1

90934

909340

SUPERVISOR'S USE ONLY

NZQA

NEW ZEALAND QUALIFICATIONS AUTHORITY
MANA TOHU MĀTAURANGA O AOTEAROA

QUALIFY FOR THE FUTURE WORLD
KIA NOHO TAKATŪ KI TŌ ĀMUA AO!

Level 1 Chemistry, 2017

90934 Demonstrate understanding of aspects of chemical reactions

9.30 a.m. Tuesday 14 November 2017
Credits: Four

Achievement	Achievement with Merit	Achievement with Excellence
Demonstrate understanding of aspects of chemical reactions.	Demonstrate in-depth understanding of aspects of chemical reactions.	Demonstrate comprehensive understanding of aspects of chemical reactions.

Check that the National Student Number (NSN) on your admission slip is the same as the number at the top of this page.

You should attempt ALL the questions in this booklet.

A periodic table and other reference material are provided in the Resource Booklet L1–CHEMR.

If you need more room for any answer, use the extra space provided at the back of this booklet and clearly number the question.

Check that this booklet has pages 2–11 in the correct order and that none of these pages is blank.

YOU MUST HAND THIS BOOKLET TO THE SUPERVISOR AT THE END OF THE EXAMINATION.

Achievement

TOTAL 08

ASSESSOR'S USE ONLY

combination, displacement, decomposition, precipitation

QUESTION ONE

ASSESSOR'S USE ONLY

(a) (i) Complete the table below to show the type of chemical reaction occurring.

Reaction	Chemical Reaction	Type of chemical reaction occurring
1	A piece of magnesium metal is held in a blue Bunsen burner flame.	thermal decomposition
2	Some hydrogen peroxide solution is placed in a test tube with a small amount of manganese dioxide powder.	~~Catalytic~~ Catalytic decomposition ~~Precipitation Displacement~~
3	A small amount of lithium carbonate powder is heated in a boiling tube.	thermal decomposition
4	A small volume of zinc sulfate solution is placed into a test tube and a clean piece of aluminium metal added.	displacement

(ii) What would be observed during **Reaction 1** and **Reaction 2**?

Link the observations to species involved.

Reaction 1:

In reaction one the magnesium metal the heat, caused the magnesium to burn, with a bright white light

Reaction 2:

speeds up the reaction of

The hydrogen peroxide ~~and~~ magnesium dioxide. Magnesium dioxide would have burned white and flew into a black residual.

(iii) Write a word equation for **Reaction 3** in the box below.

Word equation for **Reaction 3**:

lithium carbonate → lithium + carbon dioxide

$3ZnSO_4 + 2Al^{3+} \rightarrow 2Al_2(SO_4)_3 + 3Zn$

(iv) Complete the symbol equation for **Reaction 4** in the box below.

ASSESSOR'S USE ONLY

Balanced symbol equation for **Reaction 4**:

$3ZnSO_4 + 2Al^{3+} \rightarrow 2Al_2(SO_4)_3 + 3Zn$

(b) New compounds can be formed during chemical reactions.

Compare and contrast the methods that could be used to prepare samples of iron sulfide, sulfur dioxide and copper oxide.

In your answer, for the preparation of each compound, you should:

- identify the type of reaction occurring
- describe any observations that would be seen, and link these to the reactants and products
- write balanced symbol equations.

Balanced symbol equations:

1. $S + Fe \rightarrow FeS$
2. $O_2 + S \rightarrow SO_2$
3. $2Cu + O_2 \rightarrow 2CuO$

1. In reaction 1 a thermal decomposition reaction is taking place, ~~In reaction 2~~ a This would have formed between the Iron and sulfide forming iron sulfide a Black/green ~~solid~~ compound. Fe^{2+} was a magnetic iron, ~~boa~~ and S was a yellow solid and when burned the substances would have chemically decomposed and broke chemical bonds between Fe and S to form FeS.

There is more space for your answer to this question on the following page.

