

Centre Number	Examination Number



EXAMINATIONS COUNCIL OF ZAMBIA

Examination for School Certificate Ordinary Level



Science

5124/2

Paper 2

Monday

14 NOVEMBER 2022

Additional Materials:

Answer Booklet

Electronic calculator (non-programmable)

Graph paper

Soft clean eraser

Soft pencil (type B or HB is recommended)

Time: 2 hours

Marks: 85

Instructions to Candidates

1. Write the centre number and your examination number on every page of this question paper and on the separate Answer Booklet/Paper provided.

2. There are three sections in this paper; Section A, B and C.

(i) Section A

There are **twenty** questions in this section.

Answer **all**. For each question, there are four possible answers, **A, B, C and D**. Choose the best one and mark it with a cross (X) on the **Answer Grid** provided in this question paper.

(ii) Section B

There are **nine** questions in this section.

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

(iii) Section C

There are **three** questions in this section.

Answer any **two** questions. Write your answers on a separate **Answer Booklet/Paper provided**.

3. At the end of the examination:

(i) Enter the numbers of the questions you have answered from Section C in the grid provided.

(ii) Fasten the separate Answer Booklet/Paper securely to the question paper.

Information for candidates

1. Any rough working should be done on this question paper.

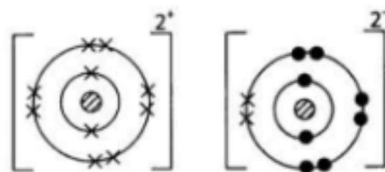
2. The Periodic Table is on page 17.

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

For Examiner's Use		
For Candidate's Use	Mark Obtain	Examiner's Initials
Section A		
Section B		
1		
2		
3		
4		
5		
6		
7		
8		
9		
Section C		
Total		

Centre Number				Examination Number															

- A1** Which of the following best describes why a factory manufacturing pesticides should be located far away from human settlement? Pesticides ...
- A** are poisonous.
 - B** contaminate the environment.
 - C** destroy buildings.
 - D** may kill animals.
- A2** Which of the following is **not** a basic unit of matter?
- A** Atom
 - B** Electron
 - C** Ion
 - D** Molecule
- A3** Which of the following shows the best order of obtaining salt from a mixture of sand and salt?
- A** Dissolving, filtering, evaporation.
 - B** Dissolving, filtering, decantation.
 - C** Dissolving, decantation, evaporation.
 - D** Dissolving, decantation, crystallisation.
- A4** The best method of separating iron filings from copper powder is ...
- A** filtration.
 - B** floatation.
 - C** hand picking.
 - D** magnetism.
- A5** In which of the following are the greatest intermolecular forces?
- A** Bromine
 - B** Chlorine
 - C** Fluorine
 - D** Iodine
- A6** The following dot and cross diagram represents a compound.

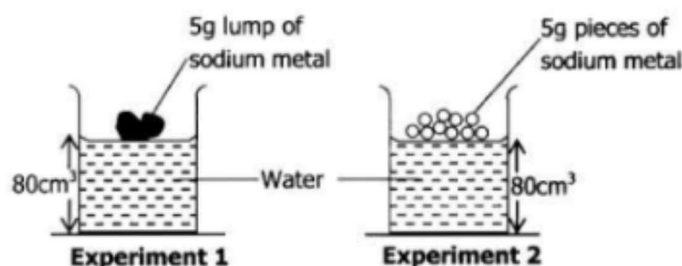


Identify the compound shown in the diagram. The compound is ...

- A** magnesium chloride.
- B** magnesium oxide.
- C** sodium chloride.
- D** sodium oxide.

