

Candidate Name \_\_\_\_\_

Centre Number			Candidate Number				

# EXAMINATIONS COUNCIL OF ZAMBIA

Examination for School Certificate Ordinary Level

## Science

5124/2

Paper 2

Friday

4 NOVEMBER 2016

**Additional Material (a)**

Electronic calculator (non-programmable) and/or Mathematical tables

Graph paper

Soft clean eraser

Soft pencil (type B or HB is recommended)

**Time 2 hours**

**Instructions to Candidates**

**Do not open this booklet until you are told to do so.**

Write your name, centre number and candidate numbers in the spaces provided at the top of the page and any separate answer booklet/paper used.

There are **three (3)** sections in this paper.

**Section A**

There are **twenty (20)** questions in this section. Answer all questions. For each question, there are four possible answers: **A, B, C** and **D**. Choose the one you consider correct and record your choice by making it with a cross (X) on the answer grid provided on the question paper.

**Section B**

Answer all questions. Write your answers in the spaces provided on the question paper.

Read very carefully the instructions on the answer sheet.

**Section C**

Answer any two questions. Write your answer on a separate answer booklet provided.

**Information for candidates**

Any rough working should be done in this question paper.

**At the end of the examination:**

1. Fasten the separate answer booklet/papers used securely to the question paper.
2. Tick the numbers of the section C questions you have answered in the grid below.

The Periodic Table is printed on page 16.

Cell phones are not allowed in the examination room.

Candidate's Use	Examiner's Use
Section A	
Section B	
Section C	
1	2
3	3
Total	

ANSWER GRID FOR SECTION A

Put a cross (X) on the letter indicating your choice of answer.

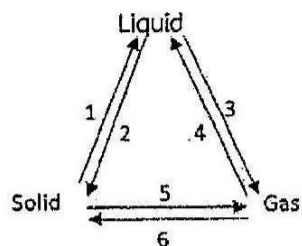
1	A	B	C	D
2	A	B	C	D
3	A	B	C	D
4	A	B	C	D
5	A	B	C	D
6	A	B	C	D
7	A	B	C	D
8	A	B	C	D
9	A	B	C	D
10	A	B	C	D

11	A	B	C	D
12	A	B	C	D
13	A	B	C	D
14	A	B	C	D
15	A	B	C	D
16	A	B	C	D
17	A	B	C	D
18	A	B	C	D
19	A	B	C	D
20	A	B	C	D

**SECTION A [20 marks]**

Answer **all** the questions on the answer grid provided.

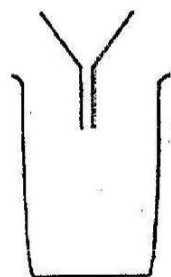
1 The diagram below shows the changes of state.



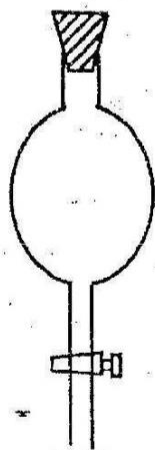
Which of the following sets of changes are exothermic and endothermic?

	<b>Exothermic</b>	<b>Endothermic</b>
<b>A</b>	1, 2, 3	4, 5, 6
<b>B</b>	1, 2, 5	3, 4, 6
<b>C</b>	2, 4, 6	1, 3, 5
<b>D</b>	1, 3, 5	2, 4, 6

2 Which of the following apparatus can be used for separating immiscible liquids?



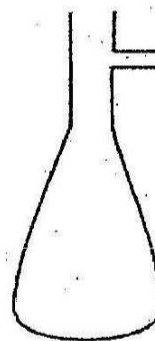
**A**



**B**

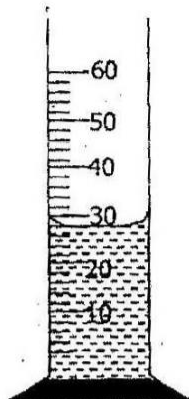


**C**



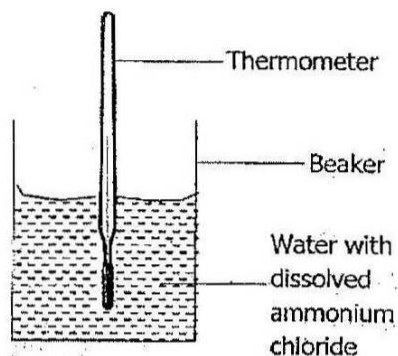
**D**

- 3 What is the volume of the liquid in the measuring cylinder below?



