Assessment Schedule – 2017

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

Evidence Statement

Q	Evidence	Achievement	Merit	Excellence
ONE (a)(i)	1. Combination. 2. Catalytic decomposition. 3. Thermal decomposition. 4. Displacement.	• Identifies FOUR correct reaction types.		
(ii)	**Reaction 1**: silver-grey coloured metal (Mg) burns with a bright white light in the colourless gas (O_2) and forms a grey / white powder (MgO). **Reaction 2:** A black solid catalyst (MnO_2) (catalyses) a colourless liquid / solution (H_2O_2) to form bubbles of colourless gas (O_2) and a colourless liquid (H_2O) (glowing splint relights – O_2, test tube gets warm).	• Describes TWO observations for either reaction.	• Links FOUR observations to the species in either reaction.	
(iii)	**Reaction 3**: Lithium carbonate → lithium oxide + carbon dioxide.		• Correct word equation.	
(iv)	**Reaction 4**: **3**$ZnSO_4$ + **2**Al → 3Zn + $Al_2(SO_4)_3$ OR $3Zn^{2+} + 2Al \rightarrow 3Zn + 2Al^{3+}$		• Correct symbol / ionic equations (unbalanced).	
(b)	$Fe(s) + S(s) \rightarrow FeS(s)$ $S(s) + O_2(g) \rightarrow SO_2(s)$ OR $S_8(s) + 8O_2(g) \rightarrow 8SO_2(s)$ $2Cu(s) + O_2(g) \rightarrow 2CuO(s)$ OR $CuCO_3(s) \rightarrow CuO(s) + CO_2(g)$ OR $Cu(OH)_2(s) \rightarrow CuO(s) + H_2O(\ell)$ All reactions involve heating the reactants. A mixture of iron filings and sulfur powder is heated in a boiling tube. The grey iron and yellow sulfur glow as they are heated and form a black solid, which is iron sulfide. This is a combination reaction. Solid yellow sulfur burns in colourless oxygen gas to produce sulfur dioxide, a colourless / pungent gas. This is a combination reaction. Copper metal is held in a Bunsen flame; the pinky-orange metal burns in the colourless oxygen gas and a black layer of copper oxide forms on the metal. This is a combination reaction. OR A green solid copper(II) carbonate / blue solid copper hydroxide is heated and a colourless gas (CO_2) escapes / colourless liquid (H_2O) forms, and a black solid residue of CuO is left. This is a thermal decomposition reaction.	• Recognises a correct type of reaction for all THREE. • Recognises that all three are heated. • Gives TWO observations for any reaction.	• Links observations for TWO reactions to the reactants and products. (*allow minor error*)	• Gives balanced equations for THREE reactions (from (a)(iv) and (b)). • Compares and contrasts all THREE reactions (type, method, observations).

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

Q	Evidence	Achievement	Merit	Excellence
TWO (a)(i)	Zinc + lead nitrate → lead + zinc nitrate Zinc chloride + lead nitrate → zinc nitrate + lead chloride	• BOTH correct word equations.	• Explains precipitation referencing the **specific** reaction substances in (a) (ii). (*Minor error allowed*)	• Explains precipitation fully including, EITHER justification of the precipitate using the rules of precipitation OR recognition of the spectator ions / soluble product.
(ii)	The reaction between zinc metal and lead nitrate is classified as a displacement reaction because when zinc metal is placed into a solution of lead nitrate, the zinc metal displaces lead ions in solution to form zinc nitrate – since zinc is higher on the activity series. Zinc metal loses two electrons to form Zn^{2+} and the electrons are gained by Pb^{2+} to form Pb. When zinc chloride and lead nitrate solutions are mixed, a precipitation reaction (or exchange reaction) occurs rather than a displacement reaction. This is because when the two solutions (zinc chloride and lead nitrate) are added together, an insoluble precipitate forms. OR because when the two solutions are added together, ions from each substance are swapped or exchanged, and an insoluble substance (precipitate) forms.	• Describes a displacement reaction. • Identifies the precipitation reaction.		
(b)	During displacement reactions, **metals** which are higher on the activity series will displace **metal ions** from solutions lower on the activity series. The more reactive metals will **transfer electrons** to the metal ion. A metal which is further down the activity series cannot displace metal ions from solutions higher on the activity series and so no reaction will occur. A > C > B (most to least reactive) **Metal A** displaces both B and C – so it must be the **most reactive** and be at the top of this activity series. **Metal B** cannot displace either A or C – so it must be the **least reactive** and be at the bottom of this activity series. **Metal C** displaces B but cannot displace A – so it must be more reactive than B but less reactive than A, and be in between them in this activity series.	• Correct order: ACB.	• Explains a displacement reaction correctly with reference to EITHER atoms forming ions and ions in solution being displaced OR electron transfer in the correct direction, related to the equation in (a) (ii) OR the correct order in (b). (*Minor error allowed.*)	• Explains a displacement reaction correctly with reference to BOTH atoms forming ions and ions in solution being displaced AND electron transfer in the correct direction related to the equation in (a) (ii) OR the correct order in (b).

