Centre Number	Candidate Number

Candidate Name _____

EXAMINATIONS COUNCIL OF ZAMBIA

Joint Examination for the School Certificate and General Certificate of Education Ordinary Level

SCIENCE 5124/3

PAPER 3 (CHEMISTRY)

Friday **6 NOVEMBER 2009** **1 hour 15 minutes**

Additional materials:
Answer paper
Mathematical tables
(Do not allow calculators)

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 paper used.

There are **12 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 paper provided.

1. Fasten the separate answer paper 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.

A copy of the **Periodic Table** is on page 10.

This question paper consists of 11 printed pages.

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

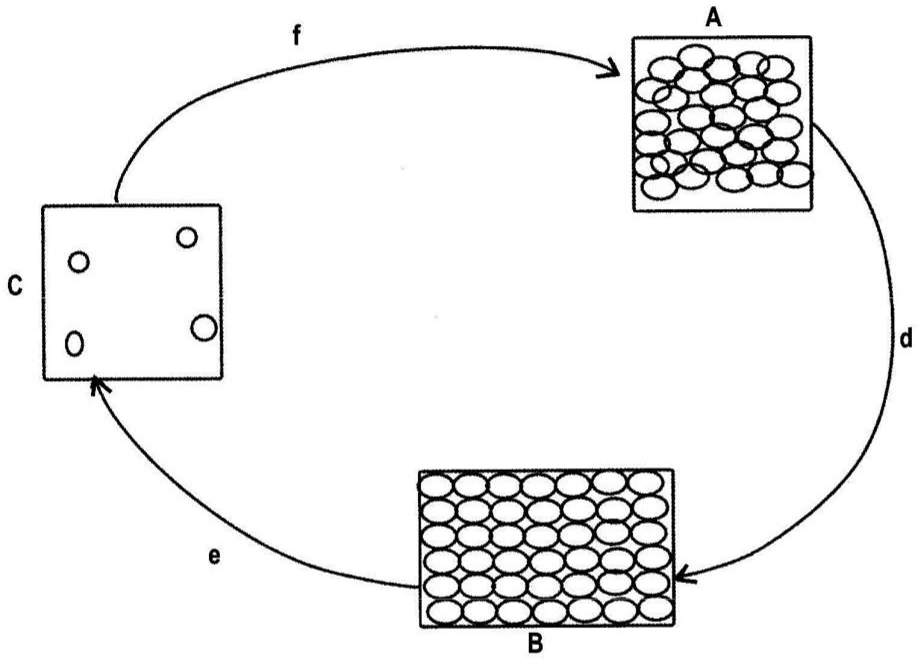
Section A

[45 MARKS]

Answer **all** the questions in this section.

Write your answers in the spaces provided.

1 Study the diagram below and answer questions that follow.



NB: d, e, f are processes.

(a) Name the processes **d**, **e** and **f**,

d _____ [1]

e _____ [1]

f _____ [1]

(b) Describe what you would do to convert substance **A** to **B**.

_____ [1]

(c) State one of the basic units of matter.

_____ [1]

Total [5]

2 Part of the process for the extraction of Uranium uses the reaction of Uranium Tetrafluoride (UF_4) with magnesium.

$$UF_4 + 2Mg \longrightarrow 2MgF_2 + U$$

(a) State whether Uranium is more or less reactive than Maganesium, explain your answer.

_____

_____ [1]

(b) **(i)** Calculate the relative molecular mass of Uranium Tetracfluoride (UF_4)

_____ [1]

(ii) How many tonnes of Uranium can be produced in the above reaction using 24 tonnes of magnesium?

_____

_____

_____ [2]

(c) Natural Uranium has several Isotopes. Define the term Isotopes.

_____

_____ [1]

Total [5]

3 **(a)** Work out the relative formula mass, M_r of the following:

(i) $Ca(HCO_3)_2$ _____ [1]

(ii) $Al_2(SO_4)_3$ _____ [1]

(b) When water containing dissolved calcium hydrogencarbonate is boiled, the calcium hydrogencarbonate decomposes according to the equation below:

$$Ca(HCO_3)_2(aq) \longrightarrow CaCO_3(s) + H_2O\ (\ell) + CO_2(g)$$

(i) Name the white solid formed in this reaction.

