Centre Number	Examination Number

EXAMINATIONS COUNCIL OF ZAMBIA

Examination for General Certificate of Education Ordinary Level

Science

5124/2

Paper 2

Tuesday 9 AUGUST 2022

5124-2-043-130

Additional Materials:
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 **eight** 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) Fasten the separate Answer Booklet/Papers used securely to the question paper.

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

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

Information for candidates

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

2 The Periodic Table is on **page 15**.

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

Centre Number	Examination Number

SECTION A

Answer **all** the questions in this section. Choose the best answer from the letters **A**, **B**, **C** or **D** and then mark the letter with a cross **(X)**.

For example if the answer is **B**, it is shown as:

A	B	C	D

ANSWER GRID

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

Centre Number	Examination Number

SECTION A [20 marks]

Answer **all** the questions on the answer grid provided in this question paper.

A1 The branch of Chemistry that deals with the identification of composition of substances is ...

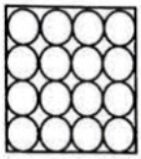
A analytical chemistry.

B inorganic chemistry.

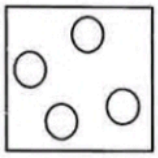
C organic chemistry.

D physical chemistry.

A2 The following diagrams show the arrangement of particles in a substance under normal atmospheric pressure but at two different temperatures.



At −125°C

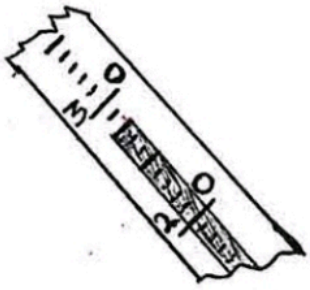


At −90°C

Which substance could the diagrams represent?

Substance	Melting point/°C	Boiling point/°C
A	−150	−138
B	−135	−120
C	−120	−88
D	−115	−92

A3 The following diagram shows part of a laboratory thermometer.



What is the temperature shown in degrees Celsius?

A 32.0°C

B 30.2°C

C 28.0°C

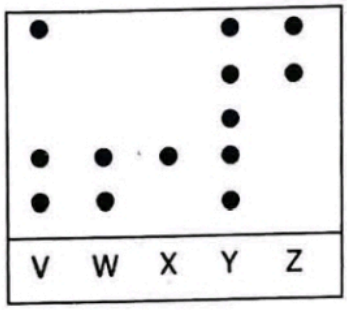
D 20.8°C

Centre Number	Examination Number

A4 The following table lists the data obtained in a titration experiment. Which reading should **not** be included to compute the average volume of the acid used in the titration?

Trial	**A**	**B**	**C**	**D**
Volume of acid/cm^3	12.9	13.0	12.8	11.9

A5 The following diagram shows a chromatogram obtained when sample **V** was analysed together with four other known dyes **W, X, Y, Z**. Dye **X** was known to be poisonous.



Which of the following dyes are safe for use?

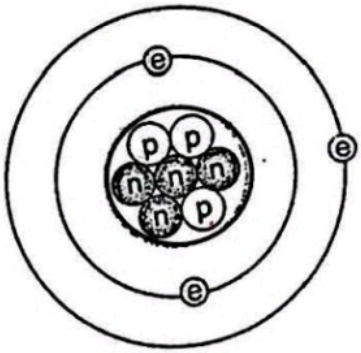
A **V** and **W**

B **W** only

C **W** and **Z**

D **Z** only

A6 The following diagram shows the structure of an atom.



What is the proton number and nucleon number of the atom?

	Proton	**Nucleon number**
A	3	4
B	3	7
C	6	4
D	6	7

Centre Number	Examination Number

A7 Lithium occurs as a mixture of two stable isotopes: $^{6}_{3}Li$ (7.5%) and $^{7}_{3}Li$ (92.5%).

The relative atomic mass of lithium is ...

A 6.2.

B 6.5.

C 6.9.

D 7.2.

A8 Magnesium forms Mg^{2+}(ions). The number of electrons in a magnesium ion is ...

A 6.

B 10.

C 12.

D 14.

A9 Which elements exist as mono atomic molecules at room temperature and pressure?

