Candidate Name:_____

Centre Number.	Candidate Number

EXAMINATIONS COUNCIL OF ZAMBIA

Examination for General Certificate of Education Ordinary Level

Science 5124/3

Paper 3 (Chemistry)

Tuesday **12 JULY 2016**

Additional materials:
Answer Booklet
Mathematical tables or
Electronic Calculator (non-programmable)

Time: 1 hour 15 minutes

Instructions to Candidates

Write your **name, centre number** and **candidate number** at the top of this page and all separate Answer Booklets used.

There are **11 questions** in this question paper.

Section A

Answer **all** the questions.

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

Section B

Answer any **two** questions.

Write your answers on the separate Answer Booklet provided.

1 Fasten the separate Answer Booklet securely to the question paper.
2 Enter the numbers of the **Section B** questions you have answered in the grid.

Candidate's Use	Examiner's Use
Section A	
Section B	
Total	

Information for Candidates

The number of marks is given in brackets [ ] at the end of each question or part question.
The **Periodic Table** is on page 11.

Cell phones are not allowed in the Examination room.

This question paper consists of 11 printed pages.

Section A

[45 MARKS]

Answer all the questions in this section.

Write your answers in the spaces provided

1 All matter is made up of small particles which are referred to as the basic units of matter. The small particles of matter are always in random motion.

(a) State any **two** basic units of matter.

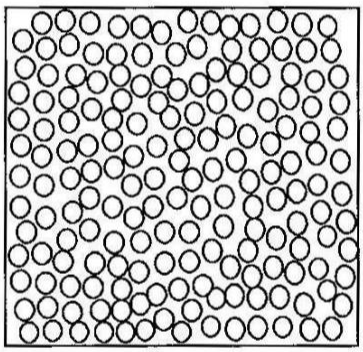
..... [2]

(b) Suggest **two** pieces of evidence which show that matter is made up of tiny, randomly moving particles.

.....

..... [2]

(c) The diagram below represents one of the physical states of matter.



Name this physical state of matter and explain why it has a fixed volume.

Name: .....

Explanation: ..... [2]

[Total 6]

2 Each of the following statements is incorrect. But if one scientific term is replaced by a correct one, the statement then becomes true. Identify the wrong word (term), underline it and in the space provided write the correct word.

(a) Condensation is the change of state of matter from solid to liquid.

..... [1]

(b) The basic units of matter that exist in sodium chloride are molecules.

..... [1]

(c) Isotopes are compounds with the same molecular formula but different structural formulae.

..... [1]

(d) Calcium hydroxide is classified as an amphoteric substance because it dissolves in sodium hydroxide solution.

..... [1]

(e) Zinc and chlorine bond covalently.

..... [1]

[Total 5]

3 Two elements **A** and **D** are represented by the notations shown below

$^{23}_{11}\mathbf{A}$ $^{16}_{8}\mathbf{D}$

(a) Draw electron-shell diagrams to show the arrangement of electrons in the atoms of **A** and **D.**

Atom of element **A**

Atom of element **D**

[2]

(b) **(i)** When atoms of element **A** and atoms of element **D** react together, what type of bonding occurs?

Type of bonding: _____ [1]

(ii) Using the dot and cross diagrams, show the structure of the compound formed between **A** and **D** showing all the electron shells.

[2]

(c) State any **two** physical properties of the compound formed between **A** and **D.**

(i) ..... [1]

(ii) ..... [1]

[Total 7]

4 When carbon dioxide gas is bubbled through aqueous calcium hydroxide (lime water), the following reaction occurs:

$Ca(OH)_{2\,(aq)} + CO_{2(g)} \longrightarrow CaCO_{3(s)} + H_2O_{(l)}$

(a) Write a word equation for this reaction.

.....

..... [1]

(b) If 1.2dm^3 of carbon dioxide gas measured at r.t.p was bubbled through excess calcium hydroxide solution.

Calculate the:

(i) mass of calcium hydroxide solution which reacted.

(ii) mass of calcium carbonate formed. [2]

[2]

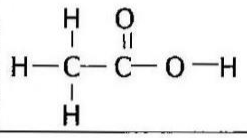
(iii) Describe what would be seen as the carbon dioxide gas is bubbled through aqueous calcium hydroxide.

.....

..... [1]

[Total 6]

5 The following table shows some information about the **second** member in the respective homologous series. Complete the table by filling in the correct information.

