

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

Centre Number	Candidate Number									

## EXAMINATIONS COUNCIL OF ZAMBIA

### Examination for School Certificate Ordinary Level

#### Science Paper 2

5124/2

Thursday

9 NOVEMBER 2017

Additional Material(s):

- 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 number 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 Circle the numbers of the section C questions you have answered in the grid below.

The Periodic Table is printed on page 15.

**Cell phones are not allowed in the examination room.**

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

**ANSWER GRID FOR SECTION A**

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

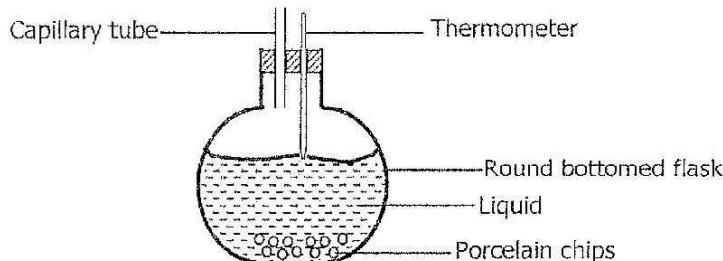
<b>1</b>	A	B	C	D
<b>2</b>	A	B	C	D
<b>3</b>	A	B	C	D
<b>4</b>	A	B	C	D
<b>5</b>	A	B	C	D
<b>6</b>	A	B	C	D
<b>7</b>	A	B	C	D
<b>8</b>	A	B	C	D
<b>9</b>	A	B	C	D
<b>10</b>	A	B	C	D

<b>11</b>	A	B	C	D
<b>12</b>	A	B	C	D
<b>13</b>	A	B	C	D
<b>14</b>	A	B	C	D
<b>15</b>	A	B	C	D
<b>16</b>	A	B	C	D
<b>17</b>	A	B	C	D
<b>18</b>	A	B	C	D
<b>19</b>	A	B	C	D
<b>20</b>	A	B	C	D

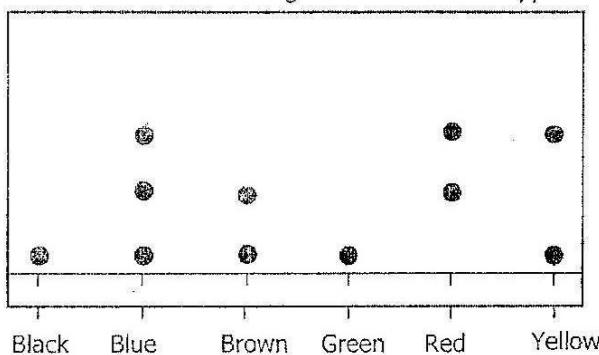
**SECTION A [20 marks]**

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

- A1** A teacher asked Mutinta to explain what happens to the particles in a stone when it is heated. The correct explanation given by Mutinta was particles in a stone ...
- will not move.
  - move randomly.
  - vibrate more in their fixed positions.
  - vibrate and begin to move randomly.
- A2** The diagram below shows the experimental set up for the determination of the boiling point of a liquid.



- Which statement explains the purpose of adding porcelain chips?
- To ensure smooth boiling of the liquid.
  - To colour the liquid as it starts to boil.
  - To make the liquid boil faster.
  - To enable the thermometer record the temperature of the boiling liquid easily.
- A3** The diagram below is a chromatogram for various types of ink.



Which statement is correct about the chromatogram?

- Red ink contains black ink.
- Green ink contains red ink.
- Black ink and green ink are pure inks.
- Blue ink can be made by mixing brown and green inks.

**A4** A phosphorus ion contains ...

	Protons	Neutrons	Electrons
<b>A</b>	15	15	13
<b>B</b>	15	16	18
<b>C</b>	16	15	16
<b>D</b>	16	16	18

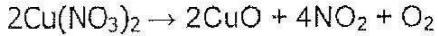
**A5** Hydrogen can form both ionic and covalent compounds. With which element will hydrogen form an ionic compound?

- A** Zinc
- B** Sodium
- C** Nitrogen
- D** Sulphur

**A6** One mole of a sample of hydrated sodium sulphide contains 162g of water of crystallization. What is the correct chemical formula of this compound?

