EXEMPLAR

90171

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NZQA

NEW ZEALAND QUALIFICATIONS AUTHORITY
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# 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** | **A** | | | | |

Solid **A** candidate

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

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## 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) $I^-(aq) + Cl_2(aq) \longrightarrow ICl_2 + H_2O$

(ii) $Zn(s) + AgNO_3(aq) \longrightarrow ZnNO_3 + Ag$

N

## 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.

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

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

before heating, Zinc hydroxide is white ppt. Upon heating the Zinc hydroxide ~~a white solid, is insoluble~~ a new insoluble white solid is formed this is the ZnO, it sits at the bottom of the test tube in a colourless solution $H_2O$.

Zinc hydroxide is not a precipitate; there is no water here. Abbreviations are not acceptable, ie ppt. Insufficient water is produced in the reaction for the ZnO to be sitting in the bottom of it.

N

## 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

Mr ZnO = (1×65.4) + (1×16) = 81.4

(b) $CuSO_4$

Mr $CuSO_4$ = (1×63.6) + (1×32.1) + (4×16) = 159.7

(c) $Pb(NO_3)_2$

Mr $Pb(NO_3)_2$ = (1×207) + ((1×14) + (3×16))×2 = 331

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.

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

Mr $Zn(OH)_2$ = 65.4 + (16+1)×2 = 99.4

Mr $H_2O$ = 2+16 = 18

99.4/18 × 1 = 5.52 g (3SF)

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.

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

Mr 2NaHCO = (23+1+12+16)×2 = 104

Mr $CO_2$ = 12+32 = 44

104/44 × 5.4 = 12.8 g (3SF)

N

Incorrect formula for $NaHCO_3$ used. This is unacceptable since it is given twice in the question.

## 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.

A very light green solution ~~is formed~~ of Iron(II) nitrate is formed and a white ppt. is formed at bottom of beaker, the precipitate is Barium Sulfate.

A

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

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.

In this reaction Barium replaces Iron II in Iron(II) Sulfate to form new white precipitate Barium Sulfate

$Ba^{2+} + SO_4^{2-} \rightarrow BaSO_4$ Iron II replaces Barium in Barium nitrate to form pale green Solution ~~Barium~~ of Iron (II) nitrate $Fe^{2+} + 2NO_3^- \rightarrow Fe(NO_3)_2$

N

Has not stated that $BaSO_4$ is insoluble, therefore **N**.

Error in equation, and $Fe^{2+}$ not identified as the ion that gives the solution its pale green colour.

## Part B

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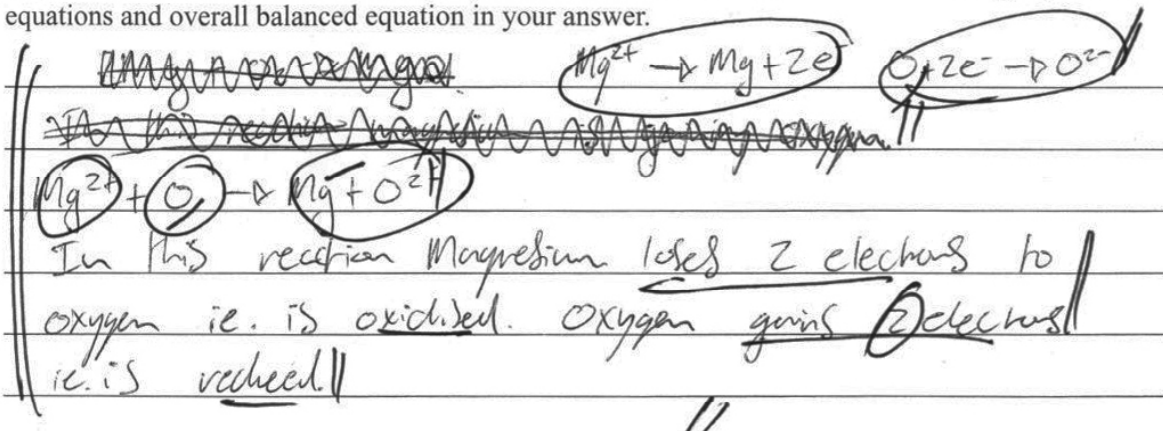
A strip of magnesium ribbon is heated over a Bunsen burner. It burns with a bright white light and forms a white ash.

