Assessment Schedule – 2016

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

Evidence Statement

Q	Evidence	Achievement	Merit	Excellence
ONE (a)(i)	**Magnesium**: solid at room temperature / high melting point / high boiling point / silvery-white colour / moderately hard / malleable / good electrical and heat conductor. **Nitrogen**: gas at room temperature / low melting point / low boiling point / colourless / odourless / does not conduct heat or electricity.	• Gives one physical property of Mg / metals OR N / non-metals.		
(ii)	The formation of magnesium ions and nitrogen ions differs because magnesium is a metal in group 2 of the periodic table, and nitrogen is a non-metal in group 15 of the periodic table. Mg has two valence electrons, which it loses to form magnesium ions with a charge of 2+, Mg^{2+}, since the ions have two more +ve protons than –ve electrons. N has 5 valence electrons, so it gains 3 electrons to form nitrogen ions with a charge of 3–, N^{3-}, since the ions have three more –ve electrons than +ve protons.	• Identifies Mg as a metal OR N as a non-metal. • Identifies that Mg loses 2 electrons / forms a 2+ ion OR that N gains 3 electrons / forms a 3– ion.	• Links position on theperiodic table to the loss / gain of electrons. OR The number of valence electrons to the charge on the ion formed.	• Explains differences in the formation of each ion with respect to position on periodic table. AND Electron gain / loss and the charge of the ion formed.

(b)	Moving down within a group, metals are involved in similar reactions since they all have the same number of valence electrons. E.g. down group 1, the electron configurations of Li and Na are: Li: 2, 1 and Na: 2, 8, 1 Both have 1 valence electron; therefore, are involved in similar reactions in order to lose the 1 electron. They react with O_2, H_2O, HCl. The reactivity of the metals increases down the group, since it is easier to lose the valence electrons as more energy levels are added (down a group). The reactions are faster and more violent moving down the group. F and Cl are also in the same group (17) and are involved in similar reactions. The electron configurations of F and Cl are: F: 2, 7 and Cl: 2, 8, 7 They must gain 1 electron to have a full shell, and so react in similar ways. They react with metals to form ionic compounds such as NaCl, and with other non-metals to form covalent compounds such as HCl. Halogens, such as F and Cl, get less reactive moving down the group because it is harder to gain an electron going down the group, as there are more energy levels added.	• Recognises similar reactions down a group for either metals or non-metals. • Recognises increase in reactivity down a group for metals. • Recognises decrease in reactivity down a group for non-metals.	• Links electron configuration to similarity of reactions down a group. • Links increasing reactivity of metals down a group to an increasing number of energy levels / ease of losing a valence electron. • Links decreasing reactivity of non-metals down a group to an increasing number of energy levels / difficulty in gaining an electron.	• Discusses similarities and differences in **reactions** of metals and non-metals; supports answer with reference to group 1 and 17 elements. • Discusses similarities and differences in the **reactivity** of metals and non-metals; supports answer with reference to group 1 and 17 elements, and gives appropriate electron configurations.

NØ	N1	N2	A3	A4	M5	M6	E7	E8
No response; no relevant evidence	1a	2a	4a	5a	2m	3m	1e	2e