A Helium, argon and neon.

B Fluorine, neon and argon.

C Chlorine, oxygen and helium.

D Hydrogen, helium and neon.

A10 Deduce the formula of lead (II) phosphate?

A $PbPO_4$

B Pb_2PO_4

C $Pb_3(PO_4)_2$

D $Pb_2(PO_4)_3$

A11 Which **one** of the following substances dissolves in water to form a solution with a pH of less than 7?

A Ammonia

B Magnesium sulphate

C Sodium chloride

D Sulphur dioxide

A12 Dilute sulphuric acid reacts with both magnesium oxide and magnesium carbonate. How are these two reactions alike?

A Water is produced

B Hydrogen is produced

C Carbon dioxide is produced

D A white precipitate is formed

Centre Number	Examination Number

A13 Crystals of sodium carbonate decahydrate ($Na_2CO_3.10H_2O$) are efflorescent. When these crystals are exposed to air, the crystals ...

A gain mass and become liquid.

B gain mass and remain solid.

C lose mass and remain solid.

D lose mass, change to liquid and evolve bubbles of gas.

A14 One mole of nitrogen and one mole of ammonia gases have ...

A equal number of atoms.

B equal number of electrons.

C equal number of molecules.

D the same masses.

A15 A solution of calcium chloride contains 11.1g of the salt in 250cm^3 of the solution. What is the concentration of the solution in mol/dm^3?

A 0.1

B 0.2

C 0.4

D 1.25

A16 When an excess of magnesium powder was reacted with dilute hydrochloric acid, the reaction was fast at first but gradually became slower and finally stopped.
Which of the following best explains why this happened? The...

A hydrochloric acid was used up.

B magnesium was used up.

C magnesium particles became coated with the hydrogen gas.

D temperature of the mixture decreased.

A17 What could be the chemical formula of the nitrate of an element **Q** of Group III of the Periodic Table?

A QNO_3

B Q_3NO_3

C $Q(NO_3)_2$

D $Q(NO_3)_3$

A18 Some metal ores are roasted in air before they are reduced in the blast furnace. What is the main air pollution caused by this process?

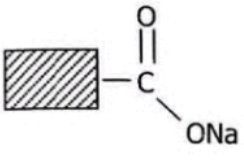
A Carbon dioxide is produced.

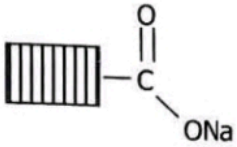
B Carbon monoxide is produced.

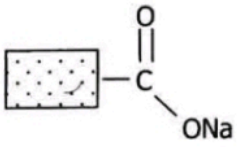
C Lead fumes are produced.

D Sulphur dioxide is produced.

A19 The following structures represent different types of soap.







Which statement about soap is correct? Soap is ...

A a base.

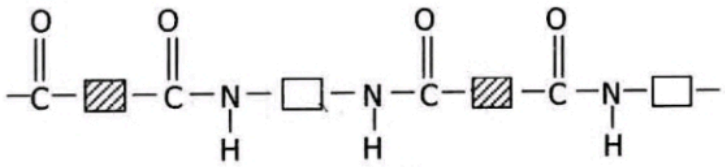
B an ester.

C a polymer.

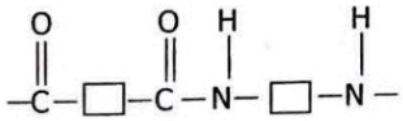
D a salt.

A20 What would be the structure of the polymer formed when the following monomers undergo polymerisation?

