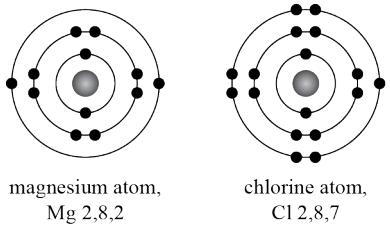
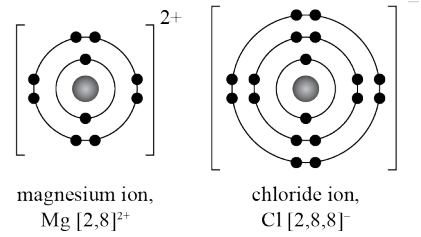


## Assessment Schedule – 2014

## Chemistry: Demonstrate understanding of aspects of selected elements (90933)

## Evidence Statement

Q	Evidence	Achievement	Achievement with Merit	Achievement with Excellence
ONE (a)	 <p>magnesium atom, Mg 2,8,2</p> <p>chlorine atom, Cl 2,8,7</p>	<ul style="list-style-type: none"> <li>Correct electron configurations.</li> </ul>		
(b)	 <p>magnesium ion, Mg [2,8]<sup>2+</sup></p> <p>chloride ion, Cl [2,8,8]<sup>-</sup></p>	<ul style="list-style-type: none"> <li>Correct ion configurations. (<i>Brackets with charge are not required.</i>)</li> </ul>	<ul style="list-style-type: none"> <li>Links group number (for each) to number of electrons lost or gained to become stable. OR Links the formation of each ion to the number of valence electrons lost or gained and includes the resulting charge.</li> </ul>	<ul style="list-style-type: none"> <li>Links group number to number of valence electrons lost or gained to form an ion and become stable AND includes the resulting charge.</li> </ul>
(c)	<p>Atoms gain or lose electrons to achieve full valence / outer shells and become more stable. Magnesium has 2 valence / outer shell electrons, so loses two electrons to form the Mg<sup>2+</sup> ion. Chlorine has 7 valence electrons, so gains one electron to form the Cl<sup>-</sup> ion.</p>	<ul style="list-style-type: none"> <li>Identifies for either atom that it will lose / gain electrons to become more stable / form an ion.</li> </ul>		
(d)	<p>Magnesium reacts with hydrochloric acid vigorously to form a salt and hydrogen gas. The magnesium reacts and disappears into solution; the solution warms up and there is fizzing due to production of hydrogen gas. Magnesium is high up on the activity series (above H), so will easily react.</p> <p>Copper is low on the activity series and there is no visible reaction in the acid because it is below hydrogen on the activity series so cannot react to produce a salt and hydrogen gas.</p> $\text{Mg}(s) + 2\text{HCl}(aq) \rightarrow \text{MgCl}_2(aq) + \text{H}_2(g)$ <p>Accept:  <math display="block">\text{Mg}(s) + 2\text{H}^+(aq) \rightarrow \text{Mg}^{2+}(aq) + \text{H}_2(g)</math></p>	<ul style="list-style-type: none"> <li>States an observation of magnesium or copper in acid.</li> <li>Identifies hydrogen gas forming, or writes a word equation.</li> </ul>	<ul style="list-style-type: none"> <li>Elaborates on the reactions of <b>both</b> Mg and Cu in acid with reference to the difference in reactivity</li> <li>Writes an unbalanced equation.</li> </ul>	<ul style="list-style-type: none"> <li>Elaborates on the reactions of <b>both</b> Mg and Cu in acid with reference to the difference in reactivity <b>relative to hydrogen</b> AND the correct balanced equation.</li> </ul> <p>(<i>States are not required in balanced symbol reactions.</i>)</p>

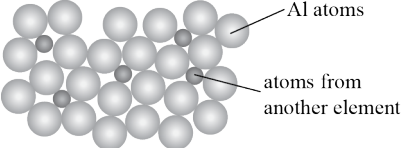
NØ	N1	N2	A3	A4	M5	M6	E7	E8
No response or no relevant evidence	1a	2a	3a	4a	2m	3m	2e with minor error / omission	2e

