Assessment Schedule – 2015

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

Evidence Statement

Q	Evidence	Achievement	Merit	Excellence
ONE (a)	Diagrams showing electron arrangements of 2,8,1 for sodium and 2,7 for fluorine.	• Correct electron arrangements.		
(b)	Sodium is in Group 1 of the periodic table with an electron arrangement of 2,8,1. It loses 1 electron from its valence (outer) shell, to form a sodium ion with an electron arrangement of 2,8 and a charge of +1. The ion has a charge of +1, as it has one more positively charged proton compared to negative electrons. Fluorine is in Group 17 of the periodic table with an electron arrangement of 2,7. It gains 1 electron to fill its valence shell, to form a fluoride ion with an electron arrangement of 2,8 and a charge of –1. The ion has a charge of –1, as it now has one more negatively charged electron compared to positive protons. The electron arrangements of the atoms are different, as they have different atomic numbers and are in different groups on the periodic table. The electron arrangements of the ions are the same, as atoms lose or gain electrons depending on which group they are in to form an ion with the same electron arrangement as the nearest noble gas (to become more stable).	• Identifies that sodium loses an electron OR that fluorine gains an electron.	• Links the ion formation to the position of the element on the periodic table, and the valence electrons to electron gain / loss for each element.	• Explains why the elements have different electron arrangements but the ions have the same electron arrangement with reference to position of the element on the periodic table, the number of valence electrons and loss or gain of electrons (with reference to how the overall charge results).
(c)	Lithium floats on the water and gently fizzes, giving off hydrogen gas until it disappears. A colourless solution of LiOH is produced. Sodium also floats on the surface, but enough heat is given off to melt the sodium, and it forms silvery balls that dash around the surface, being pushed by the hydrogen being formed. A colourless solution of NaOH is formed. Both Na and Li are reactive metals and will react violently with dilute H_2SO_4. Both metals are in group one of the periodic table, and therefore will react similarly, since they both have one valence electron. However, since the Na atom's valence electron is further away from the nucleus than Li's valence electron, Na is more reactive than Li, as it will lose its valence electron more easily. Equations: Lithium + water → lithium hydroxide + hydrogen Sodium + water → sodium hydroxide + hydrogen $2Li(s) + 2H_2O(\ell) \rightarrow 2LiOH(aq) + H_2$ $2Na(s) + 2H_2O(\ell) \rightarrow 2NaOH(aq) + H_2$	• Describes an observation for ONE reaction. • Identifies ONE product formed. • Correctly predicts that both Na and Li will react violently with H_2SO_4. • Describes the relative reactivity of Li and Na.	• Links observations to TWO correct products for one reaction. • Explains the reactivity of Li and Na by linking to their position on the periodic table and that they have one valence electron, OR observations with H_2O reaction explained for one element. • Word / unbalanced symbol equation correct.	• Compares and contrasts the reactivity by linking to the position on periodic table AND gives observations for two correct products for the reaction with water. • Correct balanced equation. (*States are not required*.)

NØ	N1	N2	A3	A4	M5	M6	E7	E8
No response; or no relevant evidence.	1a	3a	4a	5a	3m	4m	2e (including equation)	3e