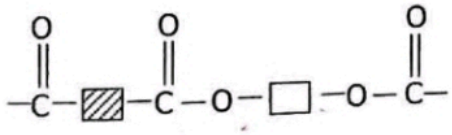
A



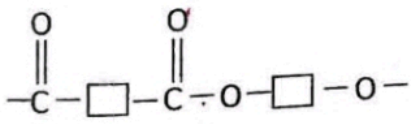
B



C



D



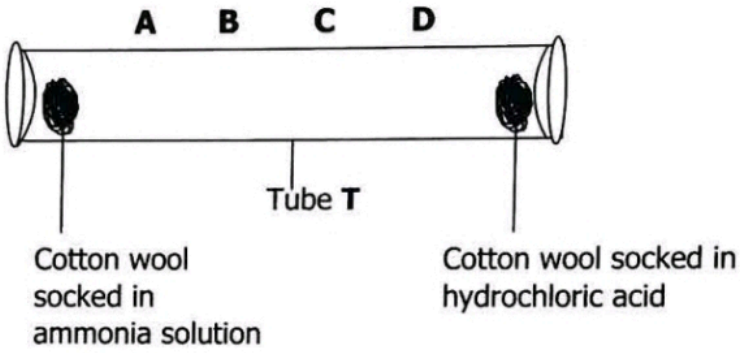
Centre Number	Examination Number

Section B [45 marks]

Answer **all** questions in this section.

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

B1 The following experiment was set up to investigate factors that affect the rate of diffusion in gases. During the experiment, a cloud of white smoke was seen as the ammonia gas (NH_3) and hydrogen chloride gas (HCl) reacted.



(a) Define the term diffusion.

.....

..... [1]

(b) Which of the particles for ammonia or hydrochloric acid will move faster?

..... [1]

(c) **(i)** At which point **A** to **D**, along the tube **T** will the white cloud be seen?

..... [1]

(ii) Explain your answer in **(c) (i)** in terms of the movement of particles.

.....

..... [1]

(d) State a

(i) factor that affects the rate of diffusion in the experiment above;

..... [1]

(ii) safety precaution you would take when carrying out the experiment.

.....

..... [1]

[Total: 6 marks]

Centre Number	Examination Number

B2 The following are some common substances:

Air	Water	Limestone	Sugar	Common salt	Brass	Calcium	Petroleum

Choose from the above list a substance which is a

(a) compound containing three elements;

..... [1]

(b) mixture of two elements;

..... [1]

(c) mixture containing both elements and compounds;

..... [1]

(d) a mixture of compounds.

..... [1]

[Total: 4 marks]

B3 Atoms of **J** and **K** have 8 and 12 electrons respectively.

(a) Determine the formulae of the compound/molecule formed by the combination of

(i) **J** and **K**;

..... [1]

(ii) **J** and **J**.

..... [1]

(b) In each of the cases shown in **(a) (i)** and **(ii)**, name the type of chemical bond formed.

.....

..... [2]

(c) Give **two** physical properties of the compound formed in **(a)(i)**.

.....

..... [2]

[Total: 6 marks]

Centre Number	Examination Number

B4 **(a)** What is the major characteristic feature of an acid?

..... [1]

(b) Explain what is meant by each of the following terms:

(i) weak acid;

..... [1]

(ii) strong acid.

..... [1]

(c) Write equations to show the ionisation of

(i) dilute sulphuric acid;

..... [1]

(ii) ethanoic acid.

..... [1]

[Total: 5 marks]

B5 Excess of zinc metal was added to 200cm^3 of 2M hydrochloric acid.

(a) Write a balanced chemical equation for the reaction.

.....

..... [2]

(b) Calculate the

(i) number of moles of hydrogen gas produced in the reaction;

[2]

(ii) volume of hydrogen gas produced at r.t.p.

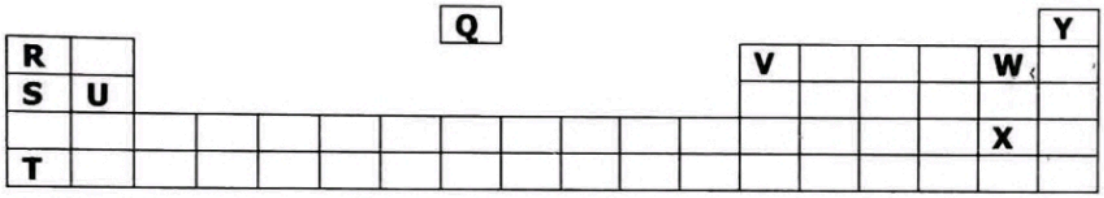
[1]

(c) What mass of zinc was used in the reaction?