Centre Number				Examination Number											

- A7** Which of the following liquids when added to a strongly acidic solution in the correct amounts could produce a solution with pH of 7?
- A** Distilled water
 - B** Ethanoic acid
 - C** Lime water
 - D** Potassium hydroxide
- A8** What is the identity test of the gas produced when an acid reacts with a carbonate? It ...
- A** puts off the burning splint with a pop sound.
 - B** relights the glowing splint.
 - C** turns lime water colourless.
 - D** turns lime water milky.
- A9** 25cm^3 of 1.0 mol/dm^3 NaOH solution are measured into a 100cm^3 volumetric flask and water added to make the solution up to the 100cm^3 mark. The concentration of NaOH in this solution is ...
- A** 0.25mol/dm^3 .
 - B** 0.025mol .
 - C** 0.0025mol/dm^3 .
 - D** 0.00025mol/dm^3 .
- A10** What mass of sodium carbonate, Na_2CO_3 , is required to make a 250cm^3 solution whose concentration is 0.3M ?
- A** 7.50g
 - B** 7.95g
 - C** 10.6g
 - D** 15.9g
- A11** An experiment was carried out as shown in the following diagrams.



Where was the reaction faster?

- A** In experiment 1
- B** In experiment 2
- C** In both experiment 1 and 2
- D** None of the two experiments

Centre Number				Examination Number														

A12 Which of the following best explains why hydrogen (H) is **not** placed in any group on the Periodic Table? It has ...

- A** no neutrons.
- B** one electron in its shell.
- C** properties of both Group I and Group VII elements.
- D** properties of most of the elements.

A13 The atomic symbols of elements **W** and **Z** are as follows;

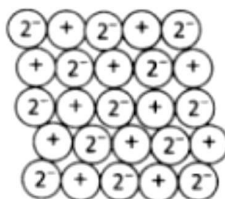


The base units of the compound formed by **W** and **Z** are ...

- A** atoms.
 - B** ions.
 - C** molecules.
 - D** radicals.
- A14** Element **X** is less dense than water and reacts fast with cold water liberating a gas. Which details are correct about element **X**?

	Name of element	Period	Type of solution	Gas produced
A	Beryllium	2	Acidic	Oxygen
B	Caesium	5	Neutral	Hydrogen
C	Calcium	4	Alkaline	Oxygen
D	Sodium	3	Alkaline	Hydrogen

A15 The following diagram shows the ionic lattice of a substance.



What is this substance likely to be?

- A** Magnesium chloride
- B** Magnesium oxide
- C** Sodium chloride
- D** Sodium oxide

Centre Number				Examination Number											

A16 The flowchart shows a commercial manufacture of slaked lime.



What is condition **J** and substance **K**?

- | | J | K |
|----------|----------|----------------|
| A | Catalyst | Water |
| B | Heat | Oxygen |
| C | Heat | Water |
| D | Oxygen | Carbon dioxide |

A17 Which of the following shows the correct method of collection of a dry sample of each of the named gas in the table shown?

	Ammonia	Carbon dioxide	Hydrogen
A	Displacement of water	Upward delivery	Downward delivery
B	Downward delivery	Displacement of water	Upward delivery
C	Upward delivery	Displacement of water	Displacement of water
D	Upward delivery	Downward delivery	Upward delivery

A18 An unsaturated hydrocarbon with six carbon atoms contains only three C=C double bonds. This hydrocarbon is reacted with excess hydrogen at a high temperature.

What is the formula of the resulting hydrocarbon?

- A** C_6H_8
B C_6H_{10}
C C_6H_{14}
D C_6H_{16}

A19 The reactions listed all involve ethanol.

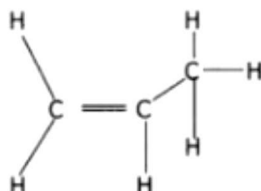
- 1** $CH_3CH_2OH + O_2 \rightarrow CH_3COOH + H_2O$
2 $CH_3CH_2OH + CH_3COOH \rightarrow CH_3COOCH_2CH_3 + H_2O$
3 $C_6H_{12}O_6 \rightarrow 2CH_3CH_2OH + 2CO_2$

Which row correctly describes each reaction?

	1	2	3
A	Combustion	Acidification	Fermentation
B	Combustion	Esterification	Addition
C	Oxidation	Acidification	Addition
D	Oxidation	Esterification	Fermentation

Centre Number	Examination Number

A20 Study the following organic compound.



Why is the compound shown able to decolourise the bromine solution? It ...

- A** can dissolve in bromine solution.
- B** has a double C=C bond.
- C** has a single C—C bond.
- D** has both single C—C and C—H bonds.