_____ [1]

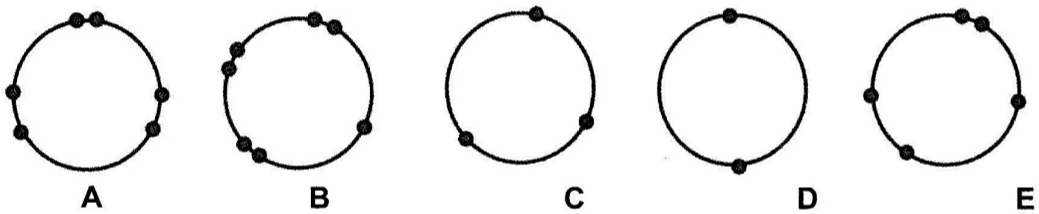
(ii) If the water boiled contained 16.2g of Calcium hydrogencarbonate, Calculate the mass of $CaCO_3$ formed

_____

_____ [2]

Total [5]

4. The diagrams below show the electron arrangement in the outer shell of five elements **A** to **E**. All elements are from Period 3 of the Periodic Table.



(a) Put the letters **A** to **E** in the table to show which elements are metals and which are non-metals.

Metals	**Non-Metals**

[2]

(b) Which element is most likely to be in Group VI of the Periodic Table?

_____ [1]

(c) Which element will form an ion of the type X^{2+}?

_____ [1]

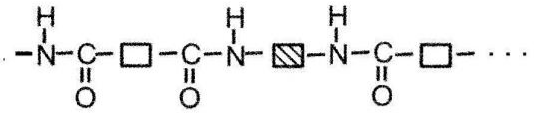
(d) Which element has an atomic number of 15?

_____ [1]

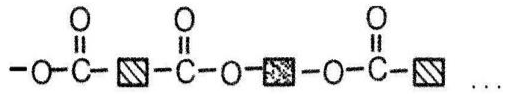
Total [5]

5. The diagrams below show sections of the polymer chain of two condensation polymers.

nylon



Terylene



(a) (i) Draw a circle around an amide linkage in the diagram. Label this amide linkage.

[1]

(ii) Draw a circle around an ester linkage in the diagram. Label this ester linkage. [1]

(b) Name a type of naturally occurring polymer that has a similar linkage to nylon.

_____ [1]

(c) Why are nylon and terylene known as condensation polymers?

_____

_____ [1]

(d) Fishing nets used to be made of natural fibres but many nets are now made from nylon. Suggest one advantage other than strength and one disadvantage of using nylon in place of natural fibres to make fishing nets.

Advantage _____ [1]

Disadvantage _____ [1]

Total [6]

6. Nitrogen and oxygen are the two main gases present in the air. Both gases are obtained from air.

(a) By what process are the two gases obtained from the air?

_____ [1]

(b) Nitrogen is used in the manufacture of ammonia by the Haber Process. State any 2 important conditions for the reaction in which ammonia is formed by the Haber Process.

_____

_____ [2]

(c) State one important use of ammonia

_____ [1

Total [4]

7 Barium sulphate is an insoluble. Describe briefly how a pure, dry sample of barium sulphate can be prepared using sodium sulphate as one of the reagents.

_____

_____

_____

_____

_____ [5]

Total [5]

8 The reaction below takes place during the production of calcium oxide when calcium carbonate is thermally decomposed.

$$CaCO_3(s) \longrightarrow CaO(s) + CO_2\ (g)$$

(a) Give a common name for:

(i) Calcium carbonate.

_____ [1]

(ii) Calcium oxide.

_____ [1]

(iii) Calcium hydroxide.