Sulfure dioxide would have been formed through catalytic decomposition, As through the aid of a catalyst (MnO_2) the rate of reaction speeds up allowing H_2O_2 to occur and react with S creating SO_2

Copper oxide would have been formed when copper was burned (thermal decomposition, when this was happening the exposed copper electrons bonded with the oxide creating copper oxide when the chemical bonds of copper were being heated causing Copper to undergo decomposition between oxide creating copperoxide

Sulfure dioxide:

Sulfure dioxide underwent thermal decomposition when the sulfure was being heated over a bunsenburner (flame) the exposed iron would have reacted with the ~~oxygen~~ carbon dioxide to form sulfure dioxide, in addition it would have had to react with carbon dioxide while being heated to break the bonds (chemically decompose), to form Sulfure dioxide

ASSESSOR'S USE ONLY

N1

QUESTION TWO

ASSESSOR'S USE ONLY

(a) Zinc metal reacts with lead nitrate in a displacement reaction. Zinc chloride solution also reacts with lead nitrate; however, this is not a displacement reaction.

(i) Complete the word equations below for these two reactions.

zinc + lead nitrate → lead + zinc nitrate

zinc chloride + lead nitrate → zinc nitrate + lead chloride

(ii) Explain why the reaction between zinc chloride and lead nitrate is **not** classified as a displacement reaction, but the reaction between zinc metal and lead nitrate is.

In your answer, you should identify what type of reaction is occurring between zinc chloride and lead nitrate.

The reaction between zinc chloride and lead nitrate is not classified as a displacement reaction as it is a precipitation reaction. This is because when lead nitrate forms, they form an insoluable precipitate. However, zinc nitrate forms a soluble precipitate. A displacement reaction occurs when a more reactive metal bonds with the solvent displacing the other solute that is less reactive on the activity field. As lead is lower on the activity series than zinc is was unable to remain bonded to nitrate and was displaced and forced to bond with chloride. Lead is less reactive than zinc causing it to be unable to displace

(turn to back)

(b) Metals can be put into a reactivity series based on the reactions between metals and solutions. The table below shows the results of putting metals **A**, **B**, and **C** into metal sulfate solutions.

ASSESSOR'S USE ONLY

Solution	Metal **A** (1st)	Metal **B** (3rd.)	Metal **C** (2nd)
Metal **A sulfate**		No reaction	No reaction
Metal **B sulfate**	Displaces **B**		Displaces **B**
Metal **C sulfate**	Displaces **C**	No reaction	

Analyse the results to determine the order of reactivity for the three metals **A**, **B**, and **C**.

Justify your answer by linking the results to your knowledge of displacement reactions.

You do NOT need to identify each metal.

Metal A is the highest on the activity series, then C and then B. This is known as Metal A was able to displace both metals (B and C). It would be likely that metal A was either Ca or Mg, as these 2 are high on the activity series. As metal C was able to displace B it is clear that it is higher on the activity series than B, however it was unable to displace metal A therefore it is less reactive than metal A. When these metals are displaced they are destablized and oxidised causing them to devolve (turn) into there element form, depositing on the flask.
Metal A = Ca or Mg - high on activity series
Metal B = Cu or Ag - low on activity series
Metal C = Zn or Fe or Pb - middle on activity series.

A4

QUESTION THREE

ASSESSOR'S USE ONLY

(a) (i) Which of the following substances are soluble in water?

You may use the solubility rules provided in the resource booklet.

Substance	Soluble in water? Yes/No
Zinc carbonate	No
Potassium hydroxide	No
Barium chloride	Yes

(ii) For each of the pairs of solutions below, identify whether a precipitate will form when the solutions are mixed.

Name any precipitates that form.

Solution being mixed	Precipitate forms? Yes/No	Name of precipitate
sodium carbonate and calcium chloride	Yes	Calcium carbonate
sodium hydroxide and potassium nitrate	No	No
sodium sulfate and lead nitrate	Yes	Lead sulfate

(iii) Choose ONE of the pairs of solutions from the table above that **forms a precipitate**, and elaborate on the reaction occurring.

