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 **9 NOVEMBER 2012**

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	
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.

Section A

[45 MARKS]

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

Write your answers in the spaces provided.

1 Matter is classified as solid, liquid or gas. State **two** physical properties of each of the following:

(a) Solid

_____

_____ [2]

(b) Liquid

_____

_____ [2]

(c) Gas

_____

_____ [2]

2 Two miscible liquids with boiling points of 78°C and 100°C were accidentally mixed.

(a) Name the process which can be used to separate the mixture.

_____ [1]

(b) Draw a labelled diagram showing the arrangement of the apparatus used to separate the mixture.

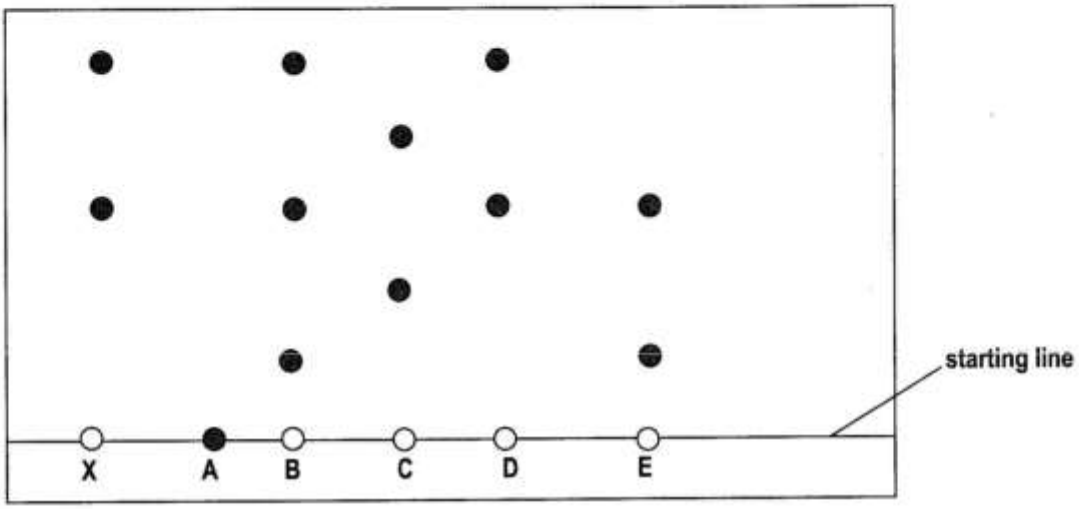
[3]

(c) Explain how you can obtain hydrated sodium sulphate crystals from an aqueous solution of sodium sulphate.

_____

_____ [2]

3 Paper chromatography was used to catch a forger. A sample of ink, X from a forged signature was compared with inks from the pens of five suspects. The diagram below shows the chromatogram obtained:



(a) Draw the apparatus you would use to produce this chromatogram.

[3]

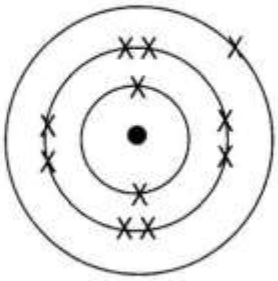
(b) Which of the inks **A**, **B**, **C**, **D** or **E** could have been used to write the forged signature?

_____ [1]

(c) Which of the inks is insoluble in water?

_____ [1]

4 The diagram below represents electronic arrangement of a particular atom. Study this diagram and answer the questions that follow.



(a) The relative atomic mass of the atom represented is 23.

(i) What is its proton number?

_____ [1]

(ii) What is its neutron number?

_____ [1]

(b) (i) In which group of the Periodic Table is the element found?

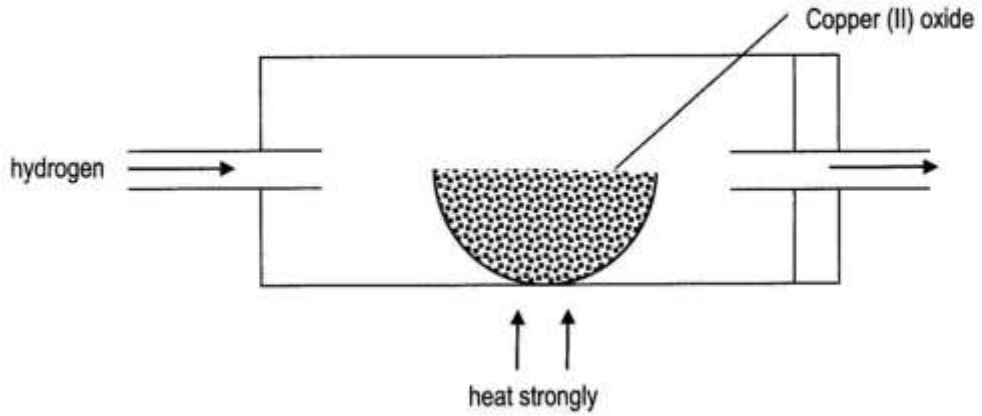
_____ [1]

(ii) Explain your answer in **(b) (i)**.

