

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** **17 OCTOBER 2013**

Additional materials:  
 Answer Booklet  
 Mathematical tables  
 or  
 Electronic calculators (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 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 10.

**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 Chlorine has two isotopes,  ${}_{17}^{35}\text{Cl}$  and  ${}_{17}^{37}\text{Cl}$ .

(a) Define the term isotopes.

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

(b) State the number of neutrons in each of the following isotopes of chlorine.

(i) chlorine – 35: \_\_\_\_\_ [1]

(ii) chlorine – 37: \_\_\_\_\_ [1]

(c) (i) Draw the atomic structure of an atom of chlorine.

[1]

(ii) Give the formula of a chloride ion

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

(d) Explain why the relative atomic mass of chlorine on the Periodic Table is not a whole number.

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

[Total:6]

2 The table below shows the properties of an alkali, an acid and a salt solution.

(a) Complete the table.

Solution	Approximate pH	Ions present
(i)	(ii)	$\text{Na}^+$ , $\text{OH}^-$
Hydrochloric acid	(iii)	(iv)
Sodium chloride	7	(v)

[5]

(b) Name the two solutions from the table which, when mixed together, form a solution of sodium chloride.

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

[Total:6]

3 (a) Define relative molecular mass ( $M_r$ ).

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

(b) Potassium carbonate reacts with dilute sulphuric acid to form potassium sulphate, carbon dioxide gas and water.

(i) Construct a balanced chemical equation, including state symbols for the reaction above.

\_\_\_\_\_  
 \_\_\_\_\_ [2]

(ii) Calculate the mass of potassium sulphate produced when 2.0g of potassium carbonate reacts with an excess of dilute sulphuric acid.

[2]

(c) What is the identity test of the gas produced in the reaction above.

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[1]

[Total:5]

4 Water is an important raw material in the home and in industry.

(a) State **two** uses of water in industry.

(i) \_\_\_\_\_ [1]

(ii) \_\_\_\_\_ [1]

(b) Outline the **two** main stages in the purification of water.

(i) \_\_\_\_\_ [1]

(ii) \_\_\_\_\_ [1]

[Total:4]

- 5 The table below shows the structural formulae of various monomers and the polymers that can be made from them.

Monomer	$\begin{array}{c} \text{H} \quad \text{H} \\   \quad   \\ \text{C} = \text{C} \\   \quad   \\ \text{H} \quad \text{H} \end{array}$	$\begin{array}{c} \text{F} \quad \text{F} \\   \quad   \\ \text{C} = \text{C} \\   \quad   \\ \text{F} \quad \text{F} \end{array}$	$\begin{array}{c} \text{CH}_3 \quad \text{H} \\   \quad   \\ \text{C} = \text{C} \\   \quad   \\ \text{H} \quad \text{H} \end{array}$ <p style="text-align: center;"><b>W</b></p>
	ethene	tetrafluoroethene	
Polymer	$\left( \begin{array}{c} \text{H} \quad \text{H} \\   \quad   \\ -\text{C} - \text{C}- \\   \quad   \\ \text{H} \quad \text{H} \end{array} \right)_n$	$\left( \begin{array}{c} \text{F} \quad \text{F} \\   \quad   \\ -\text{C} - \text{C}- \\   \quad   \\ \text{F} \quad \text{F} \end{array} \right)_n$	
	poly(ethene)	poly (tetrafluoroethene)	<b>Y</b>

- (a) Identify the monomers which are hydrocarbons.

\_\_\_\_\_ [2]

- (b) Name the monomer **W**.

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

- (c) Draw the displayed structure for polymer **Y**.

[1]

(d) (i) Identify the common feature among the monomers in the table above.

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

(ii) Give the name of the compounds with this feature.

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

(e) Decane  $C_{10}H_{22}$ , can be cracked to produce hexane,  $C_6H_{14}$  and butene,  $C_4H_8$ .

Explain the meaning of the word cracking.

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

**[Total:7]**

6 (a) Give **two** ways by which rusting of iron can be prevented.

(i) \_\_\_\_\_

(ii) \_\_\_\_\_ [2]

(b) Burning and rusting are two chemical processes.

Give

(i) one similarity \_\_\_\_\_ [1]

(ii) one difference \_\_\_\_\_ [1]

(c) (i) Name **two** non-metallic oxides which cause atmospheric pollution.