SECTION B: [45 MARKS]

Answer **all** questions in this section. Write your answers in the spaces provided in this question paper.

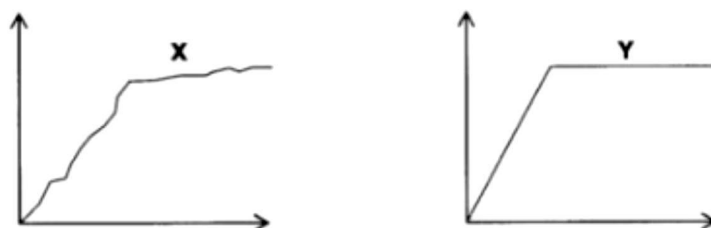
- B1 (a) (i)** Give **one** reason why laboratory rules are very important.

.....
 [1]

- (ii)** State **one** importance of chemistry in our day to day life?

.....
 [1]

- (b)** The following graphs show heating curves that were drawn after pure ice and candle wax were heated over time to their melting points.



- (i)** Identify the heating curve for the candle wax and give a reason for your answer.

Candle wax: Curve: [1]

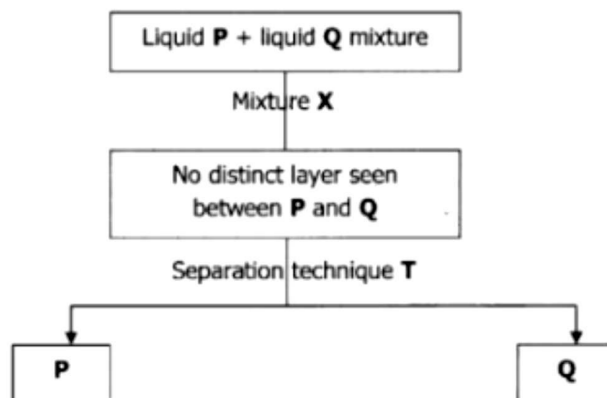
Reason:
 [1]

Centre Number				Examination Number													

- (ii) Give **one** effect of impurities on the melting and boiling points of a pure substance.
-
- [1]

[Total: 5 marks]

B2 Study the following flowchart and answer the questions that follow.



- (a) What are liquids **P** and **Q** in mixture **X** called?
- [1]
- (b) What is the separation technique **T**? Give the criterion used to separate the mixtures.
- Separation technique **T**: [1]
- Criterion: [1]
- (c) Deduce the names of liquids **P** and **Q**.
- P**: [1]
- Q**: [1]

[Total: 5 marks]

Centre Number				Examination Number													

B3 The following symbol shows a nuclide of element **A**.



- (a) Distinguish between the numbers 16 and 32 shown in the nuclide for element **A** given.

.....

 [2]

- (b) (i) To which group of the Periodic Table does element **A** belong?

..... [1]

- (ii) Use the Periodic Table to identify element **A**.

..... [1]

- (c) (i) Draw a dot and cross diagram to show the bonding formed in a compound between element **A** and hydrogen.

[1]

- (ii) Compare the bonding in the compound formed in c(i) with that in calcium oxide.

.....

 [1]

[Total: 6 marks]

Centre Number				Examination Number													

B4 Salts are important substances that have many uses.

- (a) Describe how a fairly dry sample of lead (II) sulphate can be prepared from aqueous sodium sulphate and a soluble compound of lead in the laboratory.

.....

.....

.....

.....

[4]

- (b) Suggest the name of another salt that can be prepared in the same way as lead (II) sulphate.

.....

.....

[1]

[Total: 5 marks]

B5 Calcium nitrate decomposes on heating according to the equation:



- (a) Copy the equation given and balance it.

.....

[1]

- (b) Calculate the relative formula mass of calcium nitrate.

[1]

Centre Number				Examination Number														

- (c) 16.4g of calcium nitrate is decomposed, calculate the volume of oxygen gas liberated at room temperature and pressure (r.t.p).

[2]

[Total: 4 marks]

- B6** The following elements with their electronic configurations are in a certain group of the Periodic Table.

