

Candidate Name _____

Centre Number		Candidate Number												

EXAMINATIONS COUNCIL OF ZAMBIA

Examination for School Certificate Ordinary Level

Chemistry

Paper 2 Theory

5070/2

Friday

4 NOVEMBER 2016

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 12.

Cell phones are not allowed in the examination room.

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

Section A: [50 marks]

Answer all questions in the spaces provided.

A1 (a) One of the laboratory rules reads as follows:
DO NOT EAT ANYTHING IN THE LABORATORY

(i) Explain why this rule is important

.....
.....

(ii) State one other laboratory safety rule.

.....
.....

[3]

(b) Important skills which a chemist needs to have include correct measurement of quantities and choosing correct pieces of apparatus/equipment for carrying out some experimental procedures. State the name of a piece of apparatus which can be used to

(i) measure accurately a volume of 0.6cm^3 .

.....

(ii) measure the mass of a cooking oil sample.

.....

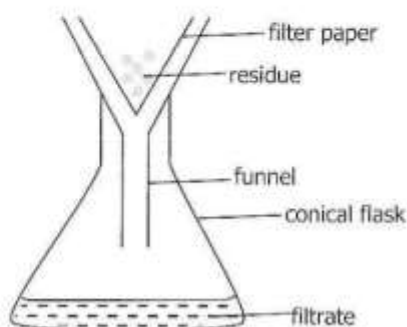
(iii) hold 50cm^3 of solution during a chemical reaction.

.....

[3]

[Total 6]

- A2** A soil sample was added to aqueous copper (II) sulphate solution forming a brown mixture. The mixture was filtered using the experimental set up shown below.



- (a)** State the
- (i)** name of the residue

- (ii)** name of the filtrate

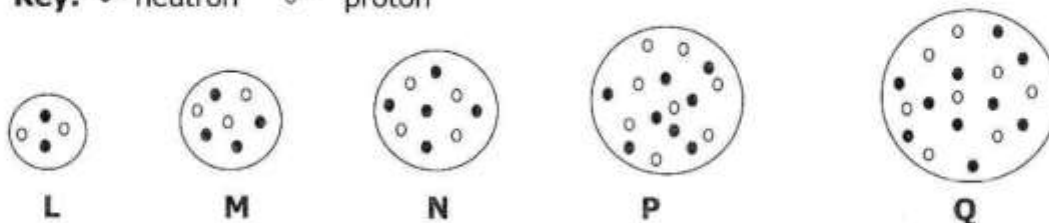
- (iii)** colour of the filtrate
 [3]
- (b)** The copper (II) sulphate solution is a mixture of two compounds.
- (i)** Name the two compounds present in the copper (II) sulphate solution.
 and
- (ii)** Describe in outline how the two compounds in the copper (II) sulphate solution can be separated.

 [4]

[Total 7]

A3 The diagrams show the nuclei of 5 different atoms.

Key: • - neutron ◦ - proton



(a) Which atom has

(i) an atomic number of 4?

..... [1]

(ii) mass number of 7?

..... [1]

(b) Using the letters **M** and **Q**, write the chemical formula of the compound formed if the atoms that contain nuclei **M** and **Q** reacted.

..... [1]

(c) What type of bond is formed for the reaction in **(b)** above?

..... [1]

(d) Which two letters represent nuclei of atoms which are isotopes?

..... [1]

[Total 5]

A4 10.00g of brass powder was added to excess dilute sulphuric acid and all the zinc reacted with the acid leaving a residue of copper. 1200cm³ of hydrogen gas measured at r.t.p was produced in the reaction of zinc and dilute sulphuric acid. After crystallizing the resulting zinc sulphate solution, 10.76g of hydrated zinc sulphate crystals, ZnSO₄•6H₂O were obtained.

(a) Write a balanced chemical equation for the reaction of zinc powder with dilute sulphuric acid. Include state symbols.

..... [1]

- (b) What mass of zinc was present in the 10.00g of brass powder?



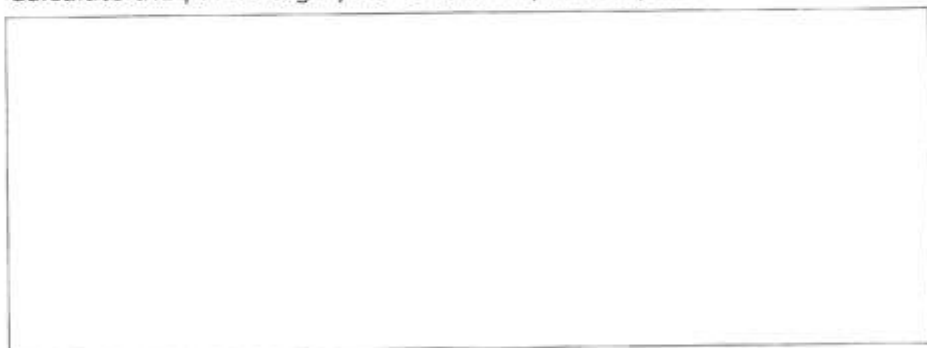
[2]

- (c) Calculate the percentage composition by mass of the brass sample.