- A**  $\text{Na}_2\text{S} \cdot 7\text{H}_2\text{O}$
- B**  $\text{Na}_2\text{S} \cdot 9\text{H}_2\text{O}$
- C**  $\text{Na}_2\text{S} \cdot 3\text{H}_2\text{O}$
- D**  $\text{Na}_2\text{S} \cdot 5\text{H}_2\text{O}$

**A7** On strong heating copper (II) nitrate decomposed to produce copper (II) oxide, nitrogen dioxide and oxygen according to the balanced chemical equation below



Calculate the mass of copper (II) oxide obtained when 56.4g of copper (II) nitrate decomposes.

- A** 24.0g
- B** 40.0g
- C** 80.0g
- D** 160.0g

**A8** An endothermic reaction is one that ...

- A** evolves heat.
- B** produces light.
- C** absorbs energy.
- D** produces sound.

- A9 Consider the following chemical reaction.



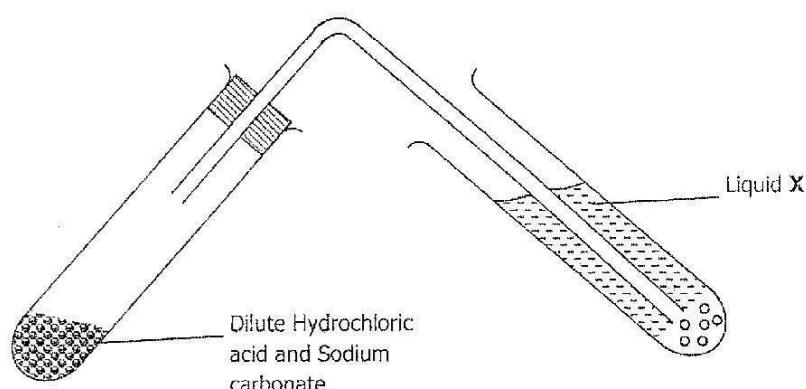
The letters X, Y and Z represent ...

	X	Y	Z
A	2	2	2
B	1	1	2
C	3	3	2
D	3	3	3

- A10 Which statement best describes the rate of a chemical reaction?

- A The time taken for reactants to be used up.
- B The time taken for products to be formed.
- C The time taken for one of the reactants to finish.
- D The increase in the concentration of a product per unit time.

- A11 Study the diagram below.



During the experiment a gas and a white precipitate were formed. What is the identity of liquid X and the white precipitate?

	Liquid X	White precipitate
A	Water	Calcium carbonate
B	Dilute nitric acid	Calcium oxide
C	Lime water	Calcium hydrogen carbonate
D	Lime water	Calcium carbonate

- A12 Which of the following salts can be crystallized?

- A Sodium sulphate
- B Barium sulphate
- C Lead (II) sulphate
- D Silver chloride

- A13** Halogens play an important role in industry. The halogen which is used in photography is ...
- A** Bromine.  
**B** Chlorine.  
**C** Fluorine.  
**D** Iodine.
- A14** An element is in period **3** and group **VII** of the Periodic table. Which statement about this element is correct?
- A** It forms a cation with a  $2+$  charge.  
**B** It is a gas at room temperature and pressure.  
**C** It is a liquid at room temperature and pressure.  
**D** It forms an anion with a  $2-$  charge.
- A15** Solution **P** forms a white precipitate with a little amount of aqueous ammonia solution. The precipitate dissolves in excess ammonia solution to form a colourless solution. The cation present in solution **P** is ...
- A**  $\text{Al}^{3+}$   
**B**  $\text{Ca}^{2+}$   
**C**  $\text{NH}_4^+$   
**D**  $\text{Zn}^{2+}$
- A16** A compound **X** leaves behind a black solid when heated. What is the identity of compound **X**?
- A** Copper (II) hydrogen carbonate  
**B** Magnesium carbonate  
**C** Sodium hydrogen carbonate  
**D** Calcium carbonate
- A17** The identity test for the element which is immediately above copper in the reactivity series is that it ...
- A** puts off a burning splint with a pop sound.  
**B** puts off a glowing splint with a pop sound.  
**C** re-lights a glowing splint.  
**D** re-lights a burning splint.
- A18** Graphite powder is used as a lubricant for machinery. What property makes graphite suitable for this use?
- A** It contains many ions.  
**B** Its atoms are spherical.  
**C** It consists of layers of atoms which slide over each other.  
**D** It has a structure of small molecules.

