Centre Number	Candidate Number

Candidate Name _____

EXAMINATIONS COUNCIL OF ZAMBIA

Examination for General Certificate of Education Ordinary Level

Chemistry 5070/2

Paper 2 Theory

Tuesday **1 AUGUST 2017**

Candidates answer on the question paper
Additional Information:
Mathematical tables/Calculators (non-programmable)
Graph paper

Time 2 hours

Instructions to Candidates

Write your **name, centre number and candidate number** in the spaces at the top of this page and on any separate answer paper used.

There are **twelve (12) questions** in this paper.

Section A

Answer **all** questions.

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

Section B

Answer any **three** questions.

Write your answers in the separate Answer Booklet provided.

At the end of the examination, fasten your Answer Booklets securely to the question paper.

Information for Candidates

The number of marks is shown in brackets [ ] at the end of each question or part question.
The **Periodic Table** is printed on page 11.

Cell phones are not allowed in the examination room.

FOR EXAMINER'S USE	
Section A	
B9	
B10	
B11	
B12	
TOTAL	

Section A: [50 marks]

Answer all questions in the spaces provided.

A1 The table below shows different gases.

Name of gas	**Formula**
Carbon monoxide	CO
Helium	He
Methane	CH_4
Nitrogen	N_2
Oxygen	O_2
Sulphur dioxide	SO_2

(a) Name the gas which will diffuse at the

(i) fastest rate

.....

(ii) slowest rate

..... [2]

(b) Which two gases will diffuse at the same rate?

..... and ..... [1]

(c) Which gas would be expected to diffuse twice as fast as

(i) sulphur dioxide?

.....

(ii) oxygen?

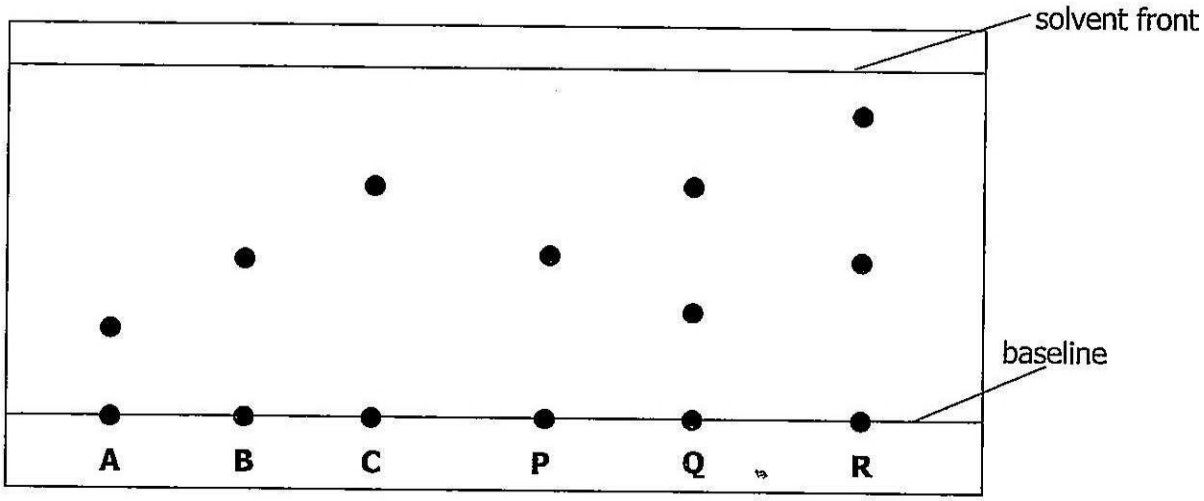
..... [2]

(d) Name a gas which will diffuse at a faster rate than any of the gases in the table above.

..... [1]

[Total 6]

A2 The diagram below shows a chromatogram obtained during the analysis of some substances. Study the chromatogram and answer the questions that follow.



A, B and **C** are standards whereas **P, Q** and **R** are unknown substances.

(a) Which of **P, Q** and **R** is a mixture/are mixtures?

..... [2]

(b) Which of the standards can be used to make substance **Q**?

..... [1]

(c) Which of the unknown substances has a component whose R_f value is different from the R_f values of any of the standards?

..... [1]

(d) Explain why the level of solvent is kept below the baseline at the start of the chromatographic process.

.....

..... [1]

[Total 5]

A3 Two elements **X** and **Y** are represented by the notations given below.

$$^{16}_{8}\mathbf{X} \qquad ^{7}_{3}\mathbf{Y}$$

Atoms of **X** and **Y** reacted together to form a compound.

(a) What changes in electronic structures occur when atoms of **X** and **Y** react?

X: .....

Y: ..... [2]

(b) What type of bonding occurs between **X** and **Y** atoms?