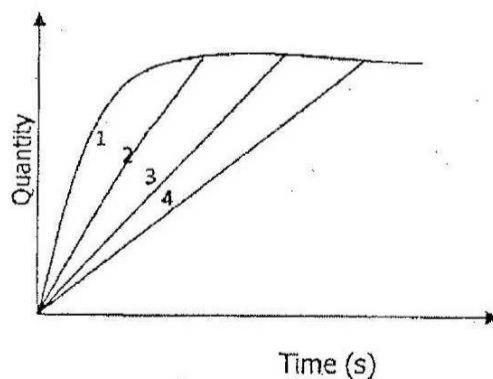
- A  $30\text{cm}^3$   
B  $29.5\text{cm}^3$   
C  $29.0\text{cm}^3$   
D  $28\text{cm}^3$
- 4 The elements **X** and **Y** have the following nuclides;  
 $^{28}_{14}\text{X}$  and  $^{16}_8\text{Y}$   
What is the correct chemical formula of the compound formed when element **X** reacts with element **Y**?
- A  $\text{XY}_2$   
B  $\text{X}_2\text{Y}$   
C  $\text{X}_3\text{Y}_2$   
D  $\text{X}_2\text{Y}_3$
- 5 All the isotopes of an element contain ...
- A different numbers of electrons.  
B different numbers of protons.  
C the same number of protons.  
D the same number of neutrons.
- 6 Given that the relative formula mass of a compound  $\text{Na}_2\text{X}_2\text{O}_3$  is 158, what is element **X**?
- A Chlorine  
B Copper  
C Phosphorus  
D Sulphur

- 7 What is the mass of 0.2 mols of chlorine ( $\text{Cl}_2$ ) molecules?
- A 142g  
 B 71g  
 C 14.2g  
 D 7.1g
- 8 2g of ammonium chloride ( $\text{NH}_4\text{Cl}$ ) is dissolved in  $20\text{cm}^3$  of tap water whose initial temperature is  $23^\circ\text{C}$ .



Which reading below suggest the temperature of the solution after all the ammonium chloride has dissolved?

- A  $25^\circ\text{C}$   
 B  $23^\circ\text{C}$   
 C  $20^\circ\text{C}$   
 D  $10^\circ\text{C}$
- 9 The graph below shows the rate of reaction between a metal and a dilute acid.



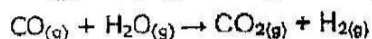
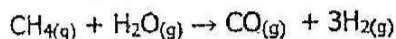
Which reaction on the graph was the fastest?

- A 1 only  
 B 4 only  
 C 1 and 4  
 D 2 and 3

- 10 Dilute hydrochloric acid reacts with both magnesium oxide and calcium carbonate. What is common about these reactions?
- A Carbon dioxide is produced
  - B Water is produced
  - C Water vapour is condensed
  - D A white precipitate is formed
- 11 Barium sulphate is one of the insoluble salts which can be prepared by precipitation. Suggest the **two** possible reagents that can be used to prepare this salt.
- A Barium oxide and sodium sulphate
  - B Barium nitrate and lead (II) sulphate
  - C Barium iodide and sodium sulphate
  - D Barium chloride and sodium sulphate
- 12 Which one of the following statements about the Periodic Table is **not** true?
- A The reactivity of the halogens decrease down the group.
  - B The elements within the group have the same number of shells.
  - C The elements within a group have the same number of electrons in the outermost shell.
  - D The elements in a period have the same number of shells.
- 13 The metal used to protect galvanized iron from rusting is ...
- A chromium.
  - B copper.
  - C magnesium.
  - D zinc.
- 14 One major stage in the extraction of copper metal from its ore, copper pyrite, (CuS) is by roasting. Which of the chemical reactions occur during roasting?
- A  $2\text{CuS} + 3\text{O}_2 \rightarrow 2\text{CuO} + 2\text{SO}_2$
  - B  $\text{CuS} + 2\text{O}_2 \rightarrow \text{CuO} + \text{SO}_3$
  - C  $\text{CuS} + \text{O}_2 \rightarrow \text{Cu} + \text{SO}_2$
  - D  $2\text{CuS} + \text{O}_2 \rightarrow 2\text{Cu} + 2\text{SO}$
- 15 Which one of the following gases is not found in the atmosphere?
- A Argon
  - B Carbon dioxide
  - C Hydrogen
  - D Water vapour