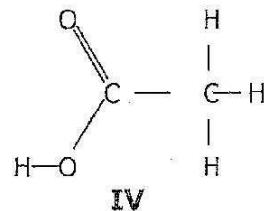
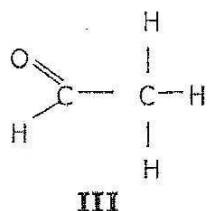
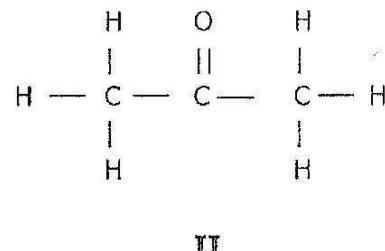
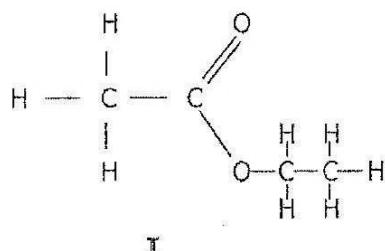
A19 A pupil reacted the monomers shown below.



What name is given to the product of the reaction between the two monomers above?

- A Nylon
- B Protein
- C Starch
- D Terylene

A20 Below are some structures of organic compounds. Which organic compound will react with rubidium?



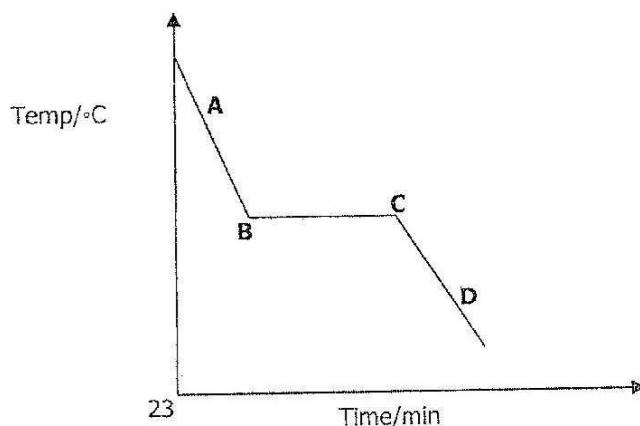
- A IV
- B III
- C II
- D I

**Section B [45 marks]**

Answer **all** questions in this section.

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

- B1** The diagram below shows the cooling curve for a liquid.



- (a) In what state of matter is the substance in area A?

..... [1]

- (b) What name is given to the point labelled B?

..... [1]

- (c) In what states of matter is the substance between points B and C?

..... [2]

- (d) Explain the reason why the thermometer reading remained constant between points B and C.

..... [1]

- (e) Explain what happens during cooling in relation to the heat content of the substance.

..... [1]

**[Total: 6 marks]**

B2 When caesium metal is reacted with water, there is a rise in temperature.

(a) (i) How would you detect the rise in temperature?

.....

(ii) What type of a reaction takes place?

.....

(iii) Give a reason for your answer in (a) (ii) above.

..... [3]

(b) Potassium is found in the same group of the Periodic table as caesium.

(i) Compare the reaction of the two metals with water.

.....

.....

.....

(ii) Give a reason for your answer in (b) (i) above.

..... [2]

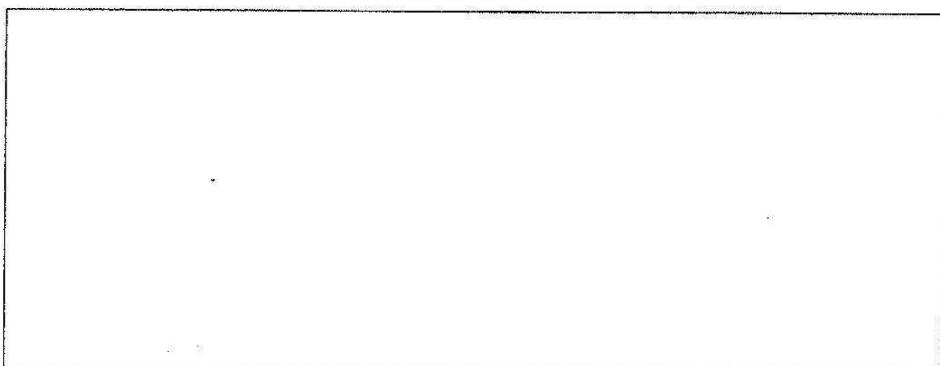
[Total: 5 marks]

B3 Beryllium burns in fluorine to form a white solid, beryllium fluoride.

(a) Name the type of bonding in beryllium fluoride.

..... [1]

(b) In the space below, draw a "dot" and "cross" diagram to show the bonding in beryllium fluoride. Show all electrons.



[2]

(c) Suggest any **two** physical properties of compounds that have similar bonding as beryllium fluoride.

.....

.....