..... [1]

(c) Use electron-shell diagrams to show the structure of the compound formed between **X** and **Y**. Use dots (•) to represent the electrons of **X** and crosses (**x**) to represent the electrons of **Y**. (Show all electron shells)

[2]

(d) Would you expect the melting point of the compound in **(c)** above to be high or low? Give a reason for your answer.

.....

..... [2]

[Total 7]

A4 Dilead (II) lead (IV) oxide, Pb_3O_4 was added to $100cm^3$ of nitric acid solution and the two reactants reacted completely with each other forming lead (IV) oxide, PbO_2, lead (II) nitrate and water. The equation of the reaction is given below.

$Pb_3O_{4(s)} + 4HNO_{3(aq)} \rightarrow PbO_{2(s)} + 2Pb(NO_3)_{2(aq)} + 2H_2O_{(l)}$

13.70g of the Pb_3O_4 was used in the reaction.

(a) Calculate the

(i) mass of lead (II) nitrate formed in the reaction.

(ii) molarity of the nitric acid solution.

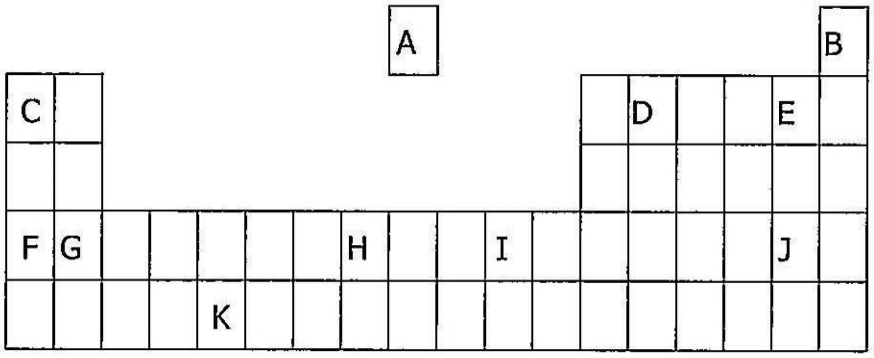
[6]

(b) State with reason whether lead (IV) oxide is a basic oxide or not.

..... [2]

[Total 8]

A5 The diagram shows part of the Periodic Table. Some elements are represented by letters which are not actual symbols of the elements.



Give the letter representing the element which

(a) has the lowest density

..... [1]

(b) is a liquid at room temperature and pressure.

..... [1]

(c) forms only a divalent cation.

..... [1]

(d) is used to make electricity cables.

..... [1]

(e) combines with oxygen to form an oxide in which one mole of atoms of the element combines with one mole of oxygen molecules.

..... [1]

(f) has atoms with the largest relative atomic mass.

..... [1]

[Total 6]

A6 An aluminium pan was anodized in order to make the aluminium oxide layer on it thicker. This is in order to increase its resistance to corrosion. This was done by electrolysing dilute sulphuric acid solution using the aluminium pan as the anode.

(a) State the formulae of the ions present in dilute sulphuric acid solution.

..... [3]

(b) Write equations for the two reactions which occur at the anode.

.....

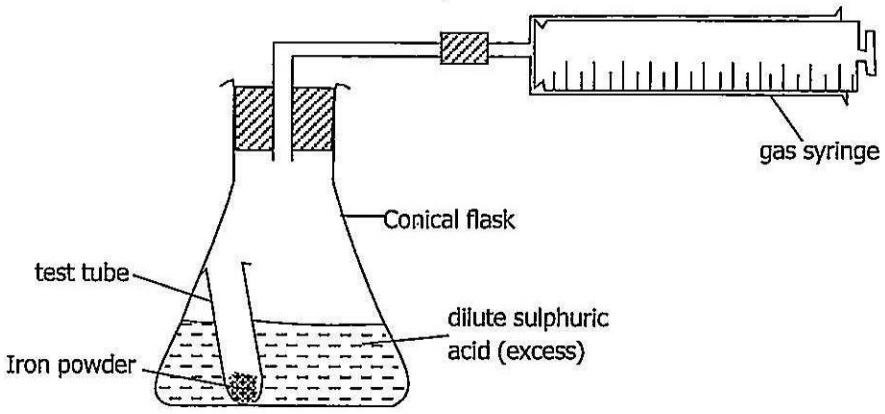
..... [2]

(c) State one other application of electrolysis.

..... [1]

[Total 6]

A7 A learner used the experimental arrangement below to investigate the effect of concentration on the rate of the reaction between iron and dilute sulphuric acid.



The learner did the experiment three times using different concentrations of sulphuric acid. The same mass of iron powder was used in each case and the experiments were carried out at a temperature of 20°C.

The results are shown in the table below.

No.	Concentration of sulphuric acid in mol/dm^3	Volume of hydrogen formed in the first minute/cm^3
1	0.5	14
2	1.0	29
3	1.5	44

(a) From the results, what is the effect of concentration on the rate of reaction between iron and dilute sulphuric acid?

