

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)**

Thursday

16 OCTOBER 2014

Additional materials:  
Answer Booklet  
Mathematical tables

**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 **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	/
<b>Total</b>	

**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 12.

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

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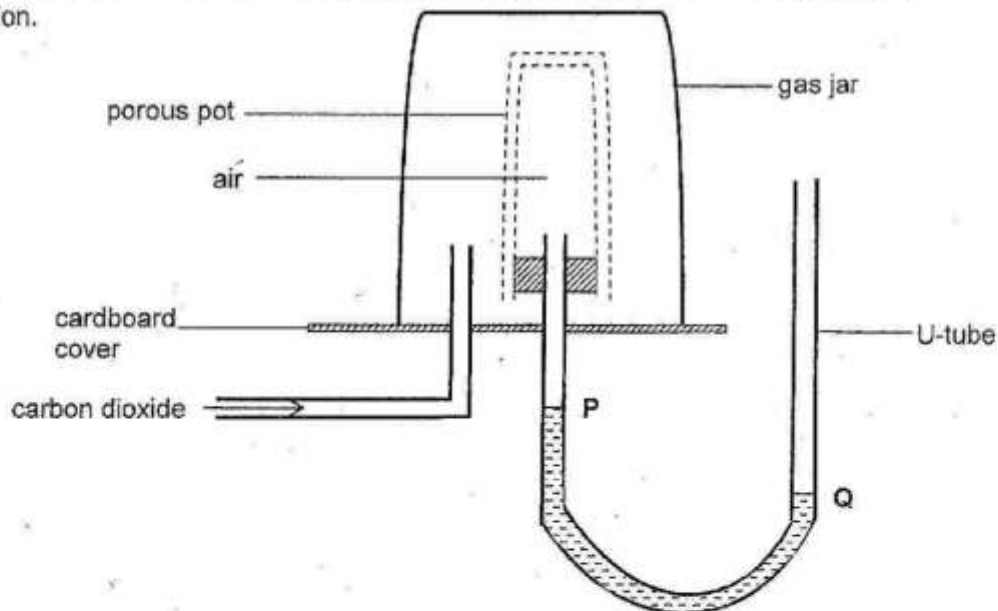
**Section A**

**[45 MARKS]**

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

Write your answers in the spaces provided.

- 1 *Figure 1.1* below shows a set of apparatus that can be used to show the process of diffusion.



*Figure 1.1.*

- (a) Explain the meaning of the term diffusion.

\_\_\_\_\_

\_\_\_\_\_

[1]

- (b) Explain the purpose of covering the gas jar with the cardboard.

\_\_\_\_\_

\_\_\_\_\_

[1]

- (c) Before carbon dioxide is introduced into the gas jar, the water level in both arms of the U-tube is the same. When the carbon dioxide is introduced into the gas jar, the water level at **P** and **Q** change as shown in the diagram.

- (i) Describe the cause of the changes in the water level at **P** and **Q**.

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

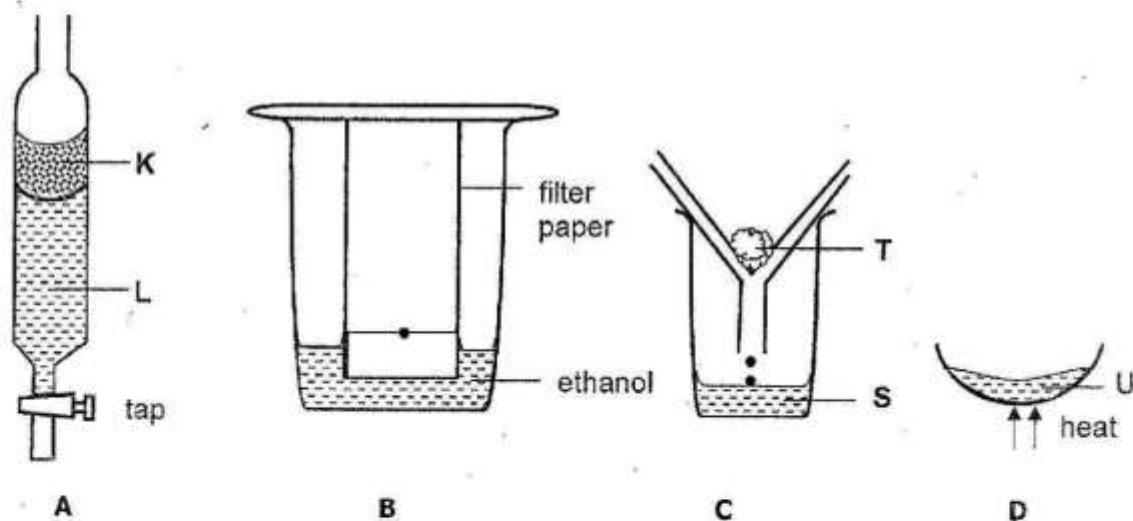
[2]

- (ii) State what would happen to the water levels at **P** and **Q** if carbon dioxide gas was replaced by hydrogen gas.

