

Centre Number			Candidate Number				

Candidate Name _____

EXAMINATIONS COUNCIL OF ZAMBIA

Examination for General Certificate of Education Ordinary Level

Chemistry

5070/2

Paper 2 Theory

Tuesday

12 JULY 2016

Candidates answer on the question paper.
 Additional materials:
 Answer Booklet
 Mathematical tables or calculator (non programmable)
 Graph paper

Time: 2 hours

Instructions to Candidates

Write your **name, centre number** and **candidate number** in the spaces at the top of this page and on any separate Answer Booklet used.

There are **12** questions in this paper.

Section A

Answer **all** questions.

Write your answers in the spaces provided on the question paper.

Section B

Answer any **three** questions.

Write your answers on the separate **Answer Booklet** provided.

At the end of the examination, fasten your Answer Booklets securely to the question paper.

Information for Candidates

The number of marks is given in brackets [] at the end of each question or part question.

The **Periodic Table** is printed on page 14.

FOR EXAMINER'S USE	
Section A	
B 9	
B 10	
B 11	
B 12	
TOTAL	

Cell phones are not allowed in the examination room.

Section A

[50 marks]

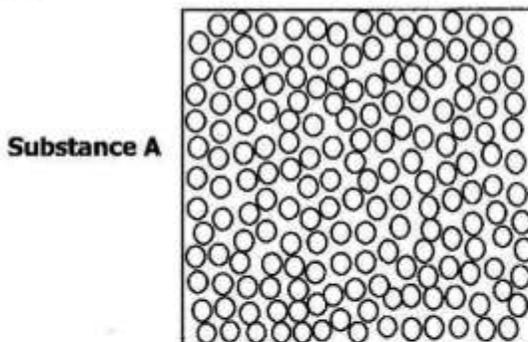
Answer **all** questions in the spaces provided.

A1 (a) State the Kinetic Theory of matter.

.....
.....
.....

[1]

(b) The diagram below shows the arrangement of particles of matter in substance **A**.



(i) In what state is the above substance?

.....
.....

[1]

(ii) If the temperature of the above substance is lowered, what happens to the arrangement and movement of the particles.

Arrangement:

.....
.....

[1]

Movement:

.....
.....

[1]

(iii) What change of state occurs when substance **A** is cooled?

.....
.....

[1]

[Total 5]

A2 (a) Explain what is meant by a pure substance?

.....
.....

[1]

(b) (i) Many people know that the boiling point of water is 100°C. However a student of Chemistry was surprised to find that the water he heated boiled at 105°C.

State **two** possibilities that could have caused an increase in the boiling point of water.

.....
.....

[2]

(ii) Would you expect the water sample which boiled at 105°C to freeze below or above 0°C at the same pressure?

.....
.....

[1]

(c) Why is the purity of substances important in food industry?

.....
.....

[1]

(d) Filtration is very vital in everyday life. Give **one** example of the industrial application of filtration in every day life.

.....
.....

[1]

[Total 6]

A3 Elements **X** and **Y** are represented respectively by the symbols:



(a) What do the following numbers stand for in these atoms?

(i) 10 and 20 in both **X** and **Y** respectively.

.....
.....

[1]

(ii) 4 and 9 in both **X** and **Y** respectively.

.....
.....

[1]

(b) Give the Period and Group for elements **X** and **Y**.

X: Period _____ Group _____

[1]

Y: Period _____ Group _____

[1]