..... [1]

(b) Explain why concentration affects the rate of reaction in the way you have described in **(a)**.

.....

..... [2]

(c) State the effect on the rate of the reaction if

(i) lumps of iron were used instead of the powder.

.....

(ii) the reaction was carried out at 30°C instead of 20°C.

..... [2]

[Total 5]

A8 Oxygen is manufactured on a large scale by fractional distillation of liquid air.

(a) Describe any **two** stages in the industrial manufacture of oxygen.

.....

..... [2]

(b) Describe the chemical test for oxygen gas.

.....

..... [2]

(c) Why must the fractionating column be longer than the one used in separation of crude oil into its various fractions?

.....

.....

..... [1]

(d) State **two** industrial uses of oxygen.

.....

..... [2]

[Total 7]

Section B (30 marks)

Answer three questions from this section.

Write your answers in the Answer Booklet provided.

B9 **(a)** A solid substance **S** was suspected to be acidic. Describe what test you would carry out in the laboratory to determine whether **S** was acidic or not. [3]

(b) When an acid reacts with an alkali, a neutralization reaction occurs and heat is released to the surroundings.

(i) Write a balanced chemical equation for the reaction of an acid and an alkali of your choice to form salt and water.

(ii) Write an ionic equation, with state symbols, for the reaction in **(b)(i)** above.

(iii) Describe how you can obtain crystals of salt from the salt solution formed in the reaction in **(b) (i).** [7]

[Total 10]

B10 Methane is a hydrocarbon whose molecular formula is CH_4. The gas burns completely in air to produce carbon dioxide, water and heat energy.

(a) **(i)** Write a balanced chemical equation for the complete combustion of methane. [1]

(ii) Why should methane never be burnt in limited air? [2]

(b) **(i)** Methane is used as a fuel in industry. Using the bond energies in the table below, calculate the enthalpy of combustion of methane.[3]

Bond	Value in KJ/mol
C – C	348
C – H	412
C = O	831
O – H	464
O = O	490

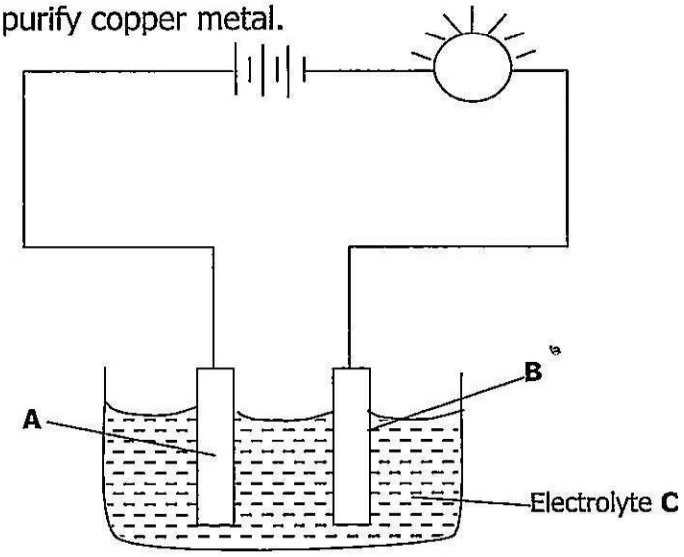
(ii) Calculate the amount of heat that would be produced from the combustion of 1200cm^3 of methane gas measured at r.t.p. [2]

(c) Draw the energy level diagram for the combustion of methane. [2]

[Total 10]

B11 **(a)** You are provided with a sample of copper (II) carbonate (green powder) and any other suitable chemicals and apparatus.
Describe with the aid of a labeled diagram how you can obtain copper metal from the copper (II) carbonate. Write down the chemical equations for the two reactions leading to the formation of the copper metal. [6]

(b) The diagram below shows an experiment which a learner carried out in order to purify copper metal.



(i) Which electrode, **A** or **B** is the impure copper?

(ii) Name a suitable electrolyte **C**, used in purification of copper.

(iii) State **one** physical property of copper and give a reason why copper has this property. [4]

[Total 10]

B12 **(a)** The following compounds are members of the homologous series of alkanes.

CH_4, C_2H_6, C_3H_8, C_4H_{10} and C_5H_{12}

(i) State the formulae of the next **two** members in this series.

(ii) State with reason whether the compound C_9H_{18} belongs to the family of alkanes or not.

(iii) Among the five members given state with reason the one with the highest boiling point. [6]

(b) The demand for petrol worldwide increases every year. To meet the demand, large molecules of hydrocarbons are cracked.

(i) What do you understand by the term cracking?

(ii) State the **two** types of cracking.

(iii) Write down the **two** possible products when the compound $C_{11}H_{24}$ is cracked. [4]

[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	43 Tc Tchnetium	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.).

$N_A = 6.0 \times 10^{23}$/mol; 1F = 96500C.