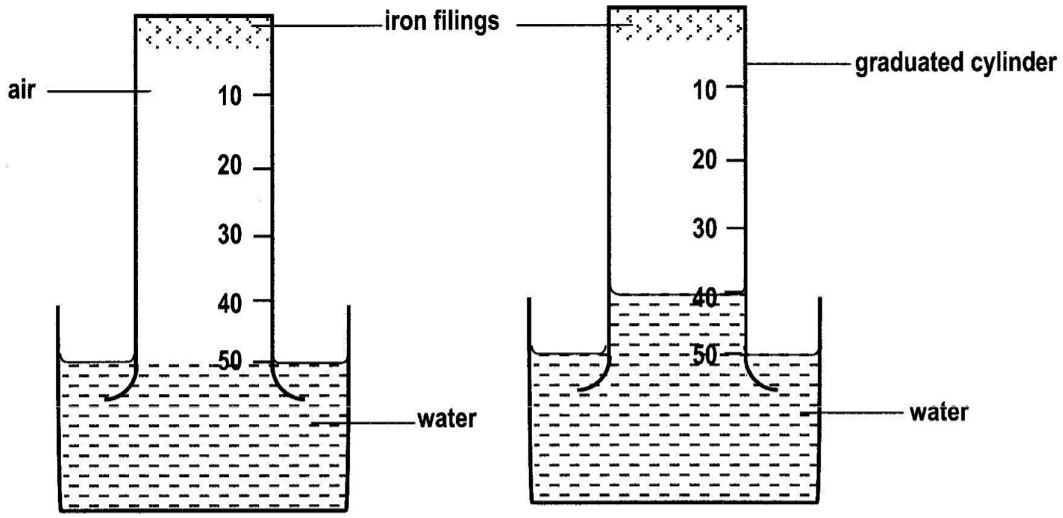
_____ [1]

(b) What is the Chemical Formula of Calcium hydroxide.

_____ [1]

Total [4]

9 The following experiment was set up to investigate the effect of damp air on iron filings. The graduated cylinder contained $50cm^3$ of air at the start.



Apparatus at the start Apparatus after 1 week

1]

(a) State two changes which would be observed after 1 week.

1]

_____

_____ [2]

(b) What volume of air was in the graduated cylinder after 1 week?

_____ [1]

(c) Calculate the % of air used up in the experiment.

_____

_____ [2]

Total [5]

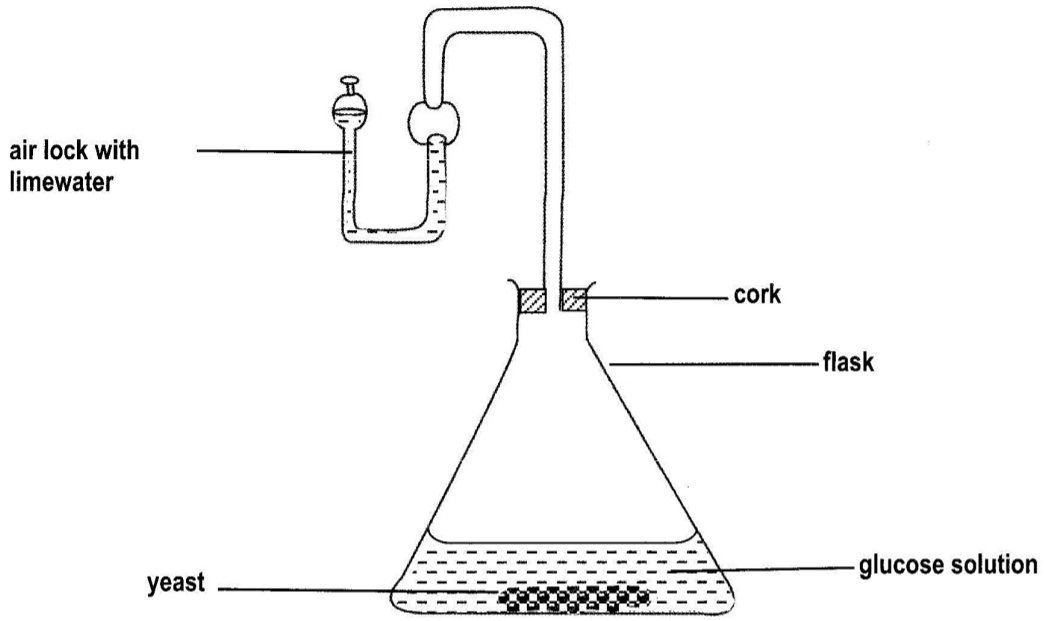
Section B

[20 MARKS]

Answer any two questions in this section.

Write your answers on the separate answer paper provided.

10 A student set up an experiment to produce ethanol from glucose, she dissolved glucose in warm water, added yeast and left the mixture in a warm place for about 7 days in the apparatus shown below.