Q	Evidence	Achievement	Merit	Excellence
TWO (a) (i)	<table><tr><td>Metal A</td><td>lead</td></tr><tr><td>Metal B</td><td>copper</td></tr><tr><td>Metal C</td><td>zinc</td></tr></table>	• Identifies two metals.		
(ii)	Examples: Lead is used to make sinkers on fishing lines in water as it is high density, it sinks, and it does not react with water. Copper is used on the bottom of saucepans, as it is an excellent conductor of heat, and it does not react with aqueous cooking fluids.	• Identifies one suitable use for any metal.	• Links the use of BOTH metals to a chemical AND physical property.	
(b)	Both metals are malleable, so they can be moulded into different shapes. However, magnesium reacts with water and dilute acids. As jewellery would come into contact with these, it is not a suitable material. Magnesium would also react slowly with oxygen in the air and would lose its shiny appearance. Silver does not react with water or dilute acids and reacts very slowly with oxygen in the air, which is why it can be used to make jewellery.	• Identifies one chemical or physical property of either metal.	• Links suitability of one metal to both a chemical and a physical property.	• Explains suitability of BOTH metals by *explicitly* linking to both chemical and physical properties of each metal.
(c)	Alloys contain a mixtures of metals / elements that can give them desired characteristics. The process of alloying is used to change the chemical composition of steel and improve its properties, depending on what the steel will be used for. Different alloying elements each have their own effect on the properties of steel. Alloying metals increases the hardness, as alloys contain atoms of different sizes, which makes it harder for the layers to slide over each other. Other elements may also be added to increase resistance to corrosion – they may form an oxide layer. Other elements may be alloyed to add shine.	• Describes what an alloy is. • Identifies a desirable property of the alloy.	• Explains how a desirable property can be obtained by alloying.	• Explains in detail how desirable properties may be obtained by alloying.

NØ	N1	N2	A3	A4	M5	M6	E7	E8
No response; or no relevant evidence.	1a	2a	3a	4a	2m	3m	1e + 1m	2e

Q	Evidence	Achievement	Merit	Excellence
THREE (a)(i)	iron + oxygen → iron oxide $2Fe + O_2 \rightarrow 2FeO$ Or accept $4Fe + 3O_2 \rightarrow 2\ Fe_2O_3$	• Completes word equation.	• Completes symbol equation.	• Writes balanced symbol equations.
(ii)	Carbon + oxygen → carbon dioxide $C + O_2 \rightarrow CO_2$			
(b)	Water is chlorinated to make it safe for human consumption. The chlorine reacts with the water to form an acidic solution because it is soluble in water. $Cl_2(g) + H_2O(l) \rightarrow HCl(aq) + HOCl(aq)$ The solution is acidic due to the increase in the concentration of hydrogen (H_3O^+ / H^+) ions in the solution. The hypochlorous acid, HOCl, acts as a disinfectant and kills any bacteria in the water. Only very small amounts of chlorine are required for this to be effective. The hypochlorous acid acts as an **oxidant** on the bacteria, destroying them.	• Describes the solution as being acidic. • Describes why chlorine is added to water.	• Explains why chlorine is added to water. • Explains why the solution is acidic. • Correct equation	• Full explanation, including balanced chemical equation (*states are not required*.)
(c)	Sulfur dioxide is often used to preserve foods such as dried fruit, sausages, and wine because it slows down the growth of bacteria and mould (accept kill). Food is preserved either by inactivating microbes, or by inhibiting their growth rate. SO_2 is a reductant; it removes oxygen from cells in plant materials to help soften the cell walls to help food dry more easily. It also removes oxygen from microbes, causing an environment in which the microbes cannot reproduce or grow, so food is less likely to spoil. SO_2 is acidic in solution; this causes the pH to decrease, again causing an environment in which the microbes cannot reproduce or grow. Also enzymes are pH specific, and if the pH of the environment changes, enzymes will be destroyed / denatured, so food is less likely to spoil. SO_2 destroys enzymes that darken foods that have been cut. It also has fungicidal and insecticidal properties. Essentially, its reactions cause an environment in which microbes cannot reproduce or grow.	• Describes one property of sulfur dioxide.	• Explains one property of sulfur dioxide.	• Explains properties of sulfur dioxide linked to the use.

NØ	N1	N2	A3	A4	M5	M6	E7	E8
No response; or no relevant evidence.	1a	2a	3a	4a	3m	4m	2e	3e

Cut Scores

Not Achieved	Achievement	Achievement with Merit	Achievement with Excellence
0 – 7	8 – 12	13 – 18	19 – 24