Q	Evidence	Achievement	Merit	Excellence
TWO (a)(i)	Steel is stronger / harder / less brittle than pure iron and does not corrode / rust as easily, therefore making it more useful.	• Recognises that the physical or chemical properties of steel make it more useful than iron.	• Links the physical and chemical properties of steel to its usefulness.	
(ii)	Iron + oxygen → iron(III) oxide $4Fe + 3O_2 \rightarrow 2Fe_2O_3$	• Correct word equation given (accept iron oxide).	• Recognises iron(III) oxide as the product. OR correct, but unbalanced, symbol equation.	• Correct balanced symbol equation.
(b)	Zinc is a solid at room temperature, but it can be molten at high temperatures so that the iron / steel can be dipped into it. The zinc bonds to the iron, forming a layer of zinc. Zn is malleable and so can be coated on top of the steel and still be bent into shapes. The zinc acts as a barrier between the iron / steel and air / water to prevent corrosion. It is also a more reactive metal than iron / steel so it will react more readily with oxygen / water, preventing the reaction of the iron / steel. The zinc does react to form a zinc oxide layer, but this does not flake off like rust does, and so protects the object. Even if the surface is scratched, the zinc will react with any oxygen / water before the iron does, thus protecting it.	• Identifies that zinc can be molten at high temperature. • Recognises that zinc is more reactive than iron / steel. • Recognises that zinc is also malleable. • Recognises that zinc reacts to form zinc oxide.	• Links zinc malleability to its suitability for galvanising OR Links the melting point of zinc to the use of molten zinc as a coating for iron / steel. • Links reactivity of zinc to the preferential reaction with oxygen / water. OR Links the physical barrier to prevention of oxidation reaction. OR Explains that the zinc oxide layer does not flake off.	• Comprehensively discusses preferential oxidation / reaction of zinc, and links these to the prevention of rusting in iron / steel. AND Relates this to the relative positions of Zn & Fe on the activity series. (*minor omission allowed*)

NØ	N1	N2	A3	A4	M5	M6	E7	E8
No response; no relevant evidence	1a	2a	4a	5a	2m	3m	1e	2e

Q	Evidence	Achievement	Merit	Excellence
THREE (a)	Sulfur is a (light yellow) crystalline solid that is brittle and has a relatively high melting point for a non-metal, but much lower than diamond. Diamond is a (colourless and clear) hard solid with a very high melting point.	• Gives one physical property for each of sulfur and diamond (not colour).		
(b)	A: **Graphite** is used in pencil tips. Graphite is composed of layers of C atoms. The bonds between the layers are very weak so the layers can slide across each other, making the graphite soft. Therefore, it can be used in pencils – as the pencil moves across the paper, layers of graphite rub off onto the paper. B: **Nanotubes / fullerene** are used in miniature wires in electrical circuits. Carbon nanotubes are long cylindrical carbon tubes made up of hexagonal rings of C atoms. They can be used in microwires because they are extremely small and have very high tensile strength, so can be made into small, strong wires. They are very good electrical conductors due to the movement of free electrons, so the wires can be used to conduct a current in an electrical circuit.	• Identifies graphite as useful in pencil tips. • Identifies nanotubes / fullerene as useful in miniature wires.	• Links physical properties of graphite to its use in pencil tips. • Links physical properties of nanotubes to its use in miniature wires in electrical circuits.	• Comprehensively links properties of graphite to its use in pencil tips (including link to graphite rubbing onto paper); AND Nanotubes / fullerenes use in miniature wires in electrical circuits (including free electrons thus its ability to conduct current).
(c)	**Ozone example, O_3,** can be used to purify water because it is a powerful oxidising agent and it is soluble in water. It interferes with the biological processes of micro-organisms in the water. Ozone also changes dissolved impurities such as iron / manganese into an insoluble form that can be filtered out of the water. The ozone forms O_2 and so the drinking water is safe to drink. $O_3 \rightarrow O_2 + O$	• States a physical and / or chemical property of both O_3 and O_2. • States a use of O_3.	• Links a use of O_3 to a physical / chemical property.	• Discusses a use of O_3 with links to the chemical / physical properties, and gives a relevant balanced symbol equation.
	Oxygen example, O_2, is used in the manufacture of steel. It is used to remove some carbon from the steel so that the steel has the desired carbon content (so it is not too brittle). As it is a gas, it is easily blown into the molten steel. It reacts readily with the carbon (oxidation reaction) to produce carbon dioxide, which escapes. $O_2 + C \rightarrow CO_2$	• States a use of O_2.	• Links a use of O_2 to a physical / chemical property.	• Discusses a use of O_2 with links to the chemical / physical properties, and gives a relevant balanced symbol equation.

NØ	N1	N2	A3	A4	M5	M6	E7	E8
No response; no relevant evidence	1a	2a	4a	5a	2m	3m	1e	2e

Cut Scores

Not Achieved	Achievement	Achievement with Merit	Achievement with Excellence
0 – 6	7 – 12	13 – 18	19 – 24