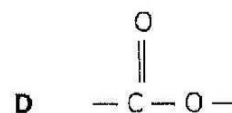
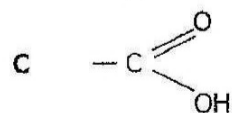
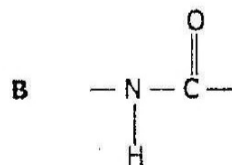
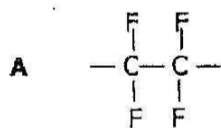
- 16 Which one of the following would be used in the chemical test for water?
- A Anhydrous copper II sulphate
  - B Lead II sulphate
  - C Litmus paper
  - D Universal indicator

- 17 The two chemical reactions below take place in the commercial production of a useful gas.



Which of the following processes use the product of the reactions above?

- A Cracking
  - B Harber process
  - C Oswald process
  - D Steam reforming
- 18 Ethane and ethene are hydrocarbons belonging to two different homologous series. These can be distinguished by ...
- A a lighted splint.
  - B aqueous barium chloride.
  - C aqueous bromine.
  - D lime water.
- 19 Study the linkages below. Which one of these would be found in terylene units?



20 Polymers are made up of monomers. Identify the correct set of monomers for the respective polymer from the pairs below.

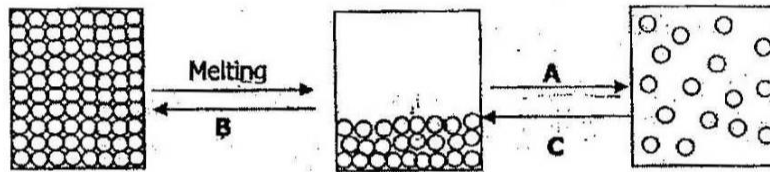
- A Fatty acid and glycerol
- B Fatty acid and glucose
- C Glycerol and glucose
- D Glucose and amino acid

**Section B [45 marks]**

Answer **all** questions in this section.

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

1 The diagram below shows how the molecules are arranged in three states of matter, solid, liquid and gas.



(a) State the name given to the change of state labeled:

- (i) A .....
- (ii) B ..... [2]

(b) Describe the movement of molecules in a gas.

.....  
..... [1]

(c) Which of the changes **A**, **B** or **C** is endothermic? Explain your answer.

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

**[Total: 5 marks]**

2. The table below shows some apparatus used in the laboratory.

Separating funnel	Liebig condenser	Pipette
Desiccator	Volumetric flask	Laboratory thermometer
Evaporating dish	Bunsen burner	Burette

State the apparatus used for the following:-

- (a) Burning and heating

.....  
 ..... [1]

- (b) Preparation of a standard molar solution.

..... [1]

- (c) Obtaining a distillate from a vapour of a liquid.

..... [1]

- (d) Drying substances or keeping them free from moisture.

..... [1]

- (e) Measuring exactly  $25.0\text{cm}^3$  of solution.

..... [1]

**[Total: 5 marks]**

3 Given below is a list of substances.

Aluminum	Nitrogen	Cement	Potassium chloride
Bronze	Water	Methanol	Sea water

- (a) Which substance is an element?  
 ..... [1]
- (b) Which substance is a single compound?  
 ..... [1]
- (c) Which substance is a mixture?  
 ..... [1]
- (d) Which substance is an element that conducts electricity?  
 ..... [1]
- (e) From the above list, select one:-
- (i) Ionic compound ..... [2]
- (ii) Alloy ..... [2]

[Total: 6 marks]

- 4 (a) Explain what is meant by limiting reactant.  
 ..... [1]
- (b) 2.4g of magnesium reacts with 0.30 mol of hydrochloric acid.
- (i) Write the balanced chemical equation for the reaction.  
 ..... [2]
- (ii) Determine the limiting reactant.  
 ..... [2]
- (iii) Calculate the mass in excess for the substance which is in excess.

