Assessment Schedule – 2022

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

Evidence Statement

Q	Evidence	Achievement	Merit	Excellence
ONE (a)	Potassium and chlorine (with an appropriate 19 and 17 electron configuration).	• Both named correctly. OR A correct atomic structure for a named element.	• Both configurations correct.	
(b)	Elements form ions to full up their valence electron shell and become stable. The ions of element X could be either K^+ or $Cl^–$, as these atoms lose or gain one electron to form an ion that has the same electron configuration as argon with a full stable outer shell. K has one valence electron, which it loses to form potassium ions with a charge of 1+, K^+, since the ions have one more +ve proton than –ve electron. Chlorine has 7 valence electrons, so it gains 1 electron to form chloride ions with a charge of 1–, $Cl^–$, since the ions have one more –ve electron than +ve protons.	• Identifies that K loses 1 electron / forms a 1+ ion. OR That loss of electrons results in positive charge. • Identifies that Cl gains 1 electron / forms a 1– ion. OR That gain of electrons results in negative charge.	• Explains the formation of one of the ions. OR Explains the number of valence electrons in relation to the charge on the ion formed.	• Explains why ions form and the differences in the formation of each ion. AND Why the ions have their specific charges. Protons v electrons / group.
(c)	The potassium reacts vigorously with the water to release hydrogen gas and form an alkali / basic solution of KOH. $2K + H_2O \rightarrow 2KOH + H_2$ The solution is basic because the concentration of $OH^–$ ions in solution has increased. Red litmus paper could be used to confirm this, as it would turn blue. The lithium reacts less vigorously with the water to release hydrogen gas more slowly and form an alkali / basic solution of LiOH. $2Li + H_2O \rightarrow 2LiOH + H_2$ The solution is basic because the concentration of $OH^–$ ions in solution has increased. Red litmus paper could be used to confirm this, as it would turn blue. Both elements produce hydrogen gas and alkaline solutions; however, they differ in speed / violence / vigour of the reaction.	• An observation of the potassium / lithium reaction described. OR Reactants / products correct for potassium / lithium reaction.	• An observation of either reaction described. AND Reactants / products correct for either reaction. • The nature of either solution explained, including how it could be confirmed in the school laboratory.	• Observations of both reactions described. AND Equations for both reactions. AND The nature of each solution explained, including how it could be confirmed in the school laboratory.

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

Q	Evidence	Achievement	Merit	Excellence
TWO (a)	Copper and aluminium can be used for electrical wiring in buildings and transmission lines because they are both solids at normal operating temperatures and are good electrical conductors. They are also ductile, so can be drawn into wires. Copper is an unreactive metal in a household wiring setting. Aluminium is relatively reactive but quickly forms an oxide layer, which protects the aluminium metal beneath. Aluminium has a lower density than copper, so is used in transmission lines rather than copper, as it can be run across larger spans. $4Al + 3O_2 \rightarrow 2Al_2O_3$ (reference to oxide layer)	• States a relevant chemical property. • States a relevant physical property. • Identifies Al_2O_3 as a product.	• Explains why a property is relevant to the use. • Gives unbalanced equation for Al.	• Explains a chemical AND a physical property and why they are relevant to the use. AND Gives a balanced equation for Al.
(b)	When aluminium is in contact with copper, it can undergo corrosion as it is higher on the activity series than copper. This means it will lose electrons and react with oxygen and water in the air (atmosphere) to form powdered Al_2O_3. This corrosion could cause the roof to leak.	• Describes relative reactivity of metals.	• Explains relative reactivity of the metals causing Al corrosion and possibility of roof leaking.	• Explains relative reactivity of the metals causing Al corrosion and possibility of roof leaking. AND
(c)(i)	An alloy contains a mixture of metals / elements that can give them desired characteristics.	• Describes an alloy.	• Describes an alloy. AND Explains why duralum would be advantageous compared to pure metal.	Explains why duralum would be advantageous compared to pure metal.
(ii)	Pure aluminium has a low density, so would result in lightweight airplane parts, but it is relatively malleable and would lack the necessary strength for this use. Alloying it with copper makes it significantly harder, whilst still retaining some of the low density of aluminium, and therefore making it more suitable for an airplane. (Reference to Strong and or Hard.)	• Gives an advantage of using duralum alloy.		

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

Q	Evidence	Achievement	Merit	Excellence
THREE (a)	Diamond = D Graphite = E Graphene = A Nanotube = B Buckminsterfullerene = C	• Four allotropes correctly identified.		
(b)	**Examples:** **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. **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. **Diamond** has a rigid structure as it is held together by strong covalent bonds, which makes diamond very hard. This physical property makes diamond useful for cutting tools, such as diamond-tipped glass cutters and oil rig drills. It is also used in jewellery because they polish well and because of their hardness they are not scratched easily. **Graphene** is composed of a single layer of carbon atoms bonded in two dimensions. Due to free electrons graphene is an excellent conductor of electricity and can be used in very small conductive applications.	• A relevant use of an allotrope stated. • A relevant property of an allotrope stated.	• A use of an allotrope and its appropriate properties explained.	• Appropriate uses of two allotropes given and explained in full.

(c)(i)	Sulfur burns with a faint blue flame and a pungent smell is given off.	• Gives an observation of combustion of sulfur.		
(ii)	$S + O_2 \rightarrow SO_2$	• Correct reactants in equation.	• Equation for combustion of sulfur.	• Symbol equation for combustion of sulfur. AND
(iii)	Sulfur dioxide can contribute to respiratory illness by making breathing more difficult. Beyond human health impacts, sulfur dioxide's contribution to acid rain can cause direct harm to trees and plants by damaging exposed tissues and, subsequently, decreasing plant growth.	• States a consequence of combustion of sulfur.	• Explains one consequence of sulfur dioxide entering the environment.	
(iv)	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 microbes, causing an environment in which 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 microbes cannot reproduce or grow, so food is less likely to spoil. • Enzymes are pH specific, and if the pH of the environment changes, enzymes will be destroyed.	• Describes one property of sulfur dioxide.	• Explains a property of sulfur dioxide.	Explains properties of sulfur dioxide linked to the use.

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

Cut Scores

Not Achieved	Achievement	Achievement with Merit	Achievement with Excellence
0 – 7	8 – 13	14 – 19	20 – 24