Name of the homologous series	**Name of the member**	**Displayed full structural formula**
Alkenes		
	Ethanol	
		

[Total 6]

6 The diagram below shows part of the Periodic Table.

																H	He
Li	Be											B	C	N	O	F	Ne
Na	Mg											Al	Si	P	S	C	Ar
K	Ca	Sc	Ti	V	Cr	Mn	Fe	Co	Ni	Cu	Zn						Kr

State the name of an element from this part of the Periodic Table which

(a) forms univalent cations.

..... [1]

(b) reacts most vigorously with cold water.

..... [1]

(c) forms oxides of formulae **X**O and $\mathbf{X}_2$O, where **X** represents the chemical symbol of the element.

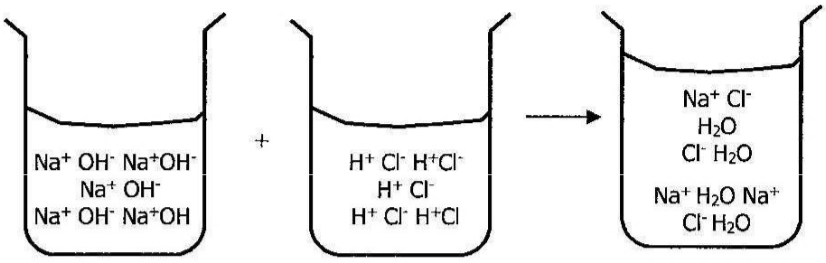
..... [1]

(d) does **not** react with oxygen.

..... [1]

[Total 4]

7 Solutions of hydrochloric acid and sodium hydroxide are mixed together and they react as shown below.



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

..... [1]

(b) State the name for this type of reaction and write an ionic equation for it.

Type of reaction: ..... [1]

Ionic equation: ..... [1]

(c) Describe how crystals of sodium chloride can be obtained from the solution formed during the reaction.

.....

.....

..... [2]

[Total 5]

8 When hot magnesium metal is introduced in a gas jar containing carbon dioxide gas, the carbon dioxide is decomposed and the following reaction occurs.

$2Mg_{(s)} + CO_{2(g)} \longrightarrow 2MgO_{(s)} + C_{(s)}$

In this reaction, both oxidation and reduction occur.

(a) What name is used to describe a reaction in which both reduction and oxidation occur?

..... [1]

(b) State, with reason, which substance is oxidised and which substance is reduced.

(i) Substance oxidised:.....

Reason: ..... [1]

(ii) Substance reduced.....

Reason ..... [1]

(c) Which substance is the reducing agent?

..... [1]

(d) Classify the **two** types of oxides from the equation above.

(i) .....

(ii) ..... [2]

[Total: 6]

Section B

[20 MARKS]

Answer any two questions

9 Copper is extracted from one of the ores, copper pyrites, $CuFeS_2$. The copper pyrites is first converted to copper (I) sulphide before copper metal is produced.

(a) Write down the equations leading to the formation of copper metal from copper pyrites. [2]

(b) Explain why this extraction leads to air pollution. [1]

(c) State the process used to purify copper. [1]

(d) State any **two** large scale uses of copper and give reasons why copper is used in that way. [4]

(e) **(i)** Copper occurs 'native' in some countries such as Zambia. Explain what is meant by the word 'native'. [1]

(ii) Name **one** alloy made from copper metal. [1]

[Total 10]

10 When a mixture of ammonium sulphate and sodium hydroxide is heated, the reaction represented by the word equation below occurs.

Ammonium sulphate + sodium hydroxide ⟶ sodium sulphate + water + ammonia.

(a) Write a balanced chemical equation for the above reaction. [2]

(b) Describe a chemical test you can carry out to show that ammonia is formed. [2]

(c) On a large scale, ammonia is produced by the Haber process:

(i) What are the reactants used in the Haber process? [2]

(ii) Write a balanced chemical equation for the Haber process. [2]

(iii) State the essential conditions used in order to obtain an economical yield of the ammonia gas. [2]

[Total 10]

11 Propene ($CH_3 - CH = CH_2$) reacts with steam to give a major product propan –2 –ol.

(a) State the essential conditions in this reaction. [2]

(b) State the kind of reaction that occurs between propene and steam. [1]

(c) However, there is also a minor by-product formed in such a reaction. [1]

(i) Give the full (displayed) structural formula and the systematic name of this by-product. [2]

(ii) How is the major product separated from the minor product? [1]

(iii) If 2.1kg of propene is fully reacted with steam. Calculate the mass of propan —2 –ol that would be formed. [2]

(d) State the general formula for alkenes. [1]

[Total 10]

DATA SHEET

The Periodic Table of the Elements

Group																	
I	II										III	IV	V	VI	VII	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 Technetium 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 +															

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

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

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.).