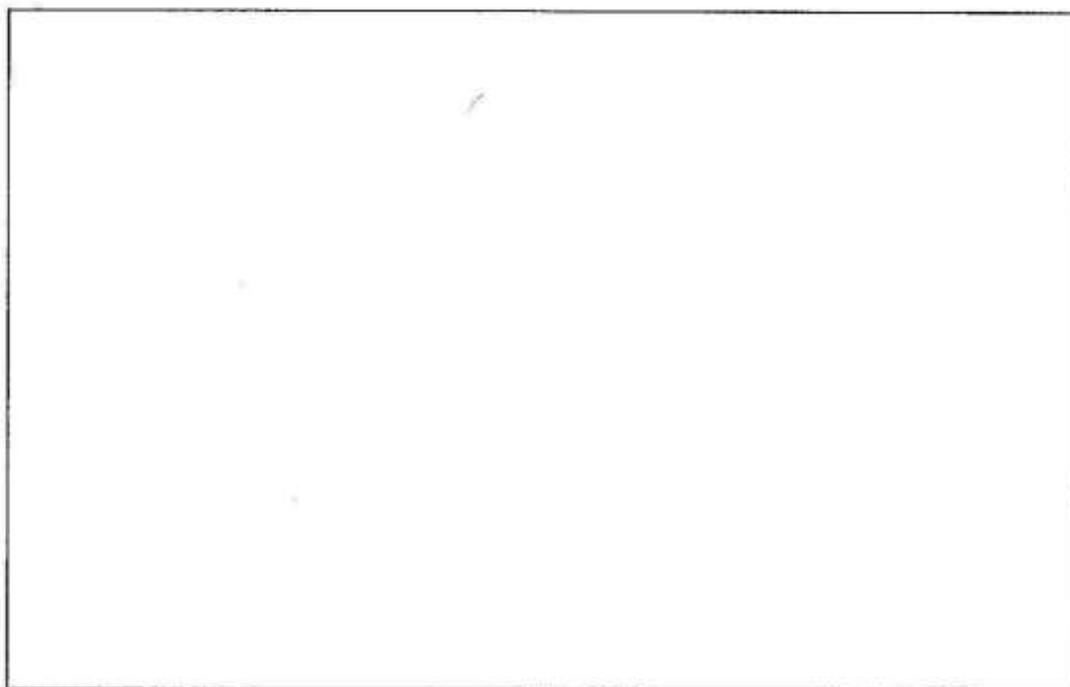
(c) Which element **X** or **Y** is a metal?

.....

[1]

(d) Draw the **●** and **X** diagram to show the bonding in a compound formed when atoms of **X** and **Y** combine. (show outer shell electrons only).

[2]



[Total 7]

A4 In an experiment 2.60g of Zinc was heated with 1.71g of sulphur according to the reaction below: $8\text{Zn} + \text{S}_8 \longrightarrow 8\text{ZnS}$

(a) Which chemical is the limiting reagent?

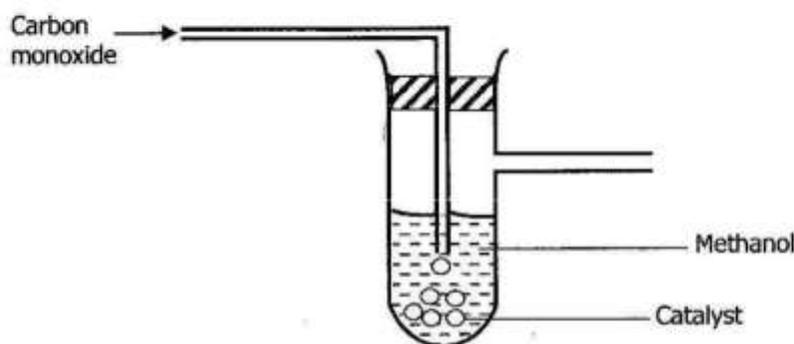
..... [1]

(b) Calculate the mass of Zinc Sulphide produced;

[2]

(c) Methanol reacts with carbon monoxide in the presence of a catalyst to produce ethanoic acid. $\text{CH}_3\text{OH}_{(l)} + \text{CO}_{(g)} \longrightarrow \text{CH}_3\text{COOH}$

In the above experiment 8.0g of methanol reacted completely with carbon monoxide in a reaction vessel shown below:



(i) What is the theoretical yield of ethanoic acid?

..... [2]

(ii) If the actual yield is 12.0g. What is the percentage yield?

..... [2]

[Total 7]

A5 Lithium, sodium, potassium and rubidium are members of Group I of the Periodic Table.

(a) What is the common name given to Group I elements?
..... [1]

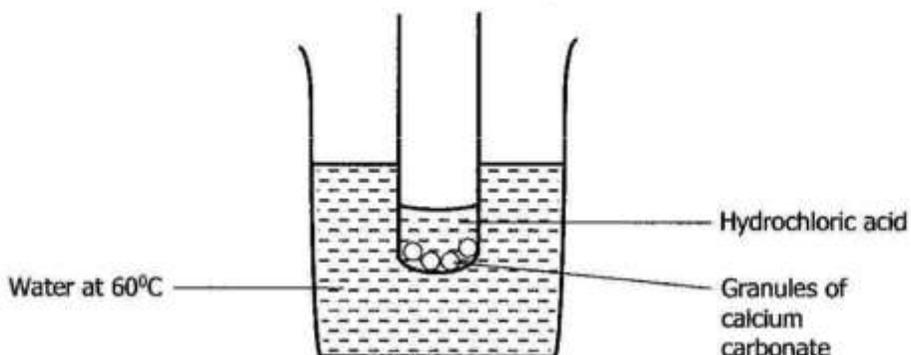
(b) State any **two** physical properties of Group I elements.
.....
..... [2]

