

No part of the candidate evidence in this exemplar material may be presented in an external assessment for the purpose of gaining credits towards an NCEA qualification.

1

90934



909340



NEW ZEALAND QUALIFICATIONS AUTHORITY  
MANA TOHU MĀTAURANGA O AOTEAROA

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

SUPERVISOR'S USE ONLY

## 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.**

Merit

TOTAL

14

ASSESSOR'S USE ONLY

## 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.	<del>Composition</del> reaction Combination
2	Some hydrogen peroxide solution is placed in a test tube with a small amount of manganese dioxide powder.	Catalytic decomposition reaction
3	A small amount of lithium carbonate powder is heated in a boiling tube.	<del>Combination</del> reaction 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 reaction

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

Link the observations to species involved.

**Reaction 1:**

As the metal which is magnesium is heated, heat is given out and ~~light~~ a bright white light appears, white solid is formed which is magnesium oxide.

**Reaction 2:**

which is manganese dioxide  
As the black powder is added into the colourless hydrogen peroxide solution, the volume of the solution is decreasing.

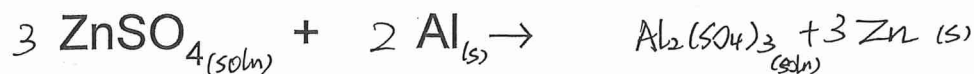
- (iii) Write a word equation for
- Reaction 3**
- in the box below.

Word equation for **Reaction 3**:

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

ASSESSOR'S  
USE ONLY

Balanced symbol equation for **Reaction 4**:



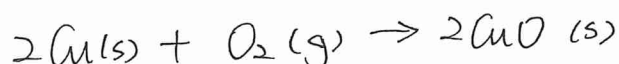
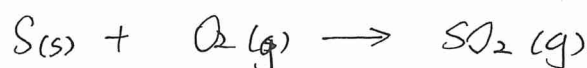
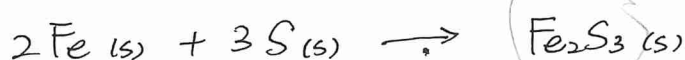
(b) New compounds can be formed during chemical reactions.

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:



Iron sulfide: Mix iron metal and <sup>yellow</sup> sulfur together then heat it, an <sup>orange</sup> flame occurs, the silver <sup>iron</sup> metal <sup>becomes</sup> dark grey and a <sup>yellow</sup> solid which is iron sulfide is formed.

sulfur dioxide: Burn the sulfur in the air, <sup>(oxygen)</sup> a blue flame occurs, the yellow sulfur melts and becomes a dark red liquid then becomes a colourless gas (sulfur dioxide) with an unpleasant smell.

copper oxide: Heat the copper in the air, <sup>(oxygen)</sup> the brown copper metal will be black, the black solid on the surface is

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

of the copper

Copper oxide.

All of the 3 reactions are combination reaction.

ASSESSOR'S  
USE ONLY

A4

## 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  $\rightarrow$  zinc nitrate + lead(s)

zinc chloride + lead nitrate  $\rightarrow$  zinc nitrate + lead chloride(s)

- (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 precipitation reaction is occurring between zinc chloride and lead nitrate. This is because  $\text{ZnCl}_2$  solution and  $\text{Pb}(\text{NO}_3)_2$  these two reactants are solution which means they are all <sup>soluble</sup> ~~soluble~~ ~~soluble~~. As they react,  $\text{Pb}^{2+}$  and  $\text{Cl}^-$  will be <sup>insoluble</sup> ~~insoluble~~ so the white solid is formed ( $\text{PbCl}_2$ ) and the  $\text{NO}_3^-$  and  $\text{Zn}^{2+}$  are spectator ions as they are not attending in this reaction.

The reaction between Zn metal and  $\text{Pb}(\text{NO}_3)_2$  is displacement reaction because there <sup>are</sup> ~~is~~ metal and solution as the reactants, two new metal and solution is formed as products. ||



- (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.

Solution	Metal A	Metal B	Metal C
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.

$A > C > B$

The displacement reactions occur because the activity of the metal(A) is higher than another metal(B) which means metal A is more reactive than metal B. Metal A is more easily to fill its outer shell by losing or gaining ions so metal A can displace metal B.

