Assessment Schedule – 2013

Chemistry: Demonstrate understanding of aspects of chemical reactions (90934)

Evidence Statement

Q	Evidence	Achievement	Merit	Excellence
ONE	In test tube A, a **white** precipitate / solid / deposit forms (or the solution turns cloudy white). The precipitate / solid / deposit is lead sulfate. In test tube B, a **yellow** precipitate / solid / deposit forms (or the solution turns cloudy yellow). The precipitate / solid / deposit is lead iodide. The type of reaction occurring in each test tube is a precipitation reaction (or exchange reaction) because when the **two solutions are added together** an **insoluble substance** called a precipitate forms. This settles at the bottom of the test tubes, so they are both precipitation reactions. (OR … because when the two solutions are added together ions from each substance are swapped or exchanged and an insoluble substance forms, so they are both exchange reactions.) Candidate could provide an ionic or a molecular balanced symbol equation. A: $Pb^{2+}(aq) + SO_4^{2-}(aq) \rightarrow PbSO_4(s)$ OR $Pb(NO_3)_2(aq) + K_2SO_4(aq) \rightarrow PbSO_4(s) + 2KNO_3(aq)$ B: $Pb^{2+}(aq) + 2I^-(aq) \rightarrow PbI_2(s)$ OR $Pb(NO_3)_2(aq) + 2KI(aq) \rightarrow PbI_2(s) + 2KNO_3(aq)$	• Describes ONE observation correctly. • Identifies the white precipitate as lead sulfate. • Identifies the yellow precipitate as lead iodide. • Identifies the type of reaction as precipitation or exchange. • Writes a correct word equation OR writes the formula for ONE product correctly.	• Links ONE correct observation to the correct chemical species / substance for one reaction. • Identifies and partially justifies the choice of the type of reaction. • ONE ionic equation has been written with correct formulae, but is not balanced. OR Writes ONE molecular equation (balanced or unbalanced) with the correct formulae.	• All observations are correct and linked to the chemical species involved for both reactions. • Identifies and justifies the choice of the type of reaction. • BOTH balanced **ionic** equations are correct. (States are not required.)

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

Q	Evidence	Achievement	Merit	Excellence
TWO	When **white** calcium carbonate solid, $CaCO_3$, is strongly heated it releases a **colourless** gas, carbon dioxide, CO_2, and forms another **white** solid calcium oxide, CaO. $CaCO_3(s) \rightarrow CaO(s) + CO_2(g)$ When **white** calcium hydroxide solid, $Ca(OH)_2$, is strongly heated it releases a **colourless** gas, water, H_2O, and also forms the **white** solid calcium oxide, CaO. $Ca(OH)_2(s) \rightarrow CaO(s) + H_2O(g)$ **Comparisons:** **Both** calcium carbonate and calcium hydroxide are undergoing **thermal decomposition** since a solid is **decomposing to form more than one substance when heated**. **Both are white solids** and when strongly heated, they **both form another white solid,** calcium oxide. During heating, both of the solids break up because gas escapes from them. **Contrast:** The **difference** in these reactions is in the **gases released**. Calcium carbonate releases carbon dioxide, so a loop of limewater (calcium hydroxide in solution) will turn **milky** (or **cloudy white**) when held in the gas / carbon dioxide will extinguish a burning splint. Calcium hydroxide releases steam or water as a gas / vapour. A piece of **cobalt chloride paper** held in this gas will turn from **blue to pink**.	• Describes ONE observation correctly. • Identifies the type of reaction as thermal decomposition. • Describes a test for one of the products. • Writes a word equation OR writes the correct formulae for the reactant or the products for ONE reaction.	• Links ONE observation to the correct chemical species / substance for one reaction. • Identifies and partially justifies the choice of the type of reaction. • Explains how one gaseous product can be identified. • Compares or contrasts the two reactions. • Writes ONE symbol equation (balanced or unbalanced) with the correct formulae.	• ALL observations are linked to the chemical species involved for both reactions. • Identifies and justifies the choice of the type of reaction. • Explains how both gaseous products can be identified. • Compares and contrasts the two reactions. • Writes BOTH balanced equations. (States are not required.)

