EXEMPLAR

90171

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For Supervisor's use only

NEW ZEALAND QUALIFICATIONS AUTHORITY
MANA TOHU MĀTAURANGA O AOTEAROA

Level 1 Chemistry, 2007

90171 Describe chemical reactions

Credits: Four
9.30 am Monday 19 November 2007

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 answer ALL the questions in this booklet.

A metal activity series, solubility rules, a table of ions and a periodic table are provided in Resource Booklet L1–CHEMR.

If you need more space for any answer, use the page(s) provided at the back of this booklet and clearly number the question.

Check that this booklet has pages 2–8 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.

For Assessor's use only	Achievement Criteria				
Achievement		**Achievement with Merit**		**Achievement with Excellence**	
Describe chemical reactions.	✓	Interpret information about chemical reactions.	✓	Apply understanding of chemical reactions.	✓
Overall Level of Performance	**E**				

Solid **E** paper

You are advised to spend 40 minutes answering the questions in this booklet.

Assessor's use only

QUESTION ONE: PRECIPITATION

The following pairs of solutions are mixed. Use the solubility rules in your Resource Booklet to identify if a **precipitate** is formed.

(a) Write the **name of the precipitate**. If none is formed, write **no precipitate.**

	Solutions that are mixed	Name of the Precipitate, OR No Precipitate
(i)	Silver nitrate + calcium chloride	Silver chloride
(ii)	Potassium sulfate + iron(II) nitrate	No precipitate
(iii)	Calcium nitrate + sodium sulfate	Calcium sulfate

A

(b) Write a balanced equation for the formation of ONE precipitate identified in Question One (a) above. Spectator ions may be omitted from ionic equations.

$Ag^+ + Cl^- \rightarrow AgCl$

M

QUESTION TWO: EQUATIONS

(a) Complete the following word equations.

(i) magnesium + oxygen $\xrightarrow{\text{heat}}$ magnesium oxide

(ii) calcium carbonate $\xrightarrow{\text{heat}}$ Calcium oxide + Carbon dioxide

(iii) lead nitrate + potassium chloride $\longrightarrow$ Lead chloride + potassium nitrate

A

(b) Complete and balance the following equations.

(i) $2I^-(aq) + Cl_2(aq) \longrightarrow 2Cl^- + I_2$

(ii) $Zn(s) + 2AgNO_3(aq) \longrightarrow Zn(NO_3)_2 + 2Ag$

M

QUESTION THREE: OBSERVING CHEMICAL REACTIONS

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A small amount of zinc hydroxide is heated in a test tube over a Bunsen burner. The following reaction occurs.

$$Zn(OH)_2(s) \xrightarrow{heat} ZnO(s) + H_2O(g)$$

(a) State what **type** of reaction is occurring. Thermal ~~decomposition~~ decomposition

A

(b) Fully describe the **observations** that would be expected if this reaction was carried out in a school laboratory. Remember to **link** your observations to the substances involved.

H_2O Gas produced is given off

~~Silver~~ grey solid is produced = ZnO

White solid ($Zn(OH)_2$) changes into a ~~grey~~ silver grey solid (ZnO)

You might see water vapour / steam, but not gas!

QUESTION FOUR: MOLAR MASSES

Calculate the relative molar masses of the following compounds. Use the relative atomic masses provided in the periodic table in the Resource Booklet.

(a) ZnO

65.4 + 16.0 = 81.4 (3s.f)

(b) $CuSO_4$

63.6 + 32.1 + (16x4) = 159.7

= 160 (3s.f)

(c) $Pb(NO_3)_2$

207 + (14x2) + (16x6) = 331 (3s.f)

A

QUESTION FIVE: CALCULATING MASS

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(a) Calculate the mass of zinc hydroxide that must be heated to produce 1.00 gram of water. Use the equation below. Show all of your working clearly.

$$Zn(OH)_2(s) \longrightarrow ZnO(s) + H_2O(g)$$

$(65.4 + (16\times2) + (1\times2))$ $((1\times2) + 16)$

99.4 18.0

5.52 1.00

$\frac{1.00}{18.0} \times 99.4 = 5.52$ (3s.f)

5.52 g of $Zn(OH)_2$

M

(b) Calculate the mass of sodium hydrogen carbonate, $NaHCO_3$, required to form 5.40 grams of carbon dioxide, CO_2, when heated. Show all of your working clearly.

$$2NaHCO_3(s) \longrightarrow Na_2CO_3(s) + H_2O(g) + CO_2(g)$$

$((23\times2) + (2\times1) + (2\times12) + (16\times6))$ $(12 + (16\times2))$

168 44.0

20.6g 5.40

$\frac{5.40}{44.0} \times 168 = 20.6\text{g}$ (3s.f)

20.6g of $NaHCO_3$

E

QUESTION SIX: CHEMICAL REACTIONS

Assessor's use only

Part A

A colourless solution of barium nitrate is added to a pale green solution of iron(II) sulfate in a beaker. A reaction occurs.

(a) Describe the observations that would be expected for this reaction.

White precipitate formed —— ($BaSO_4$)

Pale green solution turns ~~colourless~~ into a slightly darker green solution. ($Fe(NO_3)_2$)

A

(b) State what type of reaction is occurring. ~~Precipitate~~ Precipitation

A

(c) Discuss the chemistry of this reaction. Your discussion should refer to the observations you made in part (a). ~~Include a balanced~~ equation in your answer. Spectator ions may be omitted.