(c) Lithium reacts with water to form lithium hydroxide and hydrogen gas.
Write a balanced chemical equation for this reaction.
.....
..... [2]

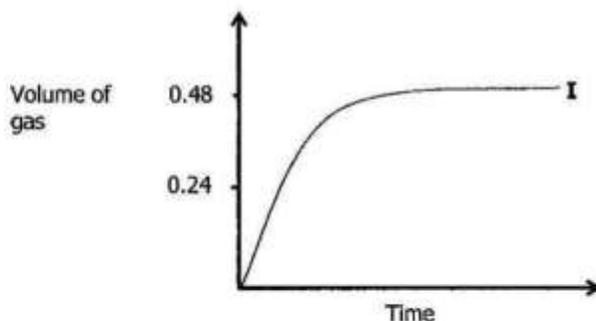
(d) How would the speed of reaction of lithium with water compare with that
of rubidium with water?
.....
..... [1]

[Total 6]

- A6** A learner carried out an experiment to investigate the various factors that affect the rate of reaction by reacting 2.0g of granulated calcium carbonate (CaCO_3) with dilute hydrochloric acid as follows:



- (a) Write down a balanced chemical equation, including state symbols, for the reaction.
- [3]
- (b) What would happen to the rate of reaction if the concentration of hydrochloric acid was increased?
- [1]
- (c) Explain in terms of the collision theory why reducing the temperature of the water would lead to the reduction in the rate of reaction.
- [2]
- (d) A sketch for the rate curve of the experiment is shown below:



- Using the same axis, draw a second curve that would be obtained in the same experiment but using 1.0g of powdered calcium carbonate. Label it II [1]

[Total 7]

[Turn over

A7 Aluminium is extracted from purified bauxite by electrolysis of molten alumina dissolved in cryolite.

(a) Write down the formula of the two ions present in the molten electrolyte.
..... [2]

(b) Write equations for reactions occurring at the electrodes.

(i) cathode
..... [1]

(ii) anode
..... [1]

(c) State **one** property in each case, which makes aluminium suitable for making

(i) aircraft bodies
..... [1]

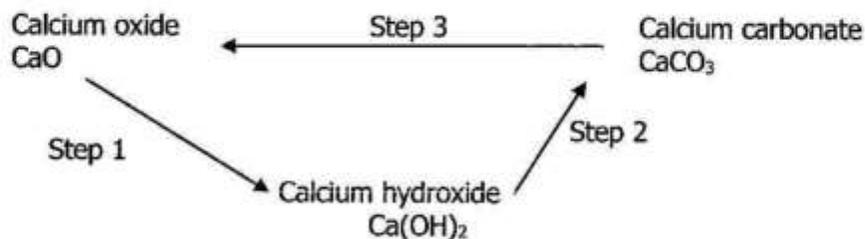
(ii) electricity cables
..... [1]

(d) Explain why aluminium appears to be unreactive even though it is high in the reactivity series.

.....
.....
..... [2]

[Total 8]

A8 The diagram below shows how three calcium compounds can be interconverted.



(a) Which of the three calcium compounds above:

(i) occurs widely in nature?

..... [1]

(ii) is present in lime water.

..... [1]

(b) **(i)** What is added to calcium oxide to carry out step 1?

..... [1]

(ii) How can step 3 be carried out?

..... [1]

[Total 4]

Section B

[45 marks]

Answer **three** questions from this section

Write your answers in the separate Answer Booklet provided.

B9 Metals have a wide range of **both** physical and chemical properties. Some physical properties of metals are changed by mixing the metals with other elements.

- (a) (i) State **one** chemical property of metals. [1]
- (ii) Explain why metals are lustrous. [2]
- (b) (i) What name is given to mixtures of metals with other elements? [1]
- (ii) Name **one** metallic mixture of elements and state the elements present in the mixture. [2]
- (iii) Give **one** use of the mixture you have named in b (ii) above. [1]
- (iv) Mention **two** reasons why metals are mixed with other elements. [2]
- (c) List two problems associated with extraction of metals. [2]
- (d) Why are some metals recycled? [2]

Metals can be extracted from their ores by electrolytic reduction or chemical reduction. Give a metal which can be extracted by:

- (i) electrolytic reduction [1]
- (ii) chemical reduction [1]

[Total 15]

- B10** Sea water contains many dissolved salts. The table below shows the ions from the dissolved salts and their masses present in 1kg (1000g) of sea water.

