Assessment Schedule – 2012

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

Evidence Statement

Q	Evidence	Achievement	Merit	Excellence
ONE (a) (i)(ii) (iii) (b) (i)(ii) (iii)	This is an example of a **combination** (accept combustion or oxidation) reaction because **two elements** react together to form **one new compound**. The **hydrogen and oxygen** would **explode** with a **small flame** and a **loud squeaky pop** would be heard. **Condensation / colourless** *(not clear)* **liquid (water)** would form on the tube. Condensation forming in the tube could be tested with **$CoCl_2$ paper**, which will turn from **blue to pink**. $2H_2 + O_2 \rightarrow 2H_2O$ This is an example of a **thermal decomposition** reaction where the copper carbonate is heated and it **decomposes to form more than one substance** The **green $CuCO_3$ powder** would heat and change colour to form a **black powder of CuO**. There would possibly be some **'jumping'** of the powder as a **colourless gas CO_2** forms and then escapes the tube. The CO_2 can be collected and bubbled into **limewater** which would go **milky** and confirm that **CO_2** is produced. CO_2 can be collected, and a **burning splint**, when introduced, would go out (CO_2 does not support combustion). Adding **sulfuric acid to the black CuO powder** will cause a **blue solution** ($CuSO_4$) to form to show **Cu^{2+}** is present. $CuCO_3 \rightarrow CuO + CO_2$	• Identifies one type of reaction. • Describes an observation of hydrogen gas and oxygen gas in air reacting. • Describes an observation of $CuCO_3$ being heated. • Describes a test for a product. • Writes a correct word / unbalanced symbol equation. OR Correctly identifies the products in both reactions.	• One reaction is identified correctly with an explanation. • One reaction has an observation made that is correctly linked to a species in the reaction. • One reaction has a correctly identified test for a product. • Both equations have correct formulae but are not balanced.	• Both reactions are identified correctly with explanations. • ALL observations and tests are correctly linked to the chemical species for ONE reaction. • Both equations are correct and balanced.

NØ	N1	N2	A3	A4	M5	M6	E7	E8
No response or no relevant evidence.	1a	2a	3a	4a	3m	4m	3e with minor errors in one aspect. (but not equations)	3e

TWO (a)	After MnO_2 (black / dark brown solid) is added to the colourless H_2O_2 solution, bubbles of colourless gas are formed rapidly. The solution remains colourless. The black / dark brown solid remains.	• Identifies one observation.	• Links type of reaction (catalytic decomposition) to formation of new chemicals OR role of MnO_2.	• Justifies the type of reaction selected.
(b)	This is a **catalytic decomposition** where hydrogen peroxide decomposes / breaks down to form H_2O and O_2 gas (two smaller products). Manganese dioxide (MnO_2) is used as a catalyst to speed up the rate of the reaction. The MnO_2 causes the colourless H_2O_2 solution to decompose more rapidly to form colourless O_2 gas / bubbles of O_2 gas and colourless H_2O. $2H_2O_2 \rightarrow 2H_2O + O_2$	• Identifies type of reaction as a catalytic decomposition reaction. • Describes MnO_2 as a catalyst. • Identifies both products of the reaction (evidence could be from equations).	• Links ONE observation to a chemical species. • An unbalanced symbol equation is given (formulae must be correct).	• ALL observations for test tube B are linked to the relevant chemical species. • A balanced symbol equation is written.

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

THREE (a)	The blue $CuSO_4$ solution decolourises / fades overnight and the iron nail has a thick pink / brown / orange deposit on it. The iron nail slowly dissolves. There is no reaction between the copper nail and $FeSO_4$. (Candidates may recognise that Fe^{2+} reacts to form Fe^{3+} overnight, so the appearance of the solution changes from pale green to yellow / orange. They must also recognise that the copper nail does not react.)	• Describes ONE observation. • Identifies type of reaction as displacement.		
(b) (i) (ii)	This is a **displacement** (oxidation-reduction) reaction as Fe is able to displace the copper ions from solution, as iron is higher than copper in the activity series / iron is more reactive than copper. $Fe + Cu^{2+} \rightarrow Cu + Fe^{2+}$	• Writes a word / unbalanced full equation / balanced half equations (correct formulae required).	• Identifies type of reaction and explains why a displacement reaction occurs. • Writes a balanced full / unbalanced ionic equation.	• Writes a balanced ionic equation (half equations are insufficient).
(c)	Tin goes between iron and lead in the activity series. Iron is more reactive because it displaces both tin ions, Sn^{2+}, and lead ions, Pb^{2+}, from solution. Lead is less reactive than tin as it will not displace Fe^{2+}or Sn^{2+}. Tin sits in the middle because it will displace lead ions from solution, but cannot displace iron ions.	• Places Sn correctly in activity series.	• Explanation links correct placement of Sn to **some** of the provided information.	• Explanation links correct placement of Sn to **all** of the information provided in the **table** OR links to **activity series** and **some** of information provided in the **table**.

NØ	N1	N2	A3	A4	M5	M6	E7	E8
No response or no relevant evidence.	1a	2a	3a	4a	2m	3m	2e with minor error (ionic equation must be correct)	2e

FOUR	An aqueous solution of silver IONS can be used to test for chloride ions. It is a **precipitation reaction**. Silver chloride would form a white precipitate if the pool water was mixed with the aqueous silver solution. The white precipitate forms because the Ag^+ ions are attracted (combine / join / bond) to the Cl^- ions in solution, forming insoluble AgCl / silver chloride. The pool water is colourless and silver nitrate is colourless but when they are mixed, a white precipitate of silver chloride is formed showing presence of chloride ions in pool water. $Ag^+ + Cl^- \rightarrow AgCl(s)$ (A white precipitate will also form with an aqueous lead solution, but it could be $PbCl_2$ or $PbSO_4$ if sulfate ions are present. $Pb^{2+} + 2Cl^- \rightarrow PbCl_2$ Using an aqueous solution of lead ions may not confirm the presence of only chloride ions.)	• Identifies a solution that will produce a precipitate. • Identifies the precipitation reaction. • Identifies white colour of precipitate. • Identifies initial solutions as colourless. • Identifies ions involved (evidence could come from an ionic equation).	• Selects a solution (Pb^{2+} or Ag^+) that will form a precipitate with chloride. • Links attractions of ions to formation of a precipitate. • Links white precipitate to the correct ions / AgCl or $PbCl_2$. • Balanced equation, but spectator ion(s) present (**correct formulae** required).	• Selects a solution that will **only** form a precipitate with chloride ions and leave other ions as spectators (Ag^+). (According to the provided solubility rules.) • ALL required observations are described and linked to the correct species. • Balanced **ionic** equation is written.

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

Judgement Statement

	Not Achieved	Achievement	Achievement with Merit	Achievement with Excellence
Score range	0 – 8	9 – 17	18 – 24	25 – 32