\_\_\_\_\_ [1]

[Total 5]

- 2 The diagrams below show four different methods of separation.



- (a) Using the letters **A**, **B**, **C** or **D**, identify the method used to;

- (i) Separate insoluble particles from water.

\_\_\_\_\_ [1]

- (ii) Separate a mixture of different dyes.

\_\_\_\_\_ [1]

- (iii) Make crystals of copper (II) sulphate from copper (II) sulphate solution?

\_\_\_\_\_ [1]

- (iv) Separate water and cooking oil.

\_\_\_\_\_ [1]

- (b) State **one** industrial application of chromatography.

\_\_\_\_\_ [1]

[Total 5]

- 3 Table 3.1 below shows the ions present in one litre of mineral water bottled for drinking by an industry.

Name of ion	Formula of the ion	Mass of ion present in one litre/milligram
Calcium	$\text{Ca}^{2+}$	5.0
Chloride	$\text{Cl}^-$	4.0
Bicarbonate	$\text{HCO}_3^-$	32
Sodium	$\text{Na}^+$	4.0
Sulphate	$\text{SO}_4^{2-}$	3.5

Table 3.1

- (a) Define the term ion?

\_\_\_\_\_

- (b) Identify the cation with the lowest concentration in the mineral water.

\_\_\_\_\_

- (c) Complete the equation below to show how a calcium ion is formed from a calcium atom.



- (d) When this sample of mineral water is evaporated to dryness. Various compounds remain as residues.

Give the names of **two** of these compounds.

\_\_\_\_\_

\_\_\_\_\_

- (e) State the type of bonding found in the various compounds in the mineral water.

\_\_\_\_\_

\_\_\_\_\_

[Total: 6]

- 4 Salts are prepared in a laboratory using several general methods.

*Table 4.1* below shows some different methods of preparing salts.

- (a) Complete the table.

Reaction		Name of salt formed	Name of reactants
(i)	Precipitation	Barium sulphate	_____ and _____
(ii)	Neutralisation		Potassium hydroxide and sulphuric acid
(iii)	Acid and carbonate	Copper (II) nitrate	_____ and _____

*Table 4.1*

[3]

- (b) Write down the ionic equation for the precipitation reaction in the *Table 4.1* above. Include state symbols.

\_\_\_\_\_

\_\_\_\_\_

[2]

**[Total 5]**

5 Magnesium carbonate decomposes on heating to form magnesium oxide and carbon dioxide.

(a) Construct a chemical equation for the decomposition of magnesium carbonate. Include state symbols.

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(b) Calculate the relative formula mass of magnesium carbonate.

(c) Given that 21kg of magnesium carbonate is heated, calculate the mass of magnesium oxide formed.

(d) Name a metal carbonate that would not decompose on heating like magnesium carbonate.

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- 6 The grid below represents part of the Periodic Table with atomic numbers of some elements.

1							2
3	4	5	6	7	8	9	10
11	12	13	14	15	16	17	18

- (a) Using the grid above, state the atomic number of an element which is;
- (i) an alkali metal \_\_\_\_\_ [1]
  - (ii) a more reactive halogen \_\_\_\_\_ [1]
  - (iii) a noble gas used in electric bulbs \_\_\_\_\_ [1]
  - (iv) a solid element at room temperature which forms an ion with a charge of negative two. \_\_\_\_\_ [1]
- (b) (i) Use the actual symbols to construct a chemical formula formed by elements with atomic number 13 and 8.  
\_\_\_\_\_ [1]
- (ii) Give the physical state in which the compound in **b (i)** above will exist at room temperature and pressure.  
\_\_\_\_\_ [1]

[Total: 6]

7 Proteins are naturally occurring macromolecules.

(a) (i) Define the term macromolecule.

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(ii) Name another naturally occurring macromolecule.