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

Identifies Mg as oxidised and $O_2$ as reduced. Also identifies number of electrons transferred (for each oxygen atom).

## QUESTION SEVEN: MOLECULAR FORMULA

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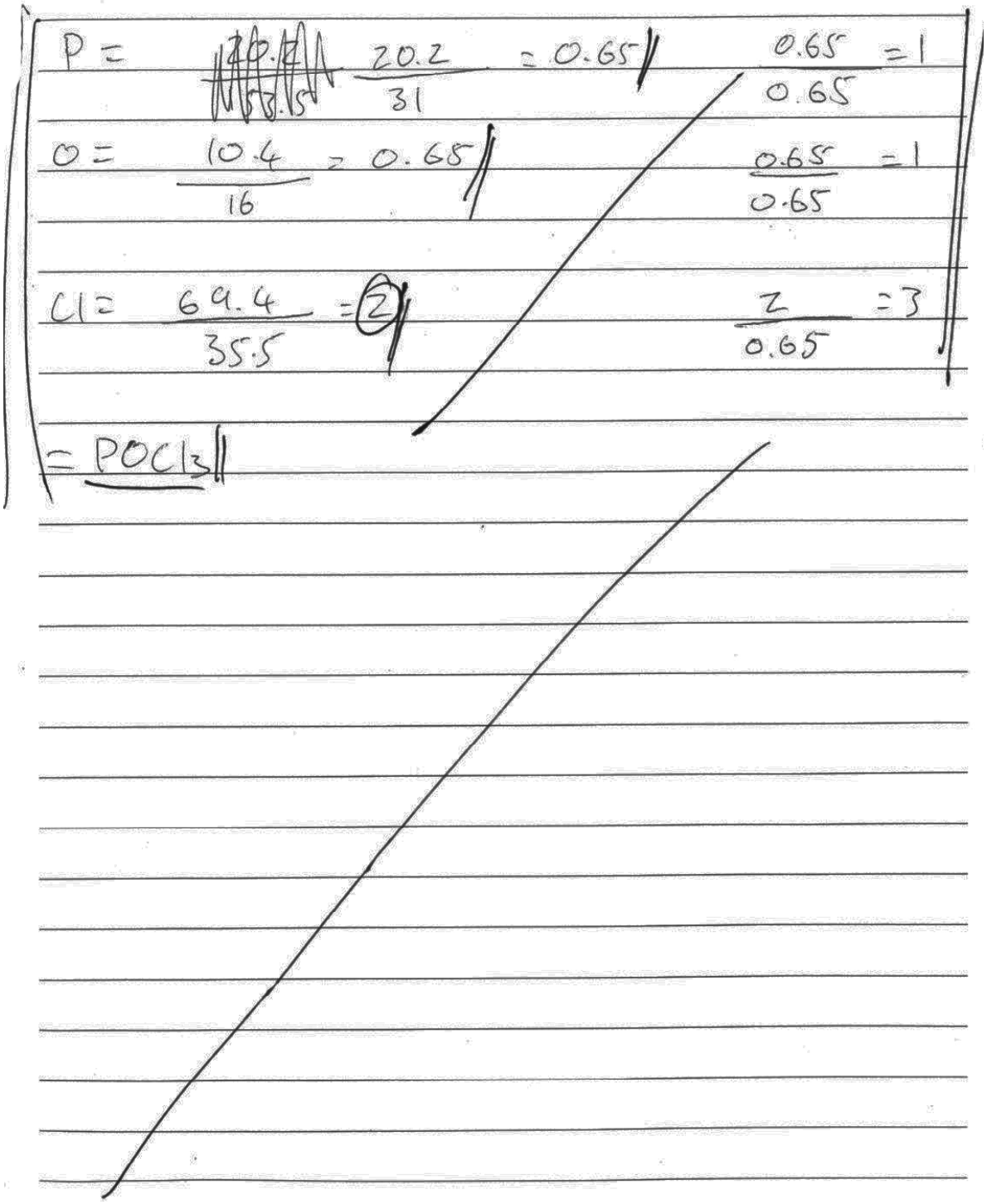
A compound was analysed and found to contain:

- 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.

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