[2]

[Total: 7 marks]

B6 The following table shows elements coded with letters **Q** to **Y** which do not represent the actual symbol of any of the elements in the Periodic Table. You will need to use these letters in some of your answers.



(a) Which element shown

(i) forms ions with a single negative charge;

..... [1]

(ii) has three electrons in its outermost shell?

..... [1]

(b) How many protons does an atom of element **Y** contain?

..... [1]

(c) State the element which is the most reactive

(i) metal;

..... [1]

(ii) non-metal.

..... [1]

(d) Deduce the formula of the compound formed between elements **U** and **W**.

..... [1]

[Total: 6 marks]

Centre Number	Examination Number

B7 The following reaction scheme shows what occurs during the extraction of zinc metal from one of its ores, zinc blende.

Zinc blende $\xrightarrow[\text{in air}]{\text{roasted}}$ solid **L** + sulphur dioxide $\xrightarrow[\text{in coke}]{\text{burn}}$ zinc + gas **M**

(a) Deduce the chemical formula of zinc blende.

..... [1]

(b) Name solid **L** and gas **M**.

..... [2]

(c) Construct the chemical equation for the reaction of solid **L** with coke.

..... [1]

(d) Sulphur dioxide gas is a pollutant. Explain its effect on plants.

..... [2]

[Total: 6 marks]

B8 The four hydrocarbons given are members of a homologous series.

CH_4 C_4H_{10} C_6H_{14} $C_{10}H_{22}$

(a) Explain the term 'hydrocarbon'.

..... [1]

(b) Name the

(i) homologous series to which the above hydrocarbons belong;

..... [1]

(ii) compound with molecular formula C_4H_{10}.

..... [1]

(c) Draw the full structural formula of the hydrocarbon which has four carbon atoms.

[1]

(d) Which of the given hydrocarbons has the highest boiling point?

..... [1]

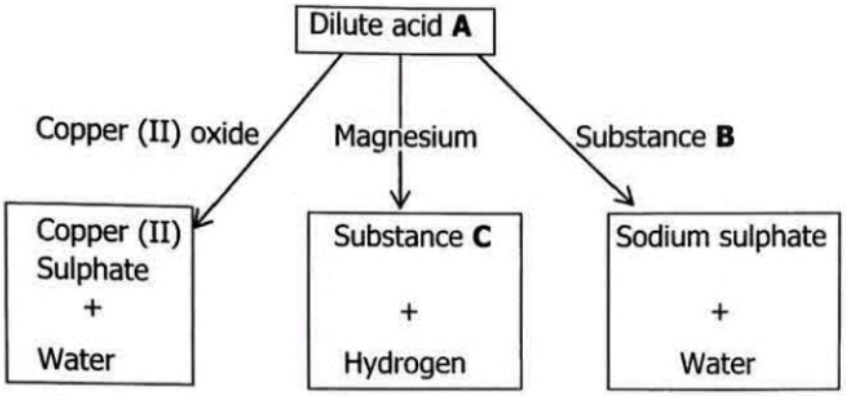
[Total: 5 marks]

Centre Number	Examination Number

SECTION C [20 marks]

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

C1 The following scheme shows some reactions of a dilute acid **A**.



(a) Name and give the formulae of

(i) dilute acid **A**; [2]

(ii) substances **B** and **C**. [4]

(b) Construct

(i) a balanced chemical equation for the reaction between substance **B** and dilute acid **A**. [2]

(ii) an ionic equation for the reaction in **(b) (i)**. [1]

(c) State the type of reaction that occurs in **(b) (i)**. [1]

[Total: 10 marks]

C2 Calcium hydroxide or slaked lime is an industrial alkali.

(a) Explain

(i) the meaning of the term alkali; [1]

(ii) how calcium hydroxide is produced starting with limestone. [3]

(b) Give **two** large scale uses of calcium hydroxide. [2]

(c) A weak solution of calcium hydroxide is called limewater and it is used to test for carbon dioxide gas.

(i) Construct a chemical equation for the reaction. Include state symbols. [2]

(ii) Give the chemical name of the salt produced during the reaction. [1]

(iii) Describe what is observed during the reaction. [1]

[Total: 10 marks]

Centre Number	Examination Number

C3 Propene is one of the many important hydrocarbons obtained from crude oil. Like propane, it is made up of molecules which contain three carbon atoms.