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

Q	Evidence	Achievement	Merit	Excellence
THREE (a)	**Shiny grey metal sodium** reacts with **yellow / green chlorine gas** to form **white crystals of sodium chloride**.	• Links ONE observation to correct reactant or product.	• Links ALL observations to correct reactants and product.	
(b)(i)	Sulfur dichloride or disulfur dichloride or sulfur chloride.	• Identifies product as sulfur dichloride / disulfur dichloride / sulfur chloride		
(ii)	This is a **combination reaction** because two **elements**, sulfur and chlorine combine to form a new substance / compound, (di)sulfur dichloride.	• Identifies the type of reaction as combination.	• Identifies and partially justifies the choice of the type of reaction.	• Identifies and justifies the choice of the type of reaction.
(c)	$2Na(s) + Cl_2(g) \rightarrow 2NaCl(s)$ $S(s) + Cl_2(g) \rightarrow SCl_2(s)$ or $2S(s)$ (or $S_2(s)$) + $Cl_2(g) \rightarrow S_2Cl_2(g)$	• Writes a correct word equation OR writes the correct formulae for the reactants OR the product of ONE reaction.	• Writes ONE symbol equation (balanced or unbalanced) with the correct formulae.	• Writes BOTH balanced equations. (States are not required.)
(d)	Sodium is a metal element and when it reacts with chlorine gas, both elements form **ions**. Each sodium atom **loses 1 electron** to each chlorine atom / **each chlorine atom gains 1 electron**. Sodium ions and chloride ions combine to form the (ionic) compound sodium chloride, NaCl. Sulfur is a non-metal element and when it reacts with chlorine gas, **electrons are shared**. Sulfur and chlorine atoms combine to form the (covalent) compound sulfur dichloride, SCl_2.	• Identifies the type of electron transfer for ONE reaction.	• Explains ONE reaction in terms of electron transfer.	• Explains BOTH reactions in terms of electron transfer (or lack thereof).

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

Q	Evidence	Achievement	Merit	Excellence
FOUR (a)	<table><tr><td></td><td>Zn</td><td>Mg</td><td>Cu</td><td>Pb</td></tr><tr><td>$Cu(NO_3)_2$</td><td>✓</td><td>✓</td><td>×</td><td>✓</td></tr><tr><td>$Pb(NO_3)_2$</td><td>✓</td><td>✓</td><td>×</td><td>×</td></tr></table>	• Completes the table correctly.		
(b)	For example: In the reaction between magnesium metal and copper nitrate solution, the grey magnesium metal would (slowly) disappear and an orange / brown deposit / solid / precipitate of copper would form. The blue copper nitrate solution's colour would fade to colourless as magnesium ions displace the blue copper ions from the solution resulting in a magnesium nitrate solution. Since the magnesium has displaced the copper **ions** (copper in solution) from the solution, this is a **displacement reaction (redox)**. Balanced equation: Either $Mg(s) + Cu^{2+}(aq) \rightarrow Cu(s) + Mg^{2+}(aq)$ $Mg(s) + Cu(NO_3)_2(aq) \rightarrow Cu(s) + Mg(NO_3)_2(aq)$	• Describes ONE observation correctly. • Identifies reaction as displacement / redox reaction. • Writes a correct word equation OR writes the correct formulae for the reactants or the products of ONE reaction OR writes two balanced half equations.	• Links ONE observation to the correct chemical species / substance for the selected reaction. • Identifies and partially justifies the choice of the type of reaction. • Writes unbalanced molecular / ionic equation with the correct formulae.	• Observations are linked to the chemical species involved for the selected reaction for **one reactant and one product**. • Identifies and justifies the choice of the type of reaction. • Writes a balanced equation. (States are not required.)
(c)	Zinc, copper and lead do not react with magnesium nitrate because magnesium is higher on the activity series, so is **more reactive** than the other metals. Therefore none of zinc, copper, or lead can displace magnesium ions from solution, so no reaction will occur.	• Identifies Mg as **more reactive** than any one of Zn, Cu and Pb.	• Explains why Zn, Cu and Pb do not react with $Mg(NO_3)_2$ solution.	

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

Judgement Statement

	Not Achieved	Achievement	Achievement with Merit	Achievement with Excellence
Score range	0 – 10	11 – 19	20 – 25	26 – 32