_____

_____ [1]

5 The diagram below shows the action of hydrogen on copper (II) oxide.



During this reaction copper (II) oxide is changed to copper and steam is produced.

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

_____

_____ [2]

(b) In this reaction, state the oxidizing agent.

_____ [1]

(c) Describe the colour change that occurs on the copper (II) oxide as the reaction progresses.

_____

_____ [2]

(d) What type of reaction is taking place in the diagram above?

_____ [1]

6 **(a)** Organic compounds form homologous series.

Give **two** characteristics of members of any homologous series.

_____

_____

_____ [2]

(b) **(i)** Draw the structure of an alkane with **two** carbon atoms in the molecule. [2]

(ii) Calculate the percentage by mass of hydrogen in this alkane.

_____

_____ [2]

7 Oxygen and nitrogen are the major gases present in the clean air. Other gases which are present in the clean air in small quantities include carbon dioxide and argon.

(a) State the percentage of oxygen and nitrogen in the air.

_____

_____ [2]

(b) Briefly describe how you would show that carbon dioxide is present in the air.

_____

_____ [2]

(c) Argon is a noble gas. What chemically makes it unreactive?

_____ [1]

8 The list below shows metals arranged in ascending order of reactivity:

Silver

Zinc

Aluminium

Sodium

Using metals from this list **only**, name:

(a) a metal which can be displaced by copper.

_____ [1]

(b) a metal which reacts with cold water to produce an alkaline solution.

_____ [1]

(c) a metal which forms an amphoteric oxide when burnt.

_____ [1]

(d) a metal whose carbonate does **not** decompose when heated.

_____ [1]

(e) a metal which forms a stable oxide layer.

_____ [1]

(f) Write a balanced chemical equation for the reaction between sodium and water.

_____ [2]

Section B

[20 MARKS]

Answer any **two** questions

9 Iron is extracted from iron (III) oxide in a blast furnace. One of the main reactions in the furnace is

$$Fe_2O_3 + 3CO \rightleftharpoons 2Fe + 3CO_2$$

(a) Name two ores of iron. [2]

(b) Calculate the relative molecular mass of iron (III) oxide, Fe_2O_3. [1]

(c) What is the mass of iron that can be obtained from 80 tonnes of iron (III) oxide. [3]

(d) Iron often rusts. State three ways of preventing the rusting of iron. [3]

(e) Give one use of iron. [1]

[Total: 10]

10 **(a)** Nuclides of magnesium and calcium are shown below.

What do the following numbers tell you about these atoms:

(i) 24 in the nuclide for magnesium? [1]

(ii) 20 in the nuclide for calcium? [1]

(b) Draw the electronic structure of the atom of magnesium. [1]

(c) Describe how the electronic structures of magnesium and calcium indicate that they are both in the same group of the periodic table. [1]

(d) An atom **A** (atomic number 11) burns in chlorine to produce a white solid chloride **B**. What is the charge on the atom

(i) before the reaction? [1]

(ii) after the reaction? [1]

(e) Write a balanced chemical equation for the reaction in **(d)** above. [2]

(f) State the type of bonding found in chloride **B** and discuss one of its properties. [2]

[Total: 10]

11 Organic acids are a homologous series of compounds having the carboxylic group – COOH joined to an alkyl radical.

(a) What is the general formula for organic acids? [1]

(b) Draw the structure of butanoic acid. [1]

(c) A reaction between an alcohol and an organic acid is described as esterification and this is similar to neutralisation. [3]

(i) Ethylethanoate is an ester. Name two reagents used to prepare it. [2]

(ii) State two ways in which esterification is different from neutralisation. [2]

(iii) Write a balanced chemical equation for the esterification of ethylethanoate. [2]

(d) Calculate the mass of ethylethanoate formed from 15g of the organic acid. [2]

[Total: 10]

DATA SHEET

The Periodic Table of the Elements

Group I	Group II											Group III	Group IV	Group V	Group VI	Group VII	Group 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 = 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.).