(a) **(i)** Draw a structural formula for propene. [1]

(ii) How does propene differ from propane in terms of bonds? [1]

(iii) To which group of hydrocarbons does propene belong? [1]

(iv) Give the molecular formula for propane and propene respectively. [2]

(b) **(i)** Explain why propene reacts immediately with bromine water whereas propane does not. [2]

(ii) Describe what would be observed during the reaction. [1]

(c) Propene is obtained by breaking down longer chains of hydrocarbons. What is this process called? [1]

(d) Propene is a monomer for making an important plastic. State the name of the polymer it forms. [1]

[Total: 10 marks]

DATA SHEET

The Periodic Table of the Elements

Group I	Group II											Group III	Group IV	Group V	Group VI	Group VII	Group 0
							1 H Hydrogen 1										4 He Helium 2
7 Li Lithium 3	9 Be Beryllium 4											11 B Boron 5	12 C Carbon 6	14 N Nitrogen 7	16 O Oxygen 8	19 F Fluorine 9	20 Ne Neon 10
23 Na Sodium 11	24 Mg Magnesium 12											27 Al Aluminium 13	28 Si Silicon 14	31 P Phosphorus 15	32 S Sulphur 16	35.5 Cl Chlorine 17	40 Ar Argon 18
39 K Potassium 19	40 Ca Calcium 20	45 Sc Scandium 21	48 Ti Titanium 22	51 V Vanadium 23	52 Cr Chromium 24	55 Mn Manganese 25	56 Fe Iron 26	59 Co Cobalt 27	59 Ni Nickel 28	64 Cu Copper 29	65 Zn Zinc 30	70 Ga Gallium 31	73 Ge Germanium 32	75 As Arsenic 33	79 Se Selenium 34	80 Br Bromine 35	84 Kr Krypton 36
85 Rb Rubidium 37	88 Sr Strontium 38	89 Y Yttrium 39	91 Zr Zirconium 40	93 Nb Niobium 41	96 Mo Molybdenum 42	Tc Tchnetium 43	104 Ru Ruthenium 44	103 Rh Rhodium 45	106 Pd Palladium 46	108 Ag Silver 47	112 Cd Cadmium 48	115 In Indium 49	119 Sn Tin 50	122 Sb Antimony 51	128 Te Tellurium 52	127 I Iodine 53	131 Xe Xenon 54
133 Cs Caesium 55	137 Ba Barium 56	139 La Lanthanum 57 *	178 Hf Hafnium 72	181 Ta Tantalum 73	184 W Tungsten 74	186 Re Rhenium 75	190 Os Osmium 76	192 Ir Iridium 77	195 Pt Platinum 78	197 Au Gold 79	201 Hg Mecury 80	204 Tl Thallium 81	207 Pb lead 82	209 Bi Bismuth 83	Po Polonium 84	At Astatine 85	Rn Radon 86
Fr Francium 87	226 Ra Radium 88	227 Ac Actinium 89 +															

*58-71 Lanthanoid series
+90-103 Actinoid series

140 Ce Cerium 58	141 Pr Praseodymium 59	144 Nd Neodymium 60	Pm Promethium 61	150 Sm Samarium 62	152 Eu Europium 63	157 Gd Gadolinium 64	159 Tb Terbium 65	162 Dy Dysprosium 66	165 Ho Holmium 67	167 Er Erbium 68	169 Tm Thulium 69	173 Yb Ytterbium 70	175 Lu Lutetium 71
232 Th Thorium 90	Pa Protactinium 91	238 U Uranium 92	Np Neptunium 93	Pu Plutonium 94	Am Americium 95	Cm Curium 96	Bk Berkelium 97	Cf Californium 98	Es Einsteinium 99	Fm Fermium 100	Md Mendelevium 101	No Nobelium 102	Lr Lawrencium 103

Key: a X b — a = relative atomic mass; X = atomic symbol; b = proton (atomic) number

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

$N_A = 6.0 \times 10^{23}$/mol; 1F = 96 500C.

2 0 2 2