

## Assessment Schedule – 2013

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

#### Evidence Statement

Q	Evidence		Achievement		Achievement with Merit		Achievement with Excellence	
ONE (a)	Fluorine 2, 7 Chlorine 2, 8, 7		<ul style="list-style-type: none"> <li>Correct electron configurations.</li> </ul>					
(b)	F, Cl, Br and I are all in Group 17 of the periodic table. Because F and Cl both have 7 electrons in their valence shell, Br and I will also have 7 valence electrons.		<ul style="list-style-type: none"> <li>Links the group number to Br, I and the valence electrons.</li> </ul>		<ul style="list-style-type: none"> <li>Links the ion formation to the position of the element on the periodic table AND the valence electrons to electron loss / gain <b>for each element</b>.</li> </ul>		<ul style="list-style-type: none"> <li>Links an explanation of the difference in the formation of each ion with respect to electron gain / loss, charge AND to the position of the element on the periodic table.</li> </ul>	
(c)	<p>The formation of the calcium ion and chloride ion differ because calcium atoms are metal atoms in Group 2 of the Periodic Table. It has 2 electrons in its valence shell, which it loses to form a calcium ion with a charge of +2. It is +2 because it now has two more positively charged protons than electrons. (Calcium atoms lose electrons to form the same electron configuration as the nearest noble gas (become more stable)).</p> <p>Whereas chlorine atoms are non-metal atoms in group 17 on the periodic table that gain 1 electron to form the chloride ion. It forms a negative ion with a –1 charge, because it will have one more negatively charged electron than proton. (Chlorine atoms gain electrons to form the same electron configuration as the nearest noble gas (become more stable)).</p> <p>Note: <i>Candidates are not asked why these atoms form ions.</i></p>		<ul style="list-style-type: none"> <li>Identifies that chlorine gains an electron.</li> <li>Identifies that calcium loses two electrons.</li> </ul>					
(d)	<p>Calcium reacts with water vigorously to form a metal hydroxide and hydrogen gas. The water goes cloudy / milky as sparingly soluble calcium hydroxide forms, and there is fizzing, which indicates a gas (hydrogen).  <math>\text{Ca}(s) + 2\text{H}_2\text{O}(l) \rightarrow \text{Ca}(\text{OH})_2(aq) + \text{H}_2(g)</math>            Magnesium does not generally react with cold water unless very clean.            (It will react in steam to produce white magnesium oxide and a gas.)  <math>\text{Mg}(s) + \text{H}_2\text{O}(l) \rightarrow \text{MgO}(s) + \text{H}_2(g)</math>            (or: <math>\text{Mg}(s) + 2\text{H}_2\text{O}(l) \rightarrow \text{Mg}(\text{OH})_2(s) + \text{H}_2(g)</math>)            Magnesium is not as reactive as calcium because it is further down the activity series / it requires more energy to remove the valence electrons than calcium.</p>		<ul style="list-style-type: none"> <li>States an observation of calcium OR magnesium in water. Identifies hydrogen gas forming.</li> </ul>		<ul style="list-style-type: none"> <li>Explains an observation of calcium AND an observation of magnesium in water and an alkaline species (named or formula) AND an unbalanced equation.</li> </ul>		<ul style="list-style-type: none"> <li>Links observations of calcium and magnesium's reaction in water with reference to the similarities / differences in reactivity AND a balanced equation.</li> </ul>	
NØ	N1	N2	A3	A4	M5	M6	E7	E8
No response or no relevant evidence.	1a	2a	3a	4a	1m	2m	1e	2e

TWO (a)  (b)  (c)	<p>Allotropes are made up of atoms of the same element but the atoms are arranged differently so that each allotrope is a different substance.</p> <p><math>O_2(g) \rightarrow 2O(g)</math> <math>O(g) + O_2(g) \rightarrow O_3(g)</math> (states not necessary)</p> <p>Ozone is an unstable gas comprising three oxygen atoms, which readily degrades back to oxygen. While this happens, a free oxygen atom forms. The free oxygen is highly reactive and short lived, and if it comes into contact with a cell wall of a bacterium, a reaction called an oxidative burst occurs which creates a tiny hole in the cell wall. After thousands of ozone collisions which happen in a few seconds, the bacterial wall can no longer maintain its shape and the cell dies.</p> <p>Advantages of using ozone:</p> <ul style="list-style-type: none"> <li>requires only a supply of air and electricity (so is easy to produce)</li> <li>one of the most active, readily available oxidising agents</li> <li>rapidly decomposes to oxygen leaving no traces or residue (so is a clean way to disinfect)</li> <li>reactions do not produce toxic compounds (so products are safe)</li> <li>acts more rapidly, and more completely on bacteria than other common disinfecting agents do (<math>3000 \times</math> more than <math>Cl_2</math>)</li> <li>acts swiftly and effectively on all strains of viruses</li> <li>does not react with water (so there is no effect on pH).</li> </ul> <p>Disadvantages of using ozone:</p> <ul style="list-style-type: none"> <li>poisonous to people (so must be handled carefully)</li> <li>rapidly decomposes to oxygen (so cannot be stored or transported)</li> <li>Rapid decomposition means that it must be constantly renewed in a situation such as a pool.</li> </ul>	<ul style="list-style-type: none"> <li>Describes an allotrope.</li> <li>Writes word equations OR ONE unbalanced symbol equation.</li> <li>Recognises that ozone reacts with microorganisms.</li> <li>Lists one advantage of ozone.</li> <li>Lists one disadvantage of ozone.</li> </ul>	<ul style="list-style-type: none"> <li>TWO unbalanced symbol equations. OR ONE balanced symbol equation.</li> <li>Explains the reaction of ozone as oxidation, which disrupts the microorganism.</li> <li>Explains ONE advantage.</li> <li>Explains ONE disadvantage.</li> </ul>	<ul style="list-style-type: none"> <li>Writes balanced equations.</li> <li>Explanation of ozone's role as a disinfectant disrupting the cell wall / membrane AND explains TWO advantages AND ONE disadvantage of using ozone as a disinfectant.</li> </ul>				
NØ	N1	N2	A3	A4	M5	M6	E7	E8
No response or no relevant evidence.	1a	2a	3a	4a	3m	4m	2e Allow minor error or omission in (c).	2e