<p>TWO (a) (b)(i)</p> <p>(ii)</p> <p>(c)(i) (ii)</p>	<p>Graphite Diamond Graphene</p> <p><b>Diamond</b></p> <ul style="list-style-type: none"> <li>• Is a very hard solid with a high melting point due to a 3-D tetrahedral arrangement of carbon atoms covalently bonded to each other. Used as an abrasive, often in cutting.</li> <li>• Is an excellent conductor of heat and a very poor conductor of electricity, both due to the strong covalent bonds between the atoms, so there are no charged particles free to move. It is used in computers to conduct heat away from heat-sensitive components.</li> <li>• Is hard, has high lustre / is shiny and disperses / reflects light well so is used as a gemstone in jewellery. Hardness makes it robust in jewellery. Lustre quality is due to the strong covalent bonds of diamond. The faces / planes on a diamond contribute to its lustre*. (<i>*This is beyond the scope of the standard but if the use is stated, the property must be relevant.</i>)</li> </ul> <p><b>Graphite</b></p> <ul style="list-style-type: none"> <li>• Is a soft, slippery solid with a high melting point. The sheets of graphite can move over each other due to weak forces holding the sheets together. These are easily broken. Graphite can be used in pencils and as a dry lubricant, eg for locks, moving parts of electric motors, dynamos, and drawers.</li> <li>• Conducts electricity as a solid because the carbon atoms bond to only 3 other carbon atoms, which allows for a delocalised valence electron that is able to carry charge. Can be used as a material in batteries, as electrodes.</li> <li>• Is a strong solid substance due to the sheets of graphite, which are carbon atoms that are covalently bonded to each other. Used in fishing rods, bike frames, golf clubs.</li> </ul> <ul style="list-style-type: none"> <li>• Oxygen, O<sub>2</sub> and ozone, O<sub>3</sub>.</li> <li>• O<sub>2</sub> and O<sub>3</sub> are both colourless gases (allow O<sub>3</sub> pale blue) and are small molecules.</li> <li>• Oxygen is needed to support combustion and life, ozone is considered a pollutant at low levels in the atmosphere.</li> <li>• Ozone can be used as a disinfectant to sterilise or destroy bacteria.</li> <li>• O<sub>2</sub> and O<sub>3</sub> are both oxidants / reactive but O<sub>3</sub> is more reactive so can be used as a disinfectant whereas O<sub>2</sub> is required by most living things to survive.</li> <li>• Accept any appropriate use.</li> </ul>	<ul style="list-style-type: none"> <li>• Correctly names all three allotropes.</li> <li>• Describes a physical property OR aspect of bonding for diamond.</li> <li>• Names a use for diamond.</li> </ul> <ul style="list-style-type: none"> <li>• Describes a physical property OR aspect of bonding for graphite.</li> <li>• Names a use for graphite.</li> </ul> <ul style="list-style-type: none"> <li>• Identifies both allotropes.</li> <li>• A similarity in properties is described.</li> <li>• A difference in use is described.</li> </ul>	<ul style="list-style-type: none"> <li>• Links ONE relevant physical property with an aspect of bonding to a named use for diamond.</li> <li>• Links ONE relevant physical property with an aspect of bonding to a named use for graphite.</li> <li>• Links ONE property and use for oxygen or ozone. <i>(May not have compared and contrasted.)</i></li> </ul>	<ul style="list-style-type: none"> <li>• Evaluates a named use of diamond in terms of the structure and bonding, and TWO physical properties of diamond.</li> <li>• Evaluates a named use of graphite in terms of the structure and bonding, and TWO physical properties of graphite.</li> <li>• Compares and contrasts properties and gives a use for both oxygen and ozone.</li> </ul>
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NØ	N1	N2	A3	A4	M5	M6	E7	E8
No response or no relevant evidence	2a	3/4a	5a	6a	1m	2m	2e	3e