As we can see in the table, metal A displaces B and C so its reactivity is higher than B and C.

metal C displaces metal B but it can not displace metal A so the reactivity of metal C is higher than B but lower than A.

Therefore the order of reactivity for the 3 metals is  $A > C > B$ .

## 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	Yes
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	
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.

sodium carbonate and calcium chloride.

As the colourless  $\text{Na}_2\text{CO}_3$  solution is added into the colourless  $\text{CaCl}_2$  solution, a white solid which is  $\text{CaCO}_3$  is formed as the ~~its~~ colourless solution goes cloudy. In the end of the reaction, the colourless solution is  $\text{NaCl}$  solution and the white precipitate is  $\text{CaCO}_3$  solid. The  $\text{Na}_2\text{CO}_3$  solution contains  $\text{Na}^+$  ions and  $\text{CO}_3^{2-}$  ions they are soluble. The  $\text{CaCl}_2$  solution contains  $\text{Ca}^{2+}$  ions and  $\text{Cl}^-$  ions, they are soluble.

When these 2 solution is mixed,  $\text{Ca}^{2+}$  ions and  $\text{CO}_3^{2-}$  ions will be insoluble and forms  $\text{CaCO}_3$  precipitate.  $\text{Na}^+$  and  $\text{Cl}^-$  will

- (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.

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.

Add the barium nitrate into the samples of 3 solutions.  
One of the sample will react with barium nitrate, a white precipitate is formed which is barium sulfate.

Because  $\text{BaSO}_4$  is insoluble and  $\text{BaCl}_2$ ,  ~~$\text{Ba(NO}_3)_2$~~ ,  $\text{BaI}_2$  are soluble.  $\text{Ba}^{2+}_{(\text{aq})} + \text{SO}_4^{2-}_{(\text{aq})} \rightarrow \text{BaSO}_4(\text{s})$ . Therefore the sample that forms precipitate contains sulfate ions.

Add the silver nitrate into the <sup>new samples of</sup> rest 2 of solutions.

One of the sample will react and a white precipitate which is  $\text{AgCl}$  is formed.  $\text{Ag}^{+}_{(\text{aq})} + \text{Cl}^{-}_{(\text{aq})} \rightarrow \text{AgCl}(\text{s})$ .

Another sample will also react and a yellow precipitate which is  $\text{AgI}$  is formed.  $\text{Ag}^{+}_{(\text{aq})} + \text{I}^{-}_{(\text{aq})} \rightarrow \text{AgI}(\text{s})$ .

$\text{AgCl}$  and  $\text{AgI}$  are insoluble but the colours of them are different. so one of the sample if there is white solid formed the solution contains  $\text{Cl}^{-}$  ions. if there is yellow solid formed the solution contains  $\text{I}^{-}$  ions.



<b>Subject:</b>		<b>Chemistry</b>	<b>Standard:</b>	<b>90934</b>	<b>Total score:</b>	<b>14</b>
<b>Q</b>	<b>Grade score</b>	<b>Annotation</b>				
1	A4	(a)(i) all reaction types correct. (a)(ii) 3 correctly LINKED observations. (4 needed for m) (a)(iii) correct answer. (a)(iv) and (b) 3 correctly balanced symbol equations for an 'E' point. (b) correctly recognised that all 3 reactions required heat for an 'A' point, and the reaction type is correct for all 3. Many correct observations, although only 2 identify the state.				
2	A3	(a)(i) both answers correct. (a)(ii) correctly identifies the precipitation reaction and correctly explains the precipitation reaction with some omissions in detail. The explanation for displacement does not show sufficient understanding of what is occurring. (b) correctly places 3 metals in order of reactivity, but explanation is not linked to a correct understanding of displacement reactions (error is losing or gaining ions rather than electrons).				
3	E7	(a)(i) all answers correct. (a)(ii) all answers correct. (a)(iii) A very sound answer with linked observations and explanation of how precipitation occurs with very minor omission. (attraction of ions) (b) all 3 equations correct, including the clear and logical procedure and observations for the identification of unknowns.				