[2]

[Total: 5 marks]

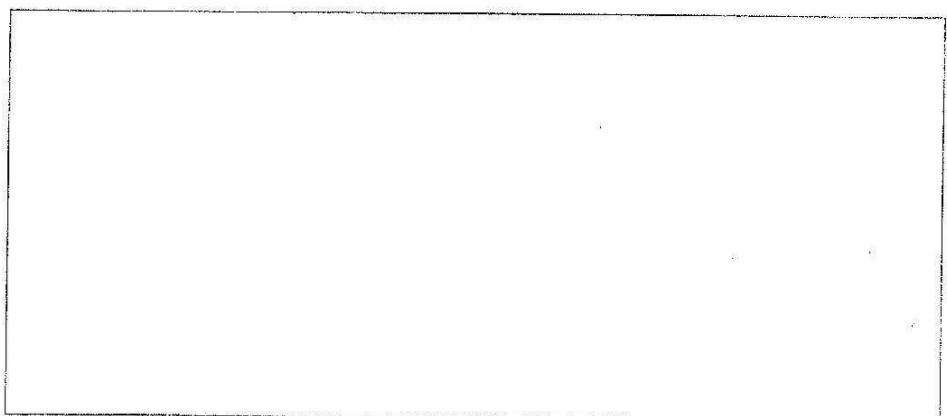
[Turn over]

**B4** A learner wanted to obtain clear water from muddy water.

- (a) Name the process that the learner would use to obtain the clear water.

..... [1]

- (b) Draw a large labelled diagram to show the arrangement of the apparatus the learner would use.



[3]

- (c) Give an industrial application of the process named in (a) above.

..... [1]

**[Total: 5 marks]**

**B5** Chlorine, Bromine and Iodine are elements in Group VII of the Periodic Table.

- (a) (i) Describe the change in the states of the elements at room temperature and pressure as the atomic numbers increase.

.....

- (ii) Why is chlorine used in water treatment?

..... [2]

- (b) Write an ionic equation for the reaction between chlorine and aqueous potassium bromide solution. Include state symbols.

..... [2]

**[Total: 4 marks]**

B6 Below are chemical formulae of organic compounds.



(a) Name the compound which reacts with steam.

..... [1]

(b) Draw the structural formula of a compound which turns blue litmus paper red.

[1]

(c) Choose **two** compounds which are isomers.

..... [2]

(d) Which **two** compounds can undergo esterification?

..... [1]

**[Total: 5 marks]**

B7 A solution of aqueous sodium hydroxide was added from a burette to 25.0cm<sup>3</sup> of dilute sulphuric acid solution in a conical flask. The pH of the mixture was measured during the addition of sodium hydroxide.

(a) Describe how the pH value changed.

..... [1]

(b) (i) Name the type of reaction that took place between sodium hydroxide and sulphuric acid.

.....

(ii) Write a balanced chemical equation for the reaction above  
(include state symbols)

..... [3]

(c) Sulphuric acid is a strong acid. What does this mean?

..... [2]

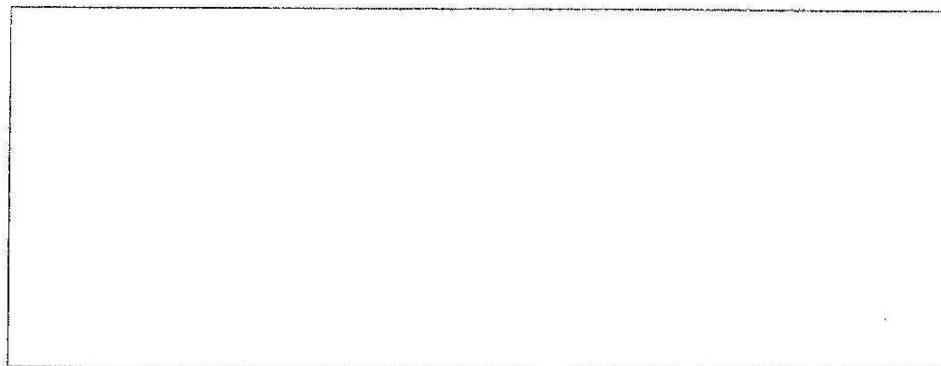
**[Total: 6 marks]**

**[Turn over**

B8 (a) Define the term concentration.

..... [1]

(b) Calculate the concentration of a solution made by dissolving 60g of sodium hydroxide, (NaOH) pellets in 300cm<sup>3</sup> of water.