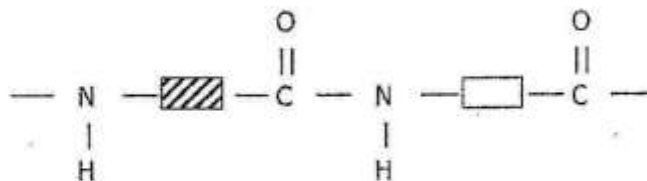
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(b) Proteins can be hydrolysed to amino acids. State a suitable reagent and condition for this hydrolysis.

Reagent \_\_\_\_\_

Condition \_\_\_\_\_

(c) The structure of a section of a protein can be represented as;



(i) Describe **one** similarity in the structure of a protein and the structure of nylon.

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(ii) Describe **one** way in which the structure of a protein differs from the structure of nylon.

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- 8 Complete the *Table 8.1* below on the properties and the use of the metal that depend on the property.

The first part has been done for you.

(a)

Property of metal	Use
High melting/boiling point	Filament in an electric bulb
(i)	Making bells/drums
Ductility	(ii)
(iii)	Making ornaments
Free electrons	(iv)

*Table 8.1*

[4]

- (b) Magnesium reacts with dilute nitric acid to form magnesium nitrate and a colourless gas.

Construct a balanced chemical equation for this reaction.

\_\_\_\_\_

\_\_\_\_\_

[2]

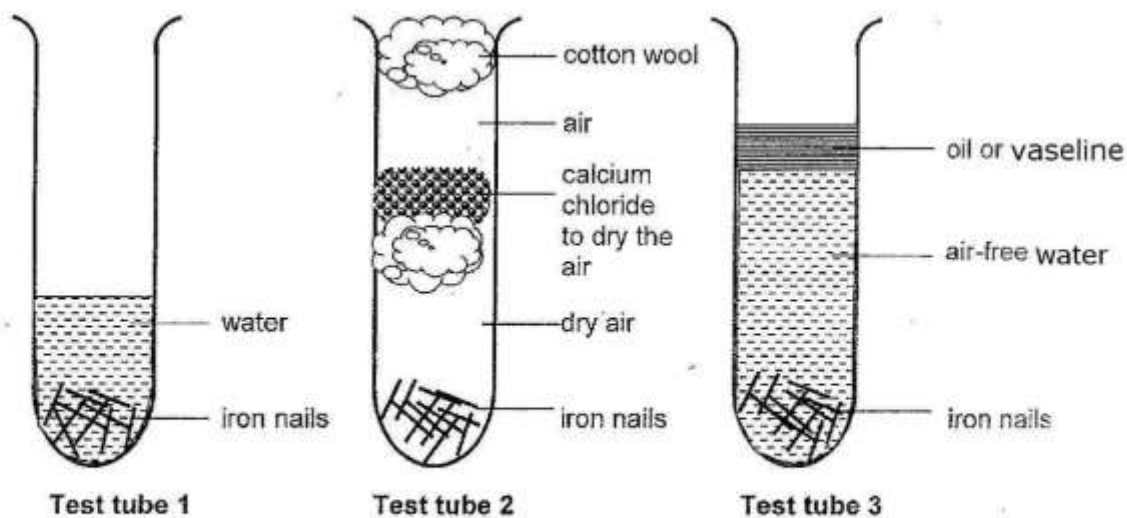
**[Total 6]**

**Section B**

**[20 MARKS]**

Answer any **two** questions

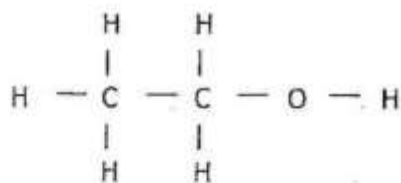
- 9 Oxygen can be made on a large scale by fractional distillation of liquid air.
- (a) Briefly outline the three major stages in this process.
  - (b) Describe the test for oxygen.
  - (c) The diagrams below show the apparatus set up to study the process of rusting.



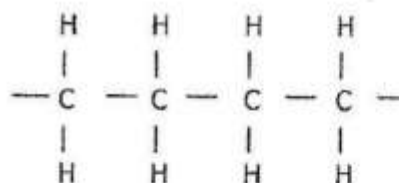
The test tubes were left to stand for three days.

- (i) Describe what is observed in test tubes 1, 2 and 3.
- (ii) Give a reason for each observation in test-tubes 2 and 3.