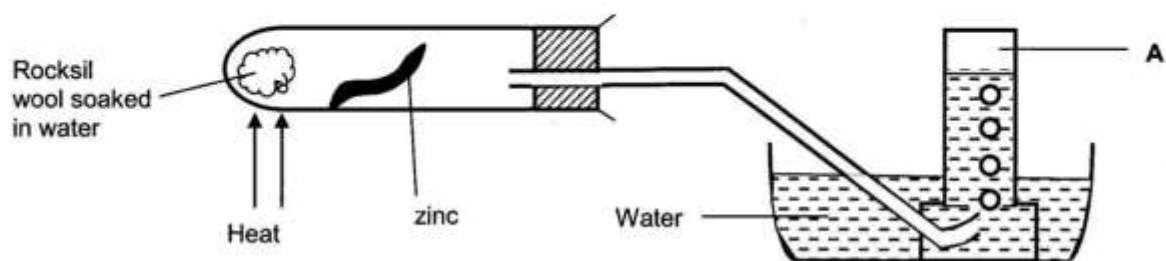
\_\_\_\_\_  
\_\_\_\_\_ [2]

(ii) State **two** sources of these pollutants.

\_\_\_\_\_  
\_\_\_\_\_ [2]

**[Total:8]**

- 7 Zinc can be reacted with steam using the apparatus shown below in the reaction of zinc with steam, gas **A** and solid **B** are formed.



- (a) Name gas **A**.

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

- (b) State the product formed when gas **A** burns in air.

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

- (c) Give **two** uses of gas **A**.

\_\_\_\_\_  
 \_\_\_\_\_ [2]

- (d) (i) What is solid **B**?

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

- (ii) Construct a balanced chemical equation with state symbols for the reaction between substance **B** and dilute hydrochloric acid.

\_\_\_\_\_  
 \_\_\_\_\_ [3]

[Total:8]

## Section B

[20 MARKS]

Answer any **two** questions

- 8 The main ore of iron, haematite, contains the compound iron (III) oxide,  $\text{Fe}_2\text{O}_3$ . The iron (III) oxide is reduced in a blast furnace to form iron.
- (a) Explain how the furnace is heated to the high temperature needed for the reduction of the iron (III) oxide. [2]
  - (b) Name **two** processes that lead to the production of carbon dioxide in the blast furnace. [2]
  - (c) Carbon dioxide reacts with carbon to form carbon monoxide, construct a balanced chemical equation for this reaction. [2]
  - (d) Apart from iron ore, name **two** other substances that are added into the blast furnace as raw materials. [2]
  - (e) Name **one** element which is added to iron to make steel and state a use for the type of steel made. [2]

[Total: 10]

- 9 Copper (II) sulphate ( $\text{CuSO}_4$ ) is a soluble salt prepared by using sulphuric acid as one of the starting materials.
- (a) Define a salt. [1]
  - (b) (i) Name one other reagent which must be reacted with dilute sulphuric acid to form copper (II) sulphate. [1]  
(ii) Construct a balanced chemical equation for the reaction in **b (i)** above. [2]
  - (c) Describe briefly how a dry sample of copper (II) sulphate can be prepared from the named reagents in **(b)**. [4]
  - (d) Will the method in part **(c)** above be suitable to prepare a sample of potassium chloride? Give a reason for your answer. [2]

[Total: 10]

10 Below is a list of some organic compounds represented by the letters **A** to **E**.

**A** CH<sub>4</sub>

**B** C<sub>4</sub>H<sub>10</sub>

**C** C<sub>4</sub>H<sub>9</sub>OH

**D** C<sub>4</sub>H<sub>8</sub>

**E** CH<sub>3</sub>COOH

(a) Give the name of compound **A**. [1]

(b) Identify the **two** compounds, from the list, that belong to the same homologous series? [2]

(c) (i) State the compound which has the same functional group as ethanol. [1]

(ii) Draw the displayed molecular structure of ethanol. [1]

(iii) Construct a chemical equation for the hydration of ethene to form ethanol. [1]

(d) (i) Give **one** compound that is an unsaturated hydrocarbon, from the list above. [1]

(ii) Describe a chemical test for an unsaturated hydrocarbon. [1]

(e) Compound **E** is acidic.

(i) State the name of the compound **E**. [1]

(ii) Describe a test to show that compound **E** is acidic. [1]

[Total: 10]

