Candidate Name_____

Centre Number	Candidate Number

EXAMINATIONS COUNCIL OF ZAMBIA

Examination for General Certificate of Education Ordinary Level

Science 5124/2

Paper 2

Tuesday **1 AUGUST 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 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	
Total		

This question paper consists of 16 printed pages

ANSWER GRID FOR SECTION A

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

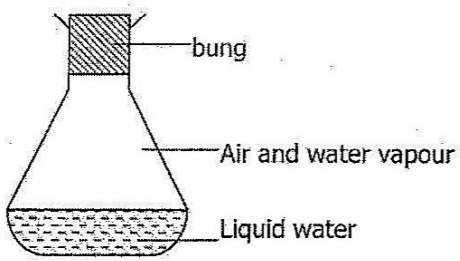
1	A	B	C	D
2	A	B	C	D
3	A	B	C	D
4	A	B	C	D
5	A	B	C	D
6	A	B	C	D
7	A	B	C	D
8	A	B	C	D
9	A	B	C	D
10	A	B	C	D

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.

A1 Some cold water is poured into a conical flask and a bung inserted. The diagram shows the flask after being left in open air for some time.



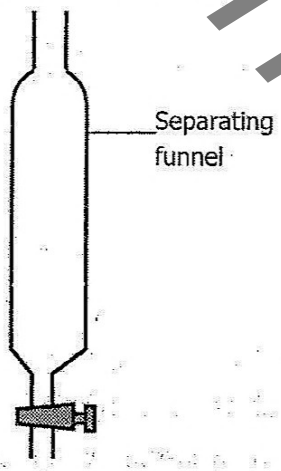
What is occurring in the flask?

A Boiling and condensation
B Evaporation and condensation
C Evaporation and freezing
D Freezing and melting

A2 Which of the following is **not** true about evaporation?

A It involves a physical change of state.
B The particles gain kinetic energy.
C It is a non-reversible change.
D It weakens the intermolecular forces of attraction.

A3 Identify a mixture of substances that can be separated using the apparatus below.



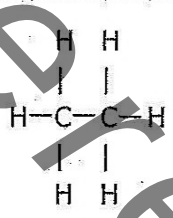
A Mixture of ...

A paraffin and water.
B common salt and iodine solution.
C sugar solution and alcohol.
D alcohol and water.

A4 The nuclide of an aluminum ion is written as $^{27}_{13}Al^{3+}$. State the numbers of neutrons and electrons in the nuclide of the ion.

	Neutrons	Electrons
A	27	13
B	14	13
C	14	10
D	27	10

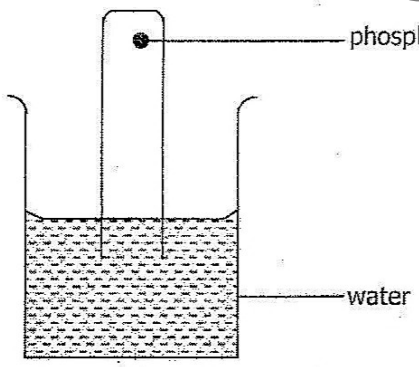
A5 Ethane has the structure shown below.



How many of the electrons in a molecule of ethane are **not** involved in bonding?

A 4
B 3
C 2
D 0

A6 The diagram shows an apparatus used to measure the percentage composition of gases in the atmosphere. Phosphorous reacts with oxygen in the air to form phosphorous (V) oxide which dissolves in water.
The initial volume of gas in the tube is 80 cm^3.



What volume of gas remained after all the phosphorous had burned?

A 16 cm^3
B 40 cm^3
C 60 cm^3
D 64 cm^3

A7 Determine the relative molecular mass of lead (IV) chloride, $PbCl_4$.

A 249
B 278
C 349
D 378

A8 Which of the following is an exothermic reaction?

A The reaction between hydrogen and iodine
B Development of photographs
C Photosynthesis
D Rusting

A9 Which change will **not** increase the rate of a chemical reaction? An increase in ...

A concentration of aqueous reactants.
B pressure of gaseous reactants.
C temperature of a reaction system.
D the particle size of solid reactants.

A10 Choose a substance which when added in excess to acidic soil will increase its pH without making it alkaline.

A $CaCl_2$
B $CaCO_3$
C CaO
D $Ca(OH)_2$

A11 An acid differs from a base in that an acid ...

A turns a red litmus paper blue.
B has a pH value above 7.
C has a sour taste.
D turns a blue litmus paper red.

A12 Which set of elements exist as diatomic molecules at room temperature?

A Hydrogen, oxygen, helium.
B Nitrogen, chlorine, neon.
C Nitrogen, oxygen, fluorine.
D Oxygen, chlorine, helium.

A13 Two elements are in the same group of the periodic table. Which property will be the same for both elements?