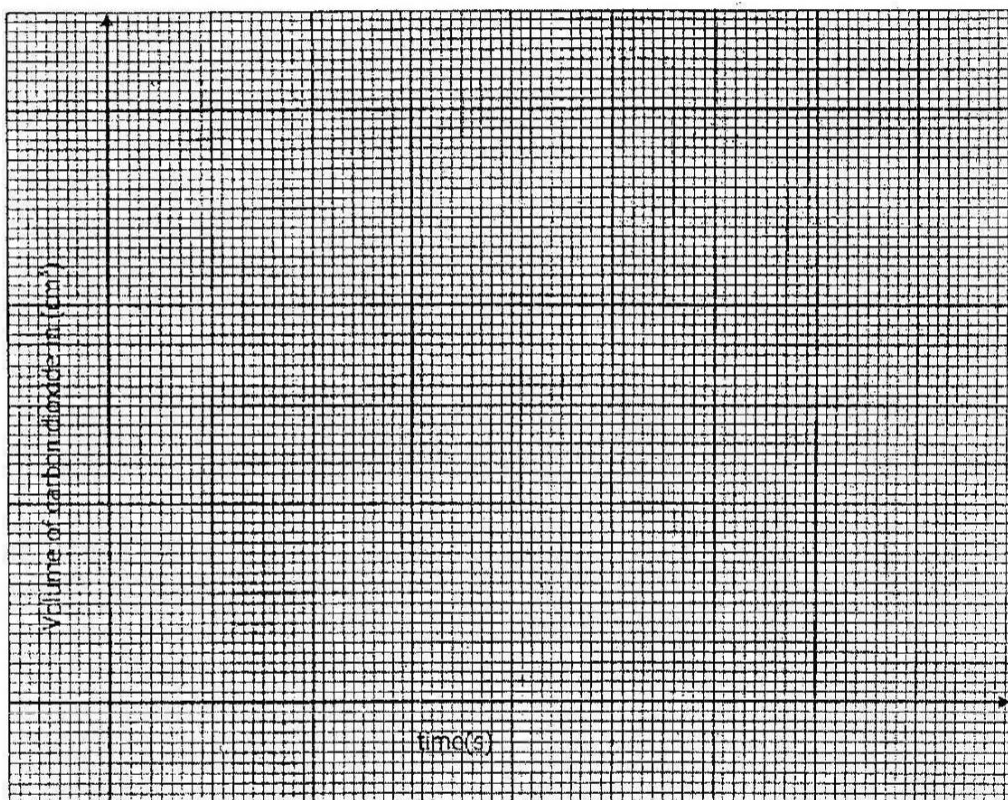
[1]

[Total: 6 marks]

- 5 20g of marble chips were reacted with 50cm<sup>3</sup> of 3.0M hydrochloric acid. The total volume of a gas formed was recorded at various time intervals and results were tabulated as shown in the table below.

Time (s)	0	15	45	60	75	90
Volume of carbon dioxide (cm <sup>3</sup> )	0	40	56	60	60	60

- (a) Plot a graph of volume of carbon dioxide against time. [3]



- (b) (i) Work out the rate of production of the gas at 30 seconds and 50 seconds. [2]
- .....
- (ii) What do you conclude about the rate of reaction as time progressed? [1]
- .....

[Total: 6 marks]

6 What do you understand by each of the following?

(a) (i) An anhydrous salt

..... [1]

(ii) An efflorescent substance

..... [1]

(b) Give an example of the following:-

(i) an efflorescent substance

..... [1]

(ii) deliquescent substance

..... [1]

**[Total: 4 marks]**

7 Bodium, Bo, is a newly discovered element.

It is a solid at room temperature and pressure. It can be cut with a knife, reacts vigorously with water liberating a flammable gas and forming a solution with a high pH.

(a) (i) To which group of the Periodic Table does bodium belong?

..... [1]

(ii) Write a balanced chemical equation for the reaction between bodium with water

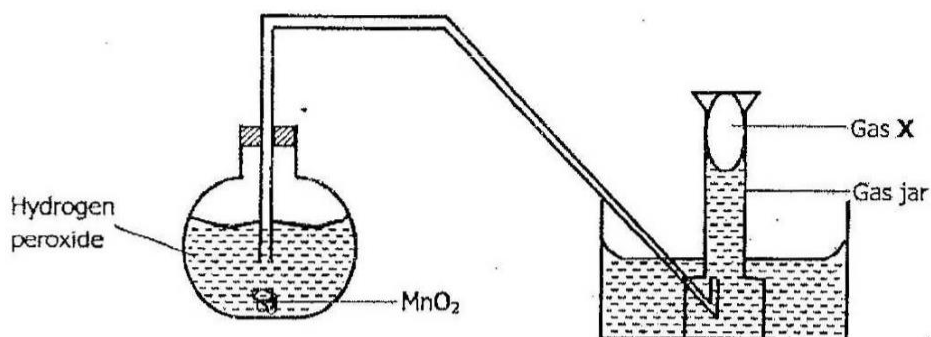
..... [2]

(b) State whether you would expect bodium carbonate to decompose on heating. Give a reason for your answer.