THREE								
(a)	Ammonia is collected via downward displacement of air because ammonia is less dense than air, so the upside down tube will hold the ammonia while air is pushed out.	<ul style="list-style-type: none"> <li>Identifies ammonia as being less dense than air.</li> </ul>	<ul style="list-style-type: none"> <li>Links density of ammonia to method of collection (air displacement).</li> </ul>					
(b)	$\text{Ca(OH)}_2 + 2\text{NH}_4\text{Cl} \rightarrow 2\text{NH}_3 + \text{CaCl}_2 + 2\text{H}_2\text{O}$	<ul style="list-style-type: none"> <li>Writes the formulae of all reactants for ONE equation or correct word equation.</li> </ul>	<ul style="list-style-type: none"> <li>All formulae correct for one equation</li> </ul>	<ul style="list-style-type: none"> <li>One balanced equation.</li> </ul>				
(c)(i)	The litmus paper changes from red to blue (or blue litmus paper remains blue).	<ul style="list-style-type: none"> <li>Litmus change correct.</li> </ul>	<ul style="list-style-type: none"> <li>Explains ammonia needs to react with the water before it can change the indicator colour.</li> </ul>					
(ii)	Litmus paper needs to be damp, so that the ammonia gas will react with the water, so it can change the colour of the indicator.	<ul style="list-style-type: none"> <li>Identifies ammonia as being soluble in water.</li> </ul>						
(d)(i)	Ammonia is highly soluble in water, so if an upside down tube of ammonia is placed into a beaker of water, the ammonia gas quickly dissolves and this causes the water to rise up into the test tube.	<ul style="list-style-type: none"> <li>Identifies ammonia as forming an alkaline solution.</li> </ul>	<ul style="list-style-type: none"> <li>Links the solubility of ammonia to the water rising in the tube.</li> </ul>	<ul style="list-style-type: none"> <li>Explains alkalinity, density and solubility properties of ammonia by linking them back to the tests and their observations.</li> </ul>				
(ii)	When ammonia dissolves in water, the solution becomes alkaline because $\text{OH}^-$ ions are formed. ( <i>Check for overlap with answer for c</i> ).  $\text{NH}_3(\text{g}) + \text{H}_2\text{O}(\text{l}) \rightarrow \text{NH}_4\text{OH}(\text{aq})$ OR $\text{NH}_3(\text{g}) + \text{H}_2\text{O}(\text{l}) \rightarrow \text{NH}_4^+(\text{aq}) + \text{OH}^-(\text{aq})$		<ul style="list-style-type: none"> <li>Links <math>\text{OH}^-</math> ions to the formation of alkaline solution.</li> </ul>					( <i>States are not required in balanced equations.</i> )

NØ	N1	N2	A3	A4	M5	M6	E7	E8
No response or no relevant evidence	1a	2a	3/4a	5a	3m	4m	2e with minor error / omission	2e

<p>FOUR</p> <p>(a) (i)</p> <p>(ii)</p> <p>(b)</p>	<p>Aluminium is a low density metal with a high strength to mass ratio. As the can is lightweight, it can be carried around by the average person, even when filled with fluid, with relative ease / transported in bulk more easily.</p> <p>Aluminium is malleable so is easily shaped into a soft drink can.</p> <p>Aluminium has high chemical reactivity but it forms an oxide coating on it that prevents further reaction, so does not react with the chemicals in the soft drink.</p> <p>Any named metal with a relevant chemical OR physical property that makes it unsuitable.</p> <p>Eg:</p> <ul style="list-style-type: none"> <li>• Lead is too dense, so the cans would be too heavy to carry around easily or transport in bulk. It is also reactive, and would slowly react with the acid soft drink.</li> <li>• Group 1 and 2 metals are too reactive with acid in soft drink.</li> <li>• Gold, although unreactive, is too dense, so the cans would be too heavy to carry around easily or transport in bulk.</li> <li>• Iron will react with the acid in the soft drink.</li> </ul> <p>Aluminium is very low density, so good for reducing mass of aircraft, but it is quite soft and easily broken. Alloying it with another metal will make it harder because the atoms of the two different metals will be a different size; so the metal becomes less malleable and harder as well, as the particles will not be able to easily slide over each other, and therefore more durable for the purpose of flight.</p> <p>A labelled diagram would be suitable as part of the answer.</p> 	<ul style="list-style-type: none"> <li>• States aluminium reacts with oxygen.</li> <li>• States a relevant physical property of aluminium for this use.</li> <li>• Names an appropriate metal.</li> <li>• States a relevant property of the named metal.</li> <li>• Names a relevant property of an alloy OR aluminium metal for this use.</li> </ul>	<ul style="list-style-type: none"> <li>• Links the reacting of aluminium with oxygen to its use as a soft drink can.</li> <li>• Links a physical property of aluminium to its use as a soft drink can.</li> <li>• Links a physical OR chemical property of a specific, named metal to its inability to be a soft drink can.</li> <li>• Links a property of aluminium or an alloy to the purpose of aircraft manufacture. OR Explains why alloys are stronger than individual metals.</li> </ul>	<ul style="list-style-type: none"> <li>• Evaluates at least ONE physical and ONE chemical property of aluminium with respect to its use.</li> <li>• Links a property of aluminium or an alloy to the purpose of aircraft manufacture. AND Explains why alloys are stronger than individual metals.</li> </ul>
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NØ	N1	N2	A3	A4	M5	M6	E7	E8
No response or no relevant evidence	1a	2a	3a	4a	2m	3m	2e with minor error / omission	2e

**Cut Scores**

	<b>Not Achieved</b>	<b>Achievement</b>	<b>Achievement with Merit</b>	<b>Achievement with Excellence</b>
<b>Score range</b>	0 – 11	12 – 18	19 – 25	26 – 32