A Their boiling points
B The number of shells
C Their electronic structure
D The charge on their ions

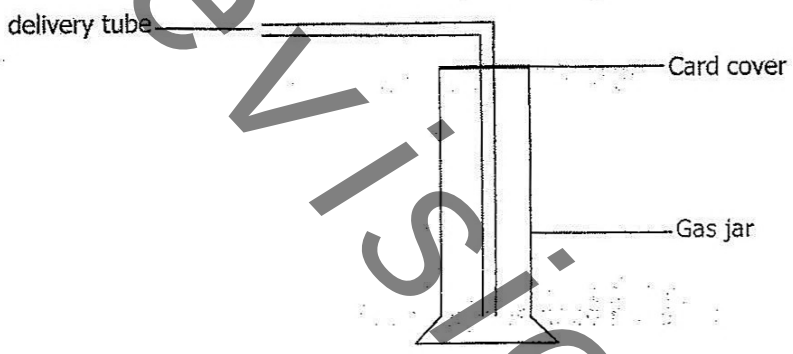
A14 Which metal is extracted from its ore by reduction of its oxide by carbon?

A Aluminum
B Copper
C Sodium
D Zinc

A15 Identify the substance which undergoes decomposition because of high temperature in the blast furnace?

A Calcium silicate
B Calcium carbonate
C Coke
D Slag

A16 A colourless gas can only be collected using the method shown below:



What does this tell you about the gas? It is ...

A denser than air and insoluble in water.
B denser than air and soluble in water.
C less dense than air and insoluble in water.
D less dense than air and soluble in water.

A17 Choose a gas which burns in air to form a single product?

A Methane
B Nitrogen dioxide
C Carbon monoxide
D Ammonia

A18 When ethene is bubbled through aqueous bromine, the solution turns ...

A brown.
B colourless.
C purple.
D red.

A19 Methane is a green house gas. Which process releases methane into the air?

A Combustion of petrol
B Decay of vegetable matter
C Volcanic activity
D Photosynthesis

A20 When the temperature of a chemical reaction is increased, the kinetic energy of particles increases and the ...

A number of effective collisions increases.
B number of effective collisions decreases.
C particles become far apart from each other.
D particles become closer to each other.

Section B [45 marks]

Answer all questions in this section.

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

B1 A spillage of 15.5 tonnes of sulphuric acid results from an accident of a road tanker. Slaked lime is used to neutralise the acid according to the equation below:

$$H_2SO_{4\,(aq)} + Ca(OH)_{2(s)} \longrightarrow CaSO_{4(s)} + H_2O_{(l)}$$

(a) Balance the equation above.

.....

..... [1]

(b) Determine the relative formula mass of $Ca(OH)_2$.

.....

..... [1]

(c) Use the balanced equation to determine the mass of calcium sulphate formed during the neutralization of the spilt acid.

.....

.....

.....

..... [2]

(d) Calcium hydroxide is a base, which ion present in the compound is responsible for its basic properties?

..... [1]

[Total: 5 marks]

B2 Most metals are not found as pure elements in the earth's crust, and iron is one such metal. Iron is extracted from its ore in a blast furnace.

(a) Name **two** other raw materials added to the blast furnace other than haematite.

.....

..... [2]

(b) Write a balanced chemical equation for the reduction of the iron ore to the metal.

.....

.....

..... [2]

(a) State **two** conditions necessary for rusting to occur.

.....

..... [2]

[Total: 6 marks]

B3 Use the following list of elements to answer the questions below.
Iron, Lithium, Mercury, Oxygen, Potassium, Sulphur.
Each element can be used once, more than once or not at all.
Which element

(a) is used as a catalyst in the manufacture of ammonia in the Haber process?

..... [1]

(b) is lower than sodium in the reactivity series?

..... [1]

(c) is a non-metallic solid, whose atoms contain only six valency electrons?

..... [1]

(d) is in Period 6 of the Periodic Table?

..... [1]

(e) forms an oxide which is amphoteric?

..... [1]

[Total: 5 marks]

B4 The complete combustion of petrol produces carbon dioxide, water vapour and sulphur dioxide. The exhaust gases from cars contain oxides of nitrogen.

(a) State the source of these oxides.

..... [1]

(b) The sulphur dioxide and oxides of nitrogen from cars cause an environmental problem.

(i) State what this problem is.

..... [1]

(ii) What is the effect of this problem on buildings painted with lime?

..... [1]

(c) Carbon monoxide is produced when there is incomplete combustion of carbon containing fuels like petrol. Name **one** solid product of incomplete combustion of petrol in car engines.

..... [1]

[Total: 4 marks]

B5 Choose a word from the box to match the chemical reactions expressed below.