Symbol	Name	Mass (in g/kg)
Cl ⁻	Chloride	19.38
Na ⁺	Sodium	10.79
Mg ²⁺	Magnesium	1.27
SO ₄ ²⁻	Sulphate	2.69
Ca ²⁺	Calcium	0.41
K ⁺	Potassium	0.40

- (a) Give the names and formulae of any two calcium salts present in this sample of sea water. [4]
- (b) Some barium nitrate solution was added to 200cm³ of the sea water. Name the insoluble salt which is formed. Describe how a pure dry sample of the salt can be obtained from the reaction mixture. Write an ionic equation, with state symbols, for the formation of the salt. [4]
- (c) Describe how you would show that chloride ions are present in this sample of seawater. [2]
- (d) Seawater has a pH value of 7.9 [2]
- (i) State the formula of the ion, other than those in the table, which must be present in seawater to account for this pH.
- (ii) One way of measuring the pH of seawater is to use a pH meter.
- Describe another method which can be used to determine the pH number of the seawater. [3]

[Total 15]

B11 The table below shows some bond energies.

Bond	Bond energy in KJ/mol
H – H	436
H – Br	366
C – H	412
Br – Br	193

- (a) What type of energy change is involved in bond breaking? [1]
- (b) Use the data in the table above to calculate the total energy needed to break all the bonds in 1 mole of methane (CH₄). [2]
- (c) Hydrogen reacts with bromine according to the equation below

$$\text{H}_{2(g)} + \text{Br}_{2(g)} \longrightarrow 2\text{HBr}_{(g)} \quad \Delta\text{H} = ?$$
- (i) Calculate the amount of energy needed to break the bonds in 1 mole of H₂ and in 1 mole of Br₂. [2]
- (ii) Calculate the amount of energy produced when 2 moles of hydrogen bromide are produced. [2]
- (iii) Hence, find the ΔH of the reaction in (c) above. [2]
- (iv) State, with reason, whether the reaction of hydrogen and bromine is exothermic or endothermic. [2]
- (d) The combustion of ethanol is given by the equation:

$$\text{C}_2\text{H}_5\text{OH} + 3\text{O}_2 \longrightarrow 2\text{CO}_2 + 3\text{H}_2\text{O} + \text{energy}.$$
 The oxygen molecule (O₂) contains the O=O bonds. Give any **two** bonds that are broken in ethanol as it reacts with oxygen. [2]
- (e) (i) State **one** word that describes the use of ethanol in the above reaction. [1]
- (ii) Give **one** disadvantage of using this source of energy. [1]

[Total 15]

- B12** 4.2g of a gaseous hydrocarbon **Z** was analysed and was found to contain 3.6g carbon and 0.6g of hydrogen. The Relative Formula Mass (RFM) of hydrocarbon **Z** is 28.
- (a) Using the information provided above deduce the molecular formula of the hydrocarbon **Z**. [4]
- (b) Draw the molecular structure of hydrocarbon **Z**. [1]
- (c) (i) To which homologous series does hydrocarbon **Z** belong? [1]
- (ii) Write the general formula of the homologous series to which hydrocarbon **Z** belongs. [1]
- (d) The analysed hydrocarbon **Z** was later burnt in limited supply of air although such a reaction is dangerous.
- (i) Explain why the burning of hydrocarbon **Z** in limited supply of air is dangerous. [2]
- (ii) Write the balanced chemical equation for the burning of hydrocarbon **Z** in limited supply of air. Include state symbols. [2]
- (e) Can hydrocarbon **Z** be polymerised? Give a reason for your answer. [2]
- (f) Hydrocarbon **Z** was bubbled into aqueous bromine and acidified potassium manganate (VII). State what was observed when ...
- (ii) hydrocarbon **Z** was bubbled into aqueous bromine. [1]
- (iii) Hydrocarbon **Z** was bubbled into acidified potassium manganate (VII). [1]
- [Total 15]

DATA SHEET
The Periodic Table of the Elements

Group		I	II	III	IV	V	VI	VII	0																																																																																																																																																																																																								
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4	4	4	4	4	4	4	4	4	4																																																																																																																																																																																																								

The volume of one mole of any gas is 24 dm³ at room temperature and pressure (r.t.p.).
N_A = 6.0 × 10²³/mol; 1F = 96500C.

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