- 10** Ethene,  $C_2H_4$ , is a hormone found in most plants. Tomatoes release ethene as they ripen. Fruit growers use ethene as a ripening agent.
- (a) Draw a displayed structural formula of ethene. [1]
- (b) (i) State the homologous series to which ethene belongs. [1]  
 (ii) Give the general formula of this homologous series. [1]  
 (iii) State the molecular formulae of the fourth and fifth members of this homologous series respectively. [2]
- (c) State **one** major source of ethene and the method by which it is obtained. [2]
- (d) Two of the substances made from ethene are shown below.



Substance R



Substance S

- (i) Name the substances R and S. [2]  
 (ii) State **one** use of substance S. [1]

[Total: 10]

- 11** Sodium is an element in Group I of the Periodic Table.
- (a) Draw an atomic structure of sodium. [1]
- (b) Sodium chloride and hydrogen chloride gas are both compounds of chlorine.
- (i) Draw a 'dot' and 'cross' diagram to show the bonding in sodium chloride. Show outer shell electrons only. [2]  
 (ii) Explain why sodium chloride is a solid at room temperature and pressure while hydrogen chloride is a gas. [2]
- (c) Compare the thermal decomposition of lithium nitrate with that of caesium nitrate. [2]
- (d) Explain why the density of Group I metals increases down the Group. [1]
- (e) Describe how Group I elements are stored. Give a reason for your answer. [2]

[Total: 10]

DATA SHEET

The Periodic Table of the Elements

		Group																																																																																												
I		II	III	IV	V	VI	VII	0																																																																																						
7 Li Lithium 3	9 Be Beryllium 4	11 Na Sodium 11	12 Mg Magnesium 12	13 Al Aluminium 13	14 Si Silicon 14	15 P Phosphorus 15	16 S Sulphur 16	17 Cl Chlorine 17	18 Ar Argon 18	19 K Potassium 19	20 Ca Calcium 20	21 Sc Scandium 21	22 Ti Titanium 22	23 V Vanadium 23	24 Cr Chromium 24	25 Mn Manganese 25	26 Fe Iron 26	27 Co Cobalt 27	28 Ni Nickel 28	29 Cu Copper 29	30 Zn Zinc 30	31 Ga Gallium 31	32 Ge Germanium 32	33 As Arsenic 33	34 Se Selenium 34	35 Br Bromine 35	36 Kr Krypton 36	37 Rb Rubidium 37	38 Sr Strontium 38	39 Y Yttrium 39	40 Zr Zirconium 40	41 Nb Niobium 41	42 Mo Molybdenum 42	43 Tc Technetium 43	44 Ru Ruthenium 44	45 Rh Rhodium 45	46 Pd Palladium 46	47 Ag Silver 47	48 Cd Cadmium 48	49 In Indium 49	50 Sn Tin 50	51 Sb Antimony 51	52 Te Tellurium 52	53 I Iodine 53	54 Xe Xenon 54	55 Cs Caesium 55	56 Ba Barium 56	57 La Lanthanum 57	58 Ce Cerium 58	59 Pr Praseodymium 59	60 Nd Neodymium 60	61 Pm Promethium 61	62 Sm Samarium 62	63 Eu Europium 63	64 Gd Gadolinium 64	65 Tb Terbium 65	66 Dy Dysprosium 66	67 Ho Holmium 67	68 Er Erbium 68	69 Tm Thulium 69	70 Yb Ytterbium 70	71 Lu Lutetium 71	72 Hf Hafnium 72	73 Ta Tantalum 73	74 W Tungsten 74	75 Re Rhenium 75	76 Os Osmium 76	77 Ir Iridium 77	78 Pt Platinum 78	79 Au Gold 79	80 Hg Mercury 80	81 Tl Thallium 81	82 Pb Lead 82	83 Bi Bismuth 83	84 Po Polonium 84	85 At Astatine 85	86 Rn Radon 86	87 Fr Francium 87	88 Ra Radium 88	89 Ac Actinium 89	90 Th Thorium 90	91 Pa Protactinium 91	92 U Uranium 92	93 Np Neptunium 93	94 Pu Plutonium 94	95 Am Americium 95	96 Cm Curium 96	97 Bk Berkelium 97	98 Cf Californium 98	99 Es Einsteinium 99	100 Fm Fermium 100	101 Md Mendelevium 101	102 No Nobelium 102	103 Lr Lawrencium 103

\*58-71 Lanthanoid series  
\*89-103 Actinoid series

Key

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

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