DATA SHEET

The Periodic Table of the Elements

		Group																																																																																												
I	II	III	IV	V	VI	VII	0																																																																																							
7 <b>Li</b> Lithium 3	9 <b>Be</b> Beryllium 4	1 <b>H</b> Hydrogen 1	12 <b>C</b> Carbon 6	14 <b>N</b> Nitrogen 7	16 <b>O</b> Oxygen 8	19 <b>F</b> Fluorine 9	20 <b>Ne</b> Neon 10	39 <b>K</b> Potassium 19	40 <b>Ca</b> Calcium 20	55 <b>Mn</b> Manganese 25	56 <b>Fe</b> Iron 26	65 <b>Zn</b> Zinc 30	78 <b>Se</b> Selenium 34	80 <b>Br</b> Bromine 35	84 <b>Kr</b> Krypton 36	85 <b>At</b> Astatine 85	86 <b>Rn</b> Radon 86																																																																													
11 <b>B</b> Boron 5	13 <b>Al</b> Aluminum 13	14 <b>Si</b> Silicon 14	15 <b>P</b> Phosphorus 15	16 <b>S</b> Sulfur 16	17 <b>Cl</b> Chlorine 17	18 <b>Ar</b> Argon 18	27 <b>Co</b> Cobalt 27	28 <b>Ni</b> Nickel 28	29 <b>Cu</b> Copper 29	30 <b>Zn</b> Zinc 30	31 <b>Ga</b> Gallium 31	32 <b>Ge</b> Germanium 32	33 <b>As</b> Arsenic 33	34 <b>Se</b> Selenium 34	35 <b>Br</b> Bromine 35	36 <b>Kr</b> Krypton 36	41 <b>Sc</b> Scandium 21	42 <b>Ti</b> Titanium 22	43 <b>V</b> Vanadium 23	44 <b>Cr</b> Chromium 24	45 <b>Mn</b> Manganese 25	46 <b>Fe</b> Iron 26	47 <b>Co</b> Cobalt 27	48 <b>Ni</b> Nickel 28	49 <b>Cu</b> Copper 29	50 <b>Zn</b> Zinc 30	51 <b>Ga</b> Gallium 31	52 <b>Ge</b> Germanium 32	53 <b>As</b> Arsenic 33	54 <b>Se</b> Selenium 34	55 <b>Br</b> Bromine 35	56 <b>Kr</b> Krypton 36	57 <b>Rb</b> Rubidium 37	58 <b>Sr</b> Strontium 38	59 <b>Y</b> Yttrium 39	60 <b>Zr</b> Zirconium 40	61 <b>Nb</b> Niobium 41	62 <b>Mo</b> Molybdenum 42	63 <b>Tc</b> Technetium 43	64 <b>Ru</b> Ruthenium 44	65 <b>Rh</b> Rhodium 45	66 <b>Pd</b> Palladium 46	67 <b>Ag</b> Silver 47	68 <b>Cd</b> Cadmium 48	69 <b>In</b> Indium 49	70 <b>Sn</b> Tin 50	71 <b>Pb</b> Lead 82	72 <b>Hf</b> Hafnium 72	73 <b>Ta</b> Tantalum 73	74 <b>W</b> Tungsten 74	75 <b>Re</b> Rhenium 75	76 <b>Os</b> Osmium 76	77 <b>Ir</b> Iridium 77	78 <b>Pt</b> Platinum 78	79 <b>Au</b> Gold 79	80 <b>Hg</b> Mercury 80	81 <b>Tl</b> Thallium 81	82 <b>Pb</b> Lead 82	83 <b>Bi</b> Bismuth 83	84 <b>Po</b> Polonium 84	85 <b>At</b> Astatine 85	86 <b>Rn</b> Radon 86	87 <b>Fr</b> Francium 87	88 <b>Ra</b> Radium 88	89 <b>Ac</b> Actinium 89	90 <b>Th</b> Thorium 90	91 <b>Pa</b> Protactinium 91	92 <b>U</b> Uranium 92	93 <b>Np</b> Neptunium 93	94 <b>Pu</b> Plutonium 94	95 <b>Am</b> Americium 95	96 <b>Cm</b> Curium 96	97 <b>Bk</b> Berkelium 97	98 <b>Cf</b> Californium 98	99 <b>Es</b> Einsteinium 99	100 <b>Fm</b> Fermium 100	101 <b>Md</b> Mendelevium 101	102 <b>No</b> Nobelium 102	103 <b>Lr</b> Lawrencium 103	104 <b>Rf</b> Rutherfordium 104	105 <b>Db</b> Dubnium 105	106 <b>Sg</b> Seaborgium 106	107 <b>Bh</b> Bohrium 107	108 <b>Hs</b> Hassium 108	109 <b>Mt</b> Meitnerium 109	110 <b>Ds</b> Darmstadtium 110	111 <b>Rg</b> Roentgenium 111	112 <b>Cn</b> Copernicium 112	113 <b>Nh</b> Nihonium 113	114 <b>Fl</b> Flerovium 114	115 <b>Mc</b> Moscovium 115	116 <b>Lv</b> Livermorium 116	117 <b>Ts</b> Tennessine 117	118 <b>Og</b> Oganesson 118
												*58-71 Lanthanoid series					+90-103 Actinoid series																																																																													
												a = relative atomic mass					X = atomic symbol																																																																													
												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.).