) bonds in MgO (than <math>MgCl_2</math>) / (1)</p> <p><b>Mark the above three points independently</b></p> <p><i>NOTE ALTERNATIVE ANSWER WITH A MAXIMUM OF TWO MARKS:-</i></p> <p><math>O^{2-}</math> (ions) smaller (than <math>Cl^{-}</math> ions) (1)</p> <p>so (force of) attraction between <b>ions</b> is stronger in MgO (than <math>MgCl_2</math>) / stronger <b>ionic</b> bonding in MgO (than <math>MgCl_2</math>) (1)</p> <p>Ignore <i>ANY</i> references to polarization of ions / covalent character / degree of covalency.</p> <p><b>Mark the above two points independently</b></p>	<p>Use of term chlorine and/or oxygen "atoms" or "molecules" (0) f answer overall</p> <p>"More bonds need to be broken"</p> <p>(0) f answer overall if mentions "intermolecular forces"</p>	3

Question Number	Acceptable Answers	Reject	Mark
4 (c)	<p><b>First Mark:</b></p> <p><i>EITHER</i>  Magnesium reacts with chlorine to form only magnesium chloride/    magnesium reacts with chlorine to form only one product /    magnesium reacts with hydrochloric acid to form hydrogen (as well as magnesium chloride) /    magnesium reacts with hydrochloric acid to form more than one product /    magnesium reacts with hydrochloric acid to form a waste product</p> <p><i>OR</i></p> <p>Both equations <math>Mg + Cl_2 \rightarrow MgCl_2</math> and <math>Mg + 2HCl \rightarrow MgCl_2 + H_2</math>    <i>IGNORE</i> state symbols, even if incorrect (1)</p> <p><b>Second Mark:</b></p> <p><i>EITHER</i>  The reaction with chlorine has an atom economy which is higher /100%    ALLOW "high"</p> <p><i>OR</i></p> <p>Any mention of numbers comparing 100 % v. 97.9% (1)</p> <p><i>IGNORE</i> any comments about yield</p> <p><b>Mark the two points independently</b></p>		2