W:2 **X**:2.8 **Y**:2, 8, 8 **Z**:2, 8, 18, 8

- (a) Name the group in which these elements belong. [1]

 (b) What accounts for the chemical unreactivity of this group of elements? [1]

 (c) **W** is used in weather balloons. Explain why **W** is the most suitable for this use. [1]

 (d) Describe the change in density as you go down the group. [1]

[Total: 4 marks]

Centre Number				Examination Number											

- B7** Many carbonates decompose to form the metal oxide and carbon dioxide. **Table 7.1** shows the mass of the carbonate before and after heating.

	Carbonate	Mass before heating/g	Mass after heating/g
1	Zinc carbonate	2.00	1.30
2	Copper carbonate	2.00	1.29
3	Calcium carbonate	2.00	1.12
4	Iron (II) carbonate	2.00	1.24
5	Potassium carbonate	2.00	2.00
6	Magnesium carbonate	2.00	0.95

Table 7.1

- (a) Write a balanced chemical equation for the decomposition of zinc carbonate.
..... [1]
- (b) Which carbonate is the most thermally stable? Give a reason for your answer.
.....
.....
..... [2]
- (c) Calcium oxide is produced on a large scale by heating calcium carbonate in a kiln. What environmental problem is associated with large scale production of calcium oxide?
.....
..... [1]
- (d) Select the carbonate which on heating produces a compound which is used as a refractory material.
..... [1]

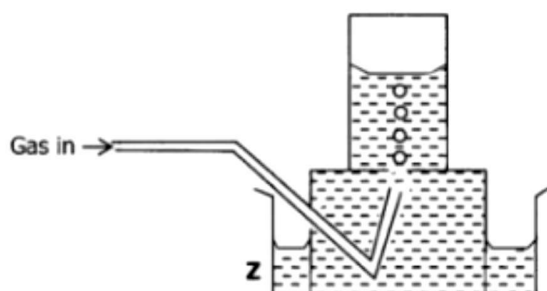
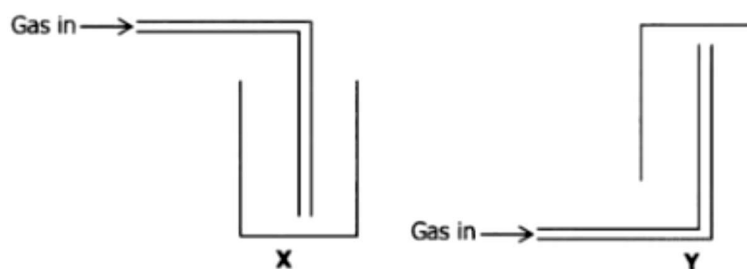
[Total: 5 marks]

Centre Number				Examination Number															

B8 Three gases **A**, **B** and **C** have properties shown in the table.

Gas	Density	Solubility in water	Appearance
A	More dense than air	Soluble	Colourless
B	Less dense than air	Soluble	Colourless
C	More dense than air	Insoluble	Colourless

Some apparatus used to collect gases are shown in the following diagrams.



(a) Which apparatus **X**, **Y** or **Z** is most suitable to collect gas

(i) **A**; [1]

(ii) **B**? [1]

Centre Number				Examination Number											

(b) Gas **C** can be collected using apparatus **Z**.

(i) State why apparatus **Z** is more suitable than apparatus **Y** to collect gas **C**?

.....
 [1]

(ii) State why apparatus **Y** is more suitable than apparatus **Z** to collect gas **B**.

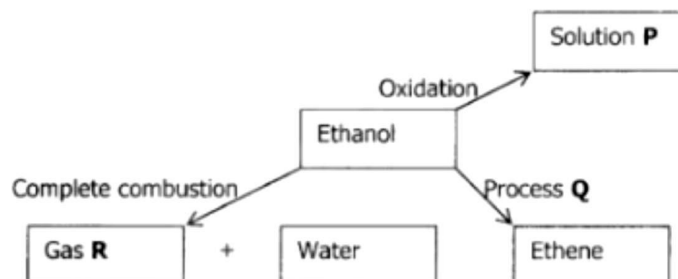
.....
 [1]

(c) Suggest a name of a gas that would be collected using apparatus **X**.