..... [1]

**[Total: 4 marks]**

- 8 The diagram below shows the set up of the apparatus that would be used to prepare gas X.



- (a) (i) Identify gas X.  
 ..... [1]
- (ii) Describe the chemical identity test for gas X.  
 .....  
 ..... [1]
- (b) (i) What is the purpose of adding manganese (iv) oxide to hydrogen peroxide?  
 ..... [1]
- (ii) Explain why this gas is obtained using the method shown in the diagram.  
 ..... [1]

[Total: 4 marks]

9 The table below shows some information on two polymers.

Name of polymer	Formula	Type of polymer
Polyvinylchloride	$\left[ \text{C}_2\text{H}_3\text{-Cl} \right]_n$	A
B	$\left[ \text{C} \begin{array}{c} \text{O} \\ \parallel \\ \text{---} \end{array} \text{---} \square \text{---} \text{C} \begin{array}{c} \text{O} \\ \parallel \\ \text{---} \end{array} \text{---} \text{O} \text{---} \square \text{---} \text{O} \right]_n$	C

[3]

(a) Complete the table above.

(b) What is the best method of disposing of polyvinylchloride and polymer B?

.....  
 .....

[1]

(c) Name the products of protein hydrolysis.

.....  
 .....

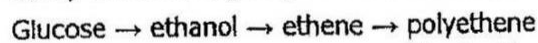
[1]

[Total: 5 marks]

**Section C [20 marks]**

Answer any **two (2)** questions from this section. Write your answers in the separate answer booklet provided.

1 Study the following sequence of reactions.



(a) (i) What name is given to the process by which glucose changes into ethanol? [1]

(ii) Name the enzyme responsible for the change in (i) above. What gas is produced during this process? [2]

(b) Name the process and the catalyst used when ethene changes into polyethene. [2]

(c) Draw the structure of polyethene with three repeating units. [1]

(d) When polyethene is burnt in excess air, two products are formed. Name the products. [2]

(e) Polyethene is a non-biodegradable substance. Explain what is meant by the term non-biodegradable and state the effect of such polymers on the environment. [2]

[Total: 10 marks]

2 One major ore of copper is copper pyrite,  $\text{CuFeS}_2$ . To extract copper from the ore, the ore is crushed, then undergoes froth-floatation and finally roasted in the air. The metal is then purified by electrolysis

- (a) Explain why:-
- (i) the copper ore has to undergo froth-floatation, [1]
  - (ii) the copper ore is roasted in air. [1]
- (b) Write a balanced chemical equation for the reaction that occurs when the copper ore is roasted. [2]
- (c) The physical properties of copper can be explained in terms of metallic bonding.
- (i) Describe with the aid of a labelled diagram the metallic bonding in copper. [3]
  - (ii) Explain how metallic bonding makes copper to be malleable. [2]
- (d) State one use of copper. [1]

[Total: 10 marks]

3 Nitric acid is an important acid in everyday life.

- (a) Name the commercial process used to prepare nitric acid. [1]
- (b) State the catalyst used during the commercial preparation of nitric acid. [1]
- (c) The equation below shows the initial stage in the industrial preparation of nitric acid.  

$$\text{NH}_3(\text{g}) + \text{O}_2(\text{g}) \rightarrow \text{NO}(\text{g}) + \text{H}_2\text{O}(\text{g})$$
 Copy and balance the equation. [1]
- (d) The nitrogen monoxide produced as shown by the equation in (c) above reacts with oxygen to give nitrogen dioxide.  
 Construct the balanced chemical equation. [2]
- (e) How is nitrogen dioxide converted to nitric acid in this process? [1]
- (f) Explain why the concentration of nitric acid cannot be made more than 68% even if it is distilled. [1]
- (g) Explain why higher concentrations of nitric acid can only be obtained if it is mixed with concentrated sulphuric acid and redistilled. [1]
- (h) Give any two uses of nitric acid. [2]

[Total: 10 marks]