(a) Write a word equation for the formation of ethanol from glucose. [1]

(b) What is the scientific name for this reaction. [1]

(c) Suggest a suitable temperature at which the process occurs. [1]

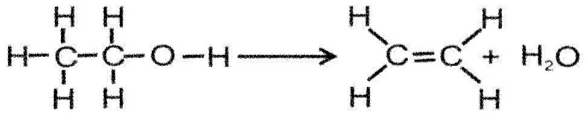
(d) The airlock prevents air from going into the flask but allows carbon dioxide gas to go out.

(i) Why must air not be allowed into the flask?

(ii) Describe the change which will be seen in the airlock. [3]

(e) Ethanol can be oxidised to ethanoic acid by boiling ethanol with acidified potassium dichromate (VI). Give two reasons why the conversion of ethanol to ethanoic acid is an oxidation process. [2]

(f) When concentrated sulphuric acid is added to ethanol, the following reaction occurs.



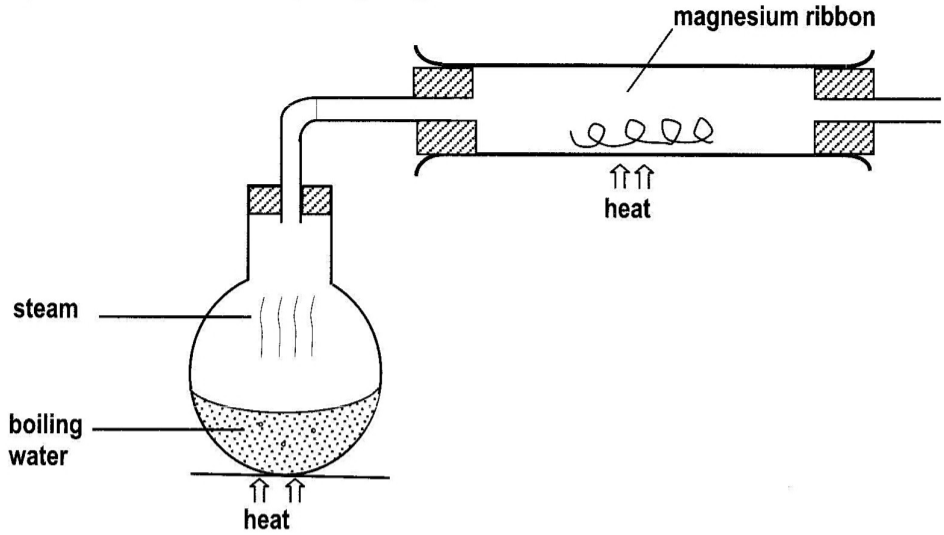
ethanol ethene

(i) What type of reaction is this?

(ii) What test can be done to show that ethene is formed? [2]

Total [10]

11 **(a)** When magnesium is heated in a stream of steam, it reacts vigorously forming a white solid and hydrogen gas.



(a) Complete the diagram to show how hydrogen gas can be collected. [2]

(b) Write a balanced chemical equation for the reaction of magnesium with steam. [3]

(c) Choose two other metals from the reactivity series of metals which will also react with steam and one metal which will not react with steam. [3]

(d) Suggest a method which can be used to extract magnesium from its ores. [1]

(e) When a piece of magnesium is added to copper(II) sulphate solution, copper metal is formed according to the word equation below:

Magnesium + Copper (II) sulphate $\longrightarrow$ magnesium sulphate + copper.

(i) Write a balanced chemical equation for the reaction. [1]

(ii) What type of a reaction is this? [1]

Total [10]

12 **(a)** The increase in industrial activity in Zambian cities has results in high levels of atmosphere (air) pollution. Carbon monoxide is one of the pollutants of the air.

(i) How is carbon monoxide produced? [1]

(ii) Explain why carbon monoxide is a dangerous gas. [1]

(iii) Name the pollutant gas which is mainly responsible for producing acid rain.[2]

(b) **(i)** State the two main stages in the purification of domestic water supply.

(ii) Give two industrial uses of water. [2]

(c) When steam is passed over very hot carbon, a mixture of carbon monoxide and hydrogen gas is formed.

$$H_2O_{(g)} + C_{(s)} \longrightarrow H2_{(g)} + CO_{(g)}.$$

State which substance is

(i) reduced.

(ii) oxidised. [2]

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 Yitterbium 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	a = relative atomic mass
X	X = atomic symbol
b	b = proton (atomic) number

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

[Turn over