.....
 [1]

[Total: 5 marks]

B9 The following diagram shows some of the reactions of ethanol.



(a) Draw the structural formula for ethene.

[1]

Centre Number				Examination Number														

- (b) Give the names for
- (i) solution **P**;
..... [1]
- (ii) process **Q**;
..... [1]
- (iii) gas **R**.
..... [1]
- (c) Write a balanced chemical equation for the complete combustion of ethanol.
.....
..... [2]
- [Total: 6 marks]**

SECTION C: [20 MARKS]

Answer any **two (2)** questions from this section in the separate Answer Booklet provided.

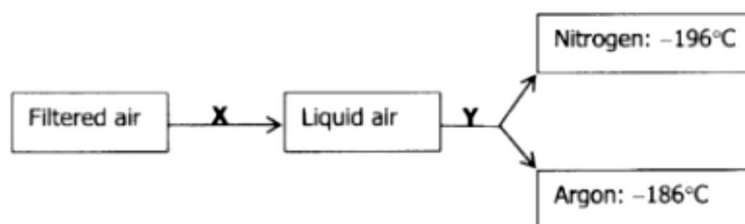
- C1** In an experiment to find the concentration of a solution of sodium hydroxide, 0.1M of hydrochloric acid was run from a burette into a conical flask containing 25cm³ of aqueous sodium hydroxide until neutralisation took place. 20cm³ of the acid was required.
- (a) (i) Name a suitable indicator to use in this experiment. [1]
- (ii) Describe the colour change that would be observed when neutralisation occurred for the indicator you named in (a) (i). [1]
- (b) Write down the chemical equation for the reaction that takes place in the conical flask. [1]
- (c) (i) How many moles of hydrochloric acid were used in the experiment? [1]
- (ii) Using the equation in (b), calculate the number of moles of sodium hydroxide used. [1]
- (iii) Calculate the concentration of the sodium hydroxide in mol/dm³. [2]
- (d) (i) Give a reason why the burette was used to determine the volume of the acid and not a measuring cylinder? [1]
- (ii) How was exactly 25cm³ of sodium hydroxide transferred into the conical flask? [2]

[Total: 10 marks]

Centre Number				Examination Number											

C2 Nitrogen and argon are both elements found in air.

- (a) Draw the electronic structures of nitrogen and argon. [2]
- (b) With reference to the electronic structures in (a), explain why nitrogen and argon are found in Period 2 and 3 respectively. [2]
- (c) The flowchart shows the separation of nitrogen and argon from air by fractional distillation.



- (i) Describe the processes that take place at X and Y. [3]
- (ii) Give **one** use of nitrogen gas. [1]
- (d) Argon is a liquid at -188°C .
- (i) In what state will argon be at 5°C ? [1]
- (ii) Draw a diagram to show how the atoms of argon are arranged at 5°C . [1]

[Total: 10 marks]

C3 Ethanol is a product of many fermentation reactions. The molecular formula of ethanol is $\text{C}_2\text{H}_5\text{OH}$.

- (a) Draw the displayed molecular structure of ethanol. [1]
- (b) When ethanol is heated with potassium dichromate (VI) it is converted to ethanoic acid.
- (i) What type of reaction is this? [1]
- (ii) Give **one** safety rule to be observed when handling ethanoic acid in the laboratory. [1]
- (c) Ethanoic acid reacts with ethanol in the presence of a catalyst to produce a new substance. Give the name and deduce the formula of the new substance. [2]
- (d) Ethanoic acid is a weak acid. It can react with a metal such as sodium and magnesium to liberate hydrogen gas.
- (i) Compare the rates of reaction of ethanoic acid with sodium and with magnesium. [2]
- (ii) What would be observed when aluminium is added to ethanoic acid? Give a reason for this observation. [2]
- (iii) Give **one** use of aluminium based on the observation made in d (ii). [1]

[Total: 10 marks]

The volume of one mole of any gas is 24 dm^3 at room temperature and pressure (r.t.p.).

$$N_A = 6.0 \times 10^{23}/\text{mol}; 1^\circ\text{F} = 9/5 500^\circ\text{C}.$$

Science/5124/2/

2022