~~$Ba^{2+} + SO_4^{2-} \rightarrow BaSO_4$~~

$Ba(NO_3)_2 + FeSO_4 \rightarrow BaSO_4 + Fe(NO_3)_2$

$Fe^{2+} + NO_3^- \rightarrow Fe(NO_3)_2$

$Ba^{2+} + SO_4^{2-} \rightarrow BaSO_4$

$BaSO_4$ is insoluble and therefore it forms a white precipitate.

$Fe(NO_3)_2$ is soluble therefore it is a solution. The green colour of the solution is due to Fe^{2+}

E

Part B

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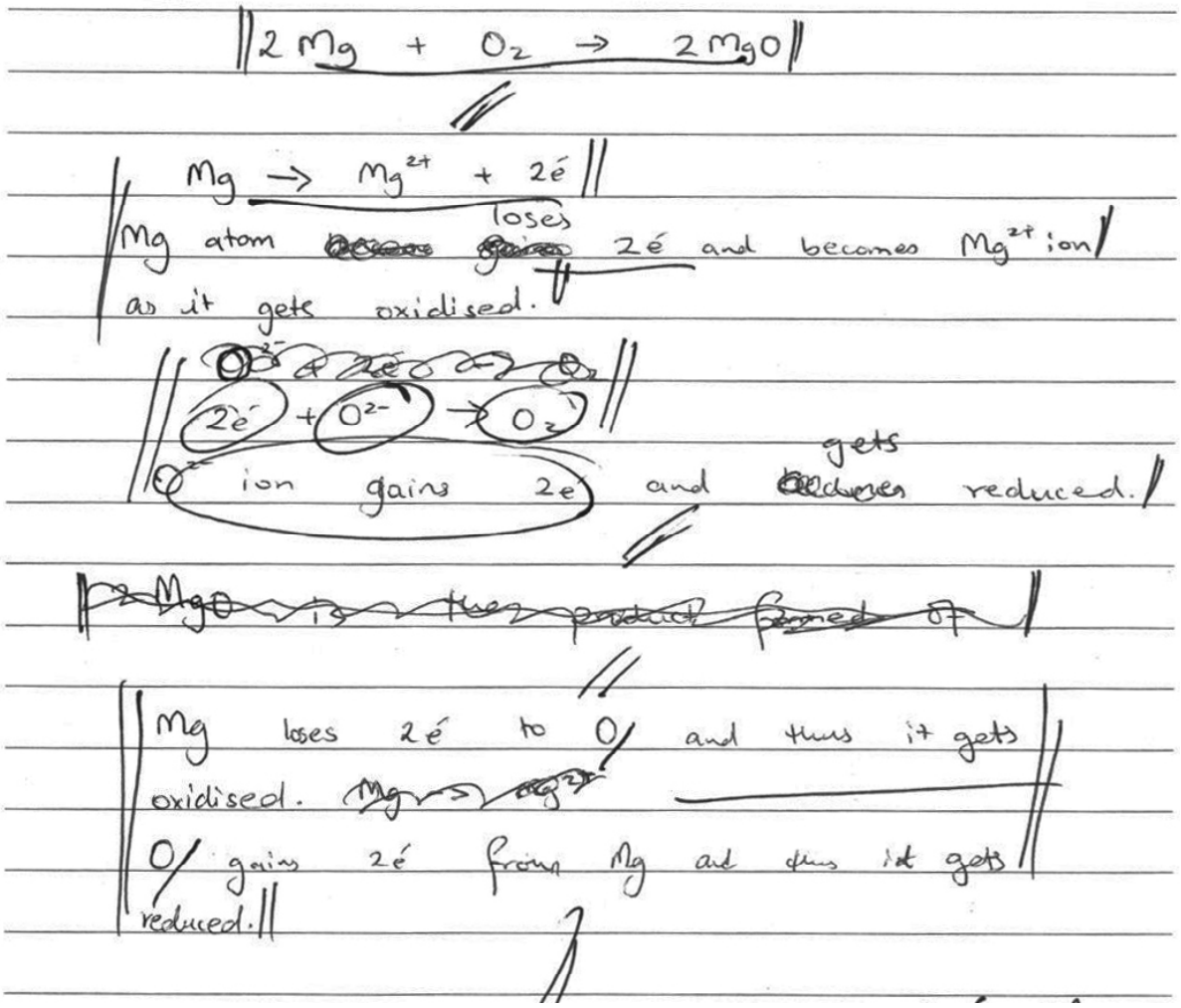
A strip of magnesium ribbon is heated over a Bunsen burner. It burns with a bright white light and forms a white ash.

Discuss the chemistry of this reaction in terms of oxidation and reduction. Write the appropriate half equations and overall balanced equation in your answer.



M

Enough for M, but O_2 half equation incorrect so can't be E. Also discusses O instead of O_2 in explanation.

QUESTION SEVEN: MOLECULAR FORMULA

Assessor's use only

A compound was analysed and found to contain:

- 20.2% phosphorus
- 10.4% oxygen and
- 69.4% chlorine.

It has a relative molar mass of 153.5.

Determine the molecular formula of this substance. Show all of your working clearly.

P	O	Cl
$\frac{20.2}{31.0}$	$\frac{10.4}{16.0}$	$\frac{69.4}{35.5}$
$\frac{0.65}{0.65}$ (3 s.f.)	$\frac{0.65}{0.65}$ (3 s.f.)	$\frac{1.95}{0.65}$ (3 s.f.)
1 :	1 :	3

Empirical formula = $POCl_3$

$(31.0 + 16.0 + (35.5 \times 3)) = 153.5$

$\frac{153.5}{153.5} = 1$ (multiplication factor)

$POCl_3 \times 1 = POCl_3$

Molecular formula = $POCl_3$

E