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

Q	Evidence	Achievement	Merit	Excellence
THREE (a)(i)	Zinc carbonate = no Potassium hydroxide = yes Barium chloride = yes	• THREE correctly identified.		
(ii)	Yes – calcium carbonate No Yes – lead sulfate.	• All correct.		
(iii)	**Calcium carbonate:** When colourless sodium carbonate solution is added to colourless calcium chloride solution, a white precipitate calcium carbonate forms (and a colourless solution of sodium chloride). This is a precipitation reaction because when the two solutions (sodium carbonate and calcium chloride) are added together, an insoluble precipitate forms, OR because when the two solutions are added together, ions from each substance are swapped or exchanged, and an insoluble substance (precipitate) forms. In this experiment, the combination of calcium ions and carbonate ions forms a precipitate of calcium carbonate. OR **Lead sulfate:** When colourless sodium sulfate solution is added to colourless lead nitrate solution, a white precipitate lead sulfate forms (and a colourless solution of sodium nitrate). This is a precipitation reaction because when the two solutions (sodium sulfate and lead nitrate) are added together, an insoluble precipitate forms, OR because when the two solutions are added together, ions from each substance are swapped or exchanged, and an insoluble substance (precipitate) forms. In this experiment, the combination of lead ions and sulfate ions forms a precipitate of lead sulfate.	• Describes a precipitation reaction. • Describes TWO observations for the chosen reaction.	• Links THREE or more observations to the reactants and products for ONE reaction. OR Explains precipitation by explaining that the specific ions in solution combine to form the insoluble precipitate by name or formula.	• Elaborates on the formation of the precipitate, and links all observations to their reactants or products including both spectator ions OR justification of precipitate using solubility rules.

(b)	Add a few mL of the solution to a test tube and add an aqueous solution of barium nitrate. If the water solution contains sulfate ions, then a white precipitate would be seen. This is because barium sulfate would be formed which is insoluble and forms a white precipitate. $Ba^{2+} + SO_4^{2-} \rightarrow BaSO_4$ To a new sample of solution, add an aqueous solution of silver nitrate. If the solution contains chloride ions then a white precipitate would be seen. This is because silver chloride would be formed which is insoluble and forms a **white** precipitate. $Ag^{+} + Cl^{-} \rightarrow AgCl$ If it contains iodide ions then a yellow precipitate would be seen. This is because silver iodide would be formed which is insoluble and forms a **yellow** precipitate. $Ag^{+} + I^{-} \rightarrow AgI$ OR Can add silver nitrate to all 3 solutions and identify all three with sulfate being identified as the unknown having the absence of a precipitate forming	• Identifies ONE of the precipitates formed by any two of name / formula / observation.	• Identifies TWO solutions correctly with a valid procedure, linked to correct observations with the formula for each precipitate.	• Identifies all three solutions correctly with a valid procedure, linked to correct observations of all precipitates formed. • Correctly balanced ionic / symbol equations, dependent on the method.

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

Cut Scores

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