In your answer, you should:

- describe any observations that would be seen, and link them to the reactants and products involved
- explain why the reaction is classified as a precipitation reaction by referring to the ions in both solutions and the precipitate formed.

~~Lead sulfate ($PbSO_4$)~~ Calcium carbonate ($CaCO_3$)
Calcium carbonate is a green/blue solution.
Sodium carbonate was a white solution and calcium chloride was a colourless solution.
Calcium carbonate forms a solid/insoluable precipitate. Fromed due to electrostatic attractions between the calcium and carbon dioxide causing a blue/green calcium carbonate to form.

ppte. defn

ASSESSOR'S USE ONLY

(b) Three solutions containing negative ions/anions have been mislabelled.

One of the solutions contains sulfate ions, one of them contains chloride ions, and one contains iodide ions. SO_4^{2-} Cl^- I^-

It is known that the solutions contain no other negative ions/anions.

How could the solutions be tested to determine which solutions contain each of the three ions: sulfate, chloride, and iodide?

In your answer, you should:

- describe a method that could be carried out in a school laboratory, using barium nitrate and silver nitrate as test solutions
- identify any precipitates formed and link these to any observations that would be made
- explain how the results could be used to identify the solutions
- give balanced ionic equations for ALL precipitates formed.

You may use the solubility rules provided in the resource booklet.

1. Iodide: All iodides are soluable except AgI and PbI_2.
In a test tube place the iodide solution with the silver nitrate. If the test tube turns yellow then there are iodides present however if the solution remains the same colour then none are present. This is because in precipitation reactions, solutions swap partner ions, if I^- and Ag^+ are both present then the electrostic bonds will cause a yellow solution to form.

2. Chloride: All chlorides are soluable except AgCl and $PbCl_2$.
In a test tube place the solution containing the chloride ions and the solution containing silver nitrate ($AgNO_3$). If the solution changes colour to white then there are chloride ions present in the solution

ASSESSOR'S USE ONLY

if it remains the same then there are non

3a Sulfate; Sulfates are soluable except $BaSO_4$, $PbSO_4$, and $CaSO_4$.
In a test tube place barium nitrate and the solution containing the sulfate ions if the solution changes to blue then there are ~~barium~~ sulfates in the solution are Barium sulfate ~~there~~ turns blue, however if it stays the same colour then none are present.

Ionic equation

1. $Ag^+ + I^- \rightarrow AgI$
2. $Ag^+ + Cl^- \rightarrow AgCl$
3. $Ba^{2+} + SO_4^{2-} \rightarrow BaSO_4$

A3

Extra paper if required.
Write the question number(s) if applicable.

ASSESSOR'S USE ONLY

QUESTION NUMBER

Zii the zinc ion. ~~the electrons~~ As zinc replaced lead it gained a full valence shell of eight electrons, making it a stable electron. These electrons were gained from the less reactive lead, destabilising it.

Subject:	Chemistry	Standard:	90934	Total score:	08

Q	Grade score	Annotation
1	N1	(a)(i) first reaction type incorrect. (a)(ii) only one correct observation. (bright white light) (a)(iii) product should be lithium oxide. (a)(iv) has incorrectly converted Al into Al^{3+} and the formula for $Al_2(SO_4)_3$ is incorrect. (b) 2 equations are correct and balanced. (3 needed for the 'e' point) Correctly recognised that all 3 reactions required heat for an 'A' point, and one correct observation, e.g. S is a yellow solid. No further observations or reaction types are correct.
2	A4	(a)(i) both answers correct. (a)(ii) correctly identifies the precipitation reaction and correctly describes a displacement reaction. Both explanations for these contain errors in understanding which limits the response to achievement. (b) correctly places 3 metals in order of reactivity, but the explanation is not linked to an understanding of displacement reactions.
3	A3	(a)(i) one answer was incorrect (a)(ii) all answers were correct (a)(iii) the term precipitate is defined correctly, but errors both in observations and understanding of a precipitate reaction which limits the response to achievement. (b) all 3 equations are correct, but the procedure and observations are largely incorrect. Colour changes are noted but not the formation of the precipitates. The procedure is not systematic.