Combustion	Synthesis
Decomposition	Displacement
Neutralisation	Precipitation

(a) $AgNO_{3(aq)} + HCl_{(aq)} \rightarrow AgCl_{(s)} + HNO_{3(aq)}$

..... [1]

(b) $Zn_{(s)} + CuSO_{4(aq)} \rightarrow ZnSO_{4(aq)} + Cu_{(s)}$

..... [1]

(c) $H^+_{(aq)} + OH^-_{(aq)} \rightarrow H_2O_{(l)}$

..... [1]

(d) $C_{(s)} + O_{2(g)} \rightarrow CO_{2(g)}$

..... [1]

(e) $NH_{3(g)} + HCl_{(g)} \rightarrow NH_4Cl_{(s)}$

..... [1]

[Total: 5 marks]

B6 Study the following list of processes: melting, chemical change, sublimation, condensation, evaporation, dissolving. Which of the processes listed above best describes what is taking place in each of the following?

(a) The formation of water droplets on the window pane on a cold day.

..... [1]

(b) The formation of liquid sodium chloride from solid sodium chloride due to strong heating.

..... [1]

(c) The formation of iodine vapour from solid iodine on heating.

..... [1]

(d) Adding sugar to hot tea and stirring it.

..... [1]

(e) The formation of calcium oxide when calcium is heated in the air.

..... [1]

[Total: 5 marks]

B7 Define the following terms:

(a) **(i)** Endothermic reaction

.....

(ii) Exothermic reaction.

..... [2]

(b) Give an example of each type of reaction in **(a)** in nature.

Endothermic reaction: .....

Exothermic reaction: ..... [2]

(c) Describe the effect of exothermic reactions in industries on the environment.

.....

..... [1]

[Total: 5 marks]

B8 **(a)** Give **two** reasons why Chemistry is important in industry.

.....

.....

.....

..... [2]

(b) State any **two** laboratory safety rules.

.....

.....

.....

..... [2]

[Total: 4 marks]

B9 The table below shows the properties of elements **W**, **X**, **Y** and **Z**.

Elements	Reaction with			Effect of heat on their carbonates
	Cold water	Oxygen	Dilute hydrochloric acid	
W	X	X	X	√
X	X	√	√	√
Y	√	√	√	X
Z	√	√	√	√

Key:

(√) Chemical change occurs

(X) **NO** Chemical change occurs

Use the letters to answer the following questions.

(a) Arrange the elements in the increasing order of their reactivity.

.....

..... [1]

(b) Which element is used in the making of car bodies?

..... [1

(c) Suggest a method by which element **W** can be extracted from its ore.

..... [1]

(d) Using the letter **Z**, construct an equation to illustrate the effect of heat on its carbonate.

..... [1]

(e) State the element which is suitable for making ornaments. Explain your answer.

.....

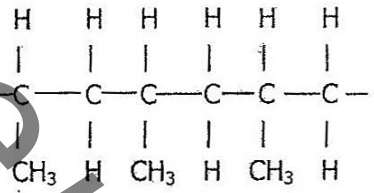
..... [2]

[Total: 6 marks]

Section C [20 marks]

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

C1 The structure below is for a polymer.



(a) **(i)** Name the polymer.

(ii) Name and draw the structural formula of the monomer for the polymer. [3]

(b) **(i)** State the type of polymer that is shown above?

(ii) Give **one** use of the polymer. [2]

(c) Ethanol is an alcoholic beverage which can be brewed from cassava. Outline the process by which ethanol can be prepared. [3]

(d) Ethanol is used as a fuel. Construct a balanced chemical equation for its complete combustion. [2]

[Total: 10 marks]

C2 Calcium chloride, $CaCl_2$ is a soluble salt that can be prepared in the laboratory.

(a) Suggest suitable reactants for its preparation in the laboratory. [2]

(b) Describe how you would prepare a pure dry sample of calcium chloride in the laboratory. [4]

(c) Lead (II) iodide is an insoluble salt.

(i) What method can be used to prepare it? [1]

(ii) Write an ionic equation for the reaction used in the preparation of the salt, include state symbols. [3]

[Total: 10 marks]

C3 The exhaust fumes from an internal combustion engine contain the pollutant gases carbon monoxide and nitrogen dioxide.

(a) Many vehicles have a catalytic converter fitted on their exhaust systems.

(i) Describe the chemical reactions which occur in the catalytic converter to reduce the emissions of carbon monoxide and nitrogen dioxide. [3]

(ii) Write a balanced chemical equation for one of the reactions that occurs in the catalytic converter. [2]

(b) Briefly explain the effect of carbon monoxide on human beings. [3]

(c) Suggest **two** other ways of minimizing pollution of the air by these two gases other than using a catalytic converter. [2]

[Total: 10 marks]

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.).