Assessment Schedule – 2023

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

Evidence Statement

Q	Evidence	Achievement	Merit	Excellence
ONE (a)(i)	Li – 2, 1 Na – 2, 8, 1 K – 2, 8, 8, 1	• ALL configurations correct.		
(ii)	Li, Na, and K are not found naturally in their elemental state. This is because they are all group 1 metals and, having a single valence electron, are very reactive. They lose this electron to become stable, forming a positively (+1) charged ion, so will be found in ionic compounds. Moving down the group, reactivity increases.	• Natural state correctly given.	• Natural state given linked to position on periodic table.	• Full answer.
(b)	Magnesium is in Group 2 of the periodic table, so is not as reactive as a Group 1 metal / sodium. This means in dry air it is quite stable, and will react slowly. Sodium, being in Group 1, is very reactive and would react with the oxygen in the air. The oil stops the oxygen from getting to the metal, so it won't react as it would if stored in air. $4Na(s) + O_2(g) \rightarrow 2Na_2O(s)$ $2Mg(s) + O_2(g) \rightarrow 2MgO(s)$	• States Mg reacts slowly with air / Na will react with air. • Reactants / products correct for ONE equation.	• Explains Mg reacts slowly with air / Na will react with air with links to the storage of the metal. AND ONE correct unbalanced equation.	• Explains Mg reacts slowly with air / Na will react with air, with links to the storage of the metal. AND Correct balanced equation (states not necessary).
(c)(i)	Potassium + Water → Potassium Hydroxide + Hydrogen $Ca(s) + 2H_2O(\ell) \rightarrow Ca(OH)_2(aq) + H_2(g)$	• Correct word equation.	• Unbalanced equation.	• Balanced equation. AND Comprehensively links ALL observations to the species involved.
(ii)	Calcium reacts fairly vigorously with cold water. Bubbles of hydrogen gas are given off, and a white precipitate of calcium hydroxide is formed. Potassium reacts violently with water to produce hydrogen gas. As a lot of heat is released this gas will ignite. Colourless potassium hydroxide will be formed in the solution.	• Gives one correct observation for either metal in water.	• Links the observations to THREE of the reactants and products.	

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

Q	Evidence	Achievement	Merit	Excellence
TWO (a)	Copper has a high melting point, hardness, and electrical conductivity. All of these physical properties make it suitable for wiring / circuit boards, as it means it will not melt under the increased heat of laptop use; it will maintain its form / shape due to its hardness, and it will conduct electricity well, which will reduce unwanted energy loss (to heat), and help the laptop to run efficiently. Lead is relatively soft, has a low melting point, but still quite high electrical conductivity. This means in solder / to connect electrical components it can be moulded and melted to form the shapes required for this purpose. Once set in its new form, its high conductivity means electricity will be able to pass through it relatively easily, with little resistance / energy loss. Aluminium has a low density, relatively high melting point, and high thermal conductivity. This means that as a heat sink, it will not introduce too much weight to the laptop, it will not melt with the heat it is taking away from the device, and the thermal conductivity means it will be able to conduct the heat away effectively.	• Uses ONE piece of info from table B to state why it makes copper appropriate for its use. • Uses ONE piece of info from table B to state why it makes lead appropriate for its use. • Uses ONE piece of info from table B to state why it makes aluminium appropriate for its use.	• Explains why TWO pieces of info from table B make a metal appropriate for its use. • Explains why TWO pieces of info from table B make a second metal (from the 3) appropriate for its use.	• Fully justifies the given use of a metal in a laptop using all available info from table B. • Fully justifies the given use of a second metal in a laptop using all available info from table B.
(b)	An alloy is a mixture of metals / elements that results in an enhanced set of properties, compared to those of the original metal in the resulting mixture. A laptop frame needs to be strong, relatively lightweight, and unreactive. When magnesium is alloyed with other metals, the different sized atoms in the alloy means it is harder for them to slide past each other, and increases the hardness of the material compared to pure magnesium alone. Magnesium has a low density, which is great for ending up with a lightweight laptop frame overall. Aluminium is still reasonably low density and zinc's is higher, so, depending on the proportions of other metals in the alloy, a lightweight frame can still be formed.	• Describes an alloy. • Gives a reason a magnesium alloy would be more suitable than pure magnesium in computer frames.	• Describes an alloy and an attribute you would want in a laptop frame. • Explains properties of magnesium and other metals that would be desirable in a laptop frame.	• Describes an alloy and attributes you would want from an alloy in a laptop frame. AND Relates the specific properties of magnesium and the other metals that make them suitable for such an alloy.

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

Q	Evidence	Achievement	Merit	Excellence
THREE (a)(i)	Allotropes are made up of atoms of the same element, but the atoms are arranged differently, so that each allotrope is a different substance.	• Allotrope defined.		
(ii)	$O_2(g) \rightarrow 2O(g)$ and then $O(g) + O_2(g) \rightarrow O_3(g)$	• Writes word equations. OR An unbalanced symbol equation.	• TWO unbalanced symbol equations (from part (b) here and part (c)(ii) below).	• THREE symbol equations (from part (b) here and part (c)(ii) below).
(b)	**Chlorine** is a pale green gas. The chlorine reacts with the water to form an acidic solution because it is soluble in water. $Cl_2(g) + H_2O(\ell) \rightarrow HCl(aq) + HOCl(aq)$ The solution is acidic due to the increase in the concentration of 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. Chlorine requires the addition of chemicals, and can leave disinfection by-products that can be hazardous to health. **Ozone** is a colourless gas. Ozone, 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, and also changes dissolved impurities, such as iron / manganese, into an insoluble form so they can be filtered out of the water. The ozone forms O_2, and so is safe for swimmers. The use of ozone requires not only power, but also is such a strong oxidiser that it tends to destroy the plumbing used to dispense it. Ozone is also unstable, so it must be made on-site as it cannot be transported easily.	• Describes one property of chlorine. • Describes one property of ozone.	• Links properties of chlorine to its use as a disinfectant. • Links properties of ozone to its use as a disinfectant.	• Full explanation for chlorine. • Full explanation for ozone.

(c)(i)	Ammonia is very soluble in water, so when exposed to water, the gas quickly dissolves in water, and the amount of gas present is reduced. The water moves up to occupy the space vacated by the ammonia gas that has dissolved.	• Describes ammonia dissolving into the water.	• Links solubility of ammonia in water to the rise in water level.	• Elaborates on solubility of ammonia in water and how it causes the water level to rise.
(ii)	A piece of damp litmus paper would turn blue in ammonia gas. The pH > 7. Ammonia reacts with water to form OH^- ions, which means there is a higher concentration of OH^- (than H_3O^+), so the solution is an alkali / basic. $NH_3(g) + H_2O(\ell) \rightarrow NH_4^+(aq) + OH^-(aq)$ (accept $NH_3(g) + H_2O(\ell) \rightarrow NH_4OH(aq)$)	• Identifies damp litmus paper will turn blue. OR Identifies NH_3 gas as basic / alkaline / pH > 7.	• Links blue litmus paper to basic / alkaline nature of NH_3.	AND Justifies answer by linking to basic nature of the solution and the presence of an increased concentration of OH^- ions.

NØ	N1	N2	A3	A4	M5	M6	E7	E8
No response; 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 – 13	14 – 19	20 – 24