THREE	<p>Surgical steel is used because as an alloy, it has a mixture of metals / elements in it that give it desired characteristics.</p> <p>Body piercing jewellery needs to be sterile, shiny, malleable and unreactive.</p> <p>The chromium in the alloy will provide the shiny appearance of the metal (lustre) and provides scratch and corrosion resistance.</p> <p>The nickel provides a smooth finish and corrosion resistance.</p> <p>The molybdenum provides extra hardness and corrosion resistance to the alloy.</p> <p>Each of the metals adds corrosion resistance to the alloy. This is important so that the jewellery doesn't corrode / react in someone's nose / mouth / belly button area and remains something that is easily sterilised / cleaned.</p> <p>Steel / Iron is malleable as are other metals so it can be shaped into jewellery but with the Mo and Ni, it remains hard and will not break due to high tensile strength.</p> <p>It has a high melting point so will withstand temperatures that may be reached by human activities.</p> <p>Although iron has lustre, Nickel and Chromium provide a shininess and high lustre in the alloy so that the jewellery remains shiny and aesthetically pleasing.</p>		<ul style="list-style-type: none"> <li>• Describes TWO relevant properties an alloy that that make it suitable for jewellery.</li> <li>• Identifies a metal and states a physical property relevant to its use as jewellery.</li> <li>• Identifies a metal and states a chemical property relevant to its use as jewellery.</li> <li>• States a reason for the use of alloys.</li> </ul>		<ul style="list-style-type: none"> <li>• Links TWO chemical properties of specific (named) metals to relevant needs for the role of body piercing jewellery.</li> <li>• Links TWO physical properties of specific (named) metals to relevant needs for the role of body piercing jewellery.</li> </ul>		<ul style="list-style-type: none"> <li>• Links a relevant physical and chemical property of EACH metal in the alloy to the use of surgical steel in body piercing jewellery.</li> </ul>	
NØ	N1	N2	A3	A4	M5	M6	E7	E8
No response or no relevant evidence.	1a	2a	3a	4a	1m	2m	e Allow minor error or omission.	e

FOUR	(a)	The zinc reacts and disappears into the solution. Bubbles of gas are observed.	<ul style="list-style-type: none"> <li>• Describes ONE observation.</li> <li>• States a similarity between zinc and iron's reaction</li> <li>• States a difference between zinc and iron's reaction</li> <li>• Writes one word equation</li> <li>• Recognises that sulfuric acid dissociates into ions.</li> <li>• Recognises ions carry charge</li> <li>• Identifies an appropriate change in the concentration of sulfuric acid.</li> </ul>	<ul style="list-style-type: none"> <li>• Similarity linked to observations.</li> <li>• Difference linked to the activity series.</li> <li>• Two word equations / one balanced symbol equation.</li> <li>• Links dissociation into ions to ability to carry charge</li> <li>• Links the changes in concentration during the reaction to the discharging AND charging processes.</li> </ul>	<ul style="list-style-type: none"> <li>• Compares and contrasts reactions of Zn and Fe with sulfuric acid, linking them to observations made AND the activity series AND two correct balanced symbol equations</li> <li>• Links dissociation into ions to ability to carry charge AND links the changes in concentration during the reaction to the discharging AND charging processes.</li> </ul>			
	(b)	Zinc and iron both react with dilute sulfuric acid relatively slowly. Eventually both metals disappear and some bubbles of gas are formed as hydrogen gas forms in both reactions. Both metals react to form sulfate compounds. However zinc is higher on the activity series than iron, so the zinc will react somewhat faster than the iron. $Zn + H_2SO_4 \rightarrow ZnSO_4 + H_2$ $Fe + H_2SO_4 \rightarrow FeSO_4 + H_2$						
	(c)	Sulfuric acid is a good electrolyte because it dissociates / forms ions easily ( $H^+$ and $SO_4^{2-}$ ). Ions are charged particles which can conduct a current through a solution.  When a battery is being used / discharged, the concentration of the acid decreases. This causes the battery to go flat, as the sulfate ions have been removed. The battery then needs recharging to reverse the reactions, and reform sulfuric acid again. This then increases its concentration.						
NØ	N1	N2	A3	A4	M5	M6	E7	E8
No response or no relevant evidence.	1a	2a	3a	4a	3m	4m	1e	2e

### Judgement Statement

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