[3]

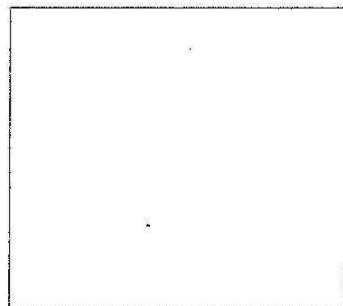
(c) What is the effect of increasing the concentration of the reactants on the rate of a chemical reaction?

..... [1]

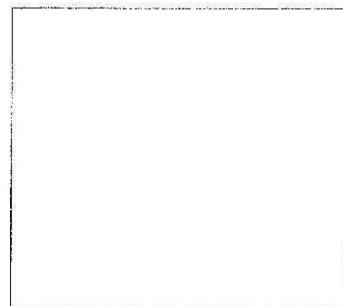
[Total: 5 marks]

B9 Draw diagrams to show the arrangement of particles in:

- (a) (i) Aluminium metal  
(ii) Hydrogen chloride



Aluminium metal



Hydrogen chloride

[2]

(b) Which of the **two** substances has a lower melting point?  
Give a reason for your answer.

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

[Total: 4 marks]

**Section C [20 marks]**

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

- C1** On the packet of a particular opaque beer is written, "contains 5% alcohol per unit volume".

(a) Name the alcohol found in the opaque beer. [1]

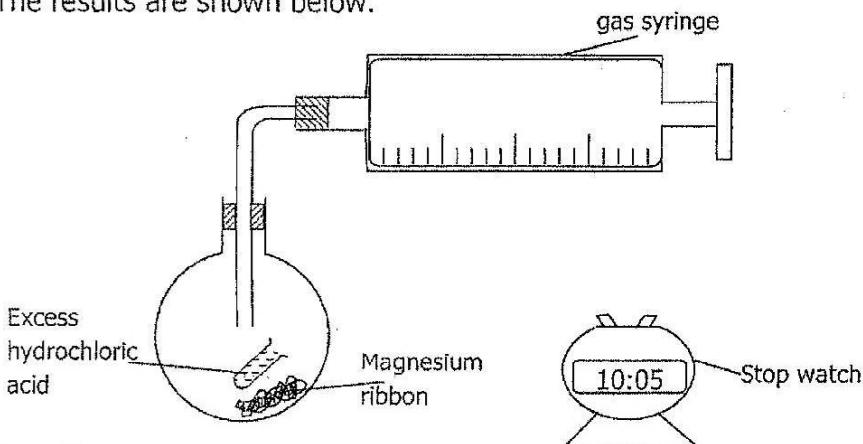
(i) Describe, in outline, how this alcohol you have named in (a) above is commercially produced from starch. [5]

(ii) Write down a balanced chemical equation for the formation of the alcohol from glucose. State symbols not required [2]

(b) Give **one** use and **one** bad effect of the alcohol found in beer. [2]

[Total: 10 marks]

- C2** A piece of Magnesium ribbon was made to react with dilute hydrochloric acid. The volume of the hydrogen gas collected in a syringe was measured at intervals. The results are shown below.

**Results**

Time/min	0	0.5	1.0	1.5	2.0	2.5	3.0	3.5	4.0	4.5	5.0	5.5	6.0
Volume of hydrogen/(cm <sup>3</sup> )	0	8	14	20	25	35	33	36	38	39	40	40	40

- (a) Write a balanced chemical equation for the reaction between magnesium and dilute hydrochloric acid (include state symbols). [3]
- (b) Plot a graph of the results (volume against time) on the graph paper provided. [3]
- (c) Which result should be rejected as being an error? [1]
- (d) What was the maximum volume of hydrogen produced in this reaction? [1]
- (e) From the graph, how can you tell when the reaction came to an end? [1]
- (f) What is the average rate of this reaction? [1]

[Total: 10 marks]

- C3 Iron (II) sulphate crystals can be prepared from the reaction between iron metal and warm dilute sulphuric acid.
- (a) (i) Construct a balanced chemical equation for the above chemical reaction. [2]
- (ii) What is the importance of warming the acid? [1]
- (iii) How do you ensure that the iron (II) sulphate obtained is free of sulphuric acid? [1]
- (iv) Describe how you can obtain pure crystals of iron (II) sulphate from the above reaction. [3]
- (b) When an iron nail is placed in an aqueous solution of copper (II) sulphate, a reaction takes place.
- (i) Construct an ionic equation for the reaction. [1]
- (ii) State **two** observations you would make during the reaction. [2]

[Total: 10 marks]





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