[2]

- (d) Calculate the percentage yield of zinc sulphate crystals.



[3]

[Total 8]

A5 (a) Fluorine, chlorine, bromine and iodine are placed in the same Group of the Periodic Table.

(i) State the common name used to describe elements in this Group.

.....

(ii) State the Group in which the elements are placed and explain why they are placed in that Group.

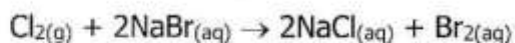
.....

(iii) Which of the above named elements is a solid at room temperature and pressure?

.....

[4]

(b) Chlorine reacts with sodium bromide to give sodium chloride and bromine according to the equation below.



(i) Explain why the above reaction is possible.

.....

.....

(ii) What would be observed during this reaction?

.....

.....

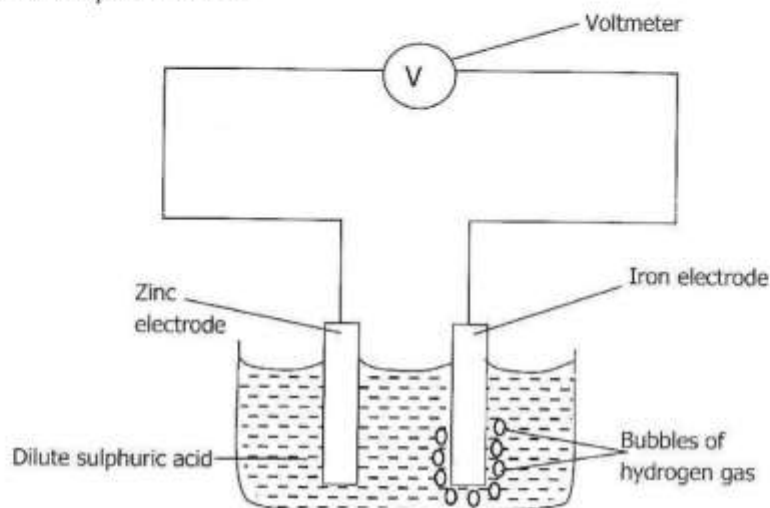
(iii) Construct an ionic equation for the reaction above.

.....

[4]

[Total 8]

- A6** The diagram below shows an electrochemical cell made using zinc and iron dipped in dilute sulphuric acid.



- (a)** What is the overall energy change which occurs in the electrochemical cell? Does this represent an endothermic or an exothermic process?

.....

[2]

- (b)** To increase the voltage of the above cell, either the zinc rod or the iron rod can be replaced by another metal rod. Name a suitable metal which can be used in place of the

- (i)** zinc rod.

.....

- (ii)** iron rod.

.....

[2]

- (c)** Write an equation for the reaction occurring at the iron electrode.

.....

[1]

[Total 5]



The equation above shows a redox reaction used to prepare chlorine gas in the laboratory.

(a) What is meant by a redox reaction?

..... [1]

(b) Calculate the oxidation number of chlorine in HCl and explain why a change from HCl to Cl₂ is an oxidation process.

.....

 [2]

(c) (i) Calculate the oxidation number of manganese, Mn in KMnO₄ and MnCl₂.

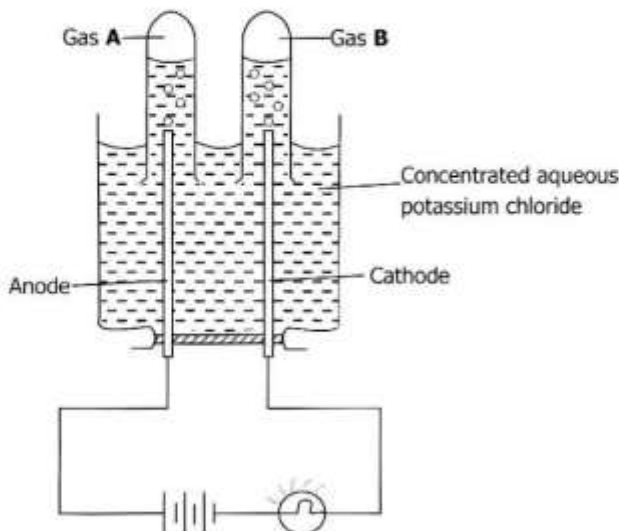
.....

(ii) Is a change from KMnO₄ to MnCl₂ oxidation or reduction?

..... [3]

[Total 6]

A8 The diagram below shows apparatus used to electrolyse concentrated potassium chloride.



- (a) Suggest a suitable material for the electrodes
 [1]
- (b) Write an ionic equation to show the formation of gas
 (i) A.....
 (ii) B..... [2]
- (c) Explain why potassium metal is not formed at the cathode in this electrolysis.

 [1]
- (d) Write the overall equation for the electrolysis of concentrated aqueous potassium chloride.
 [1]

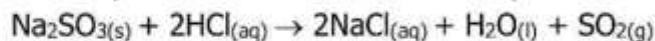
[Total 5]

Section B (30 marks)**Answer three questions from this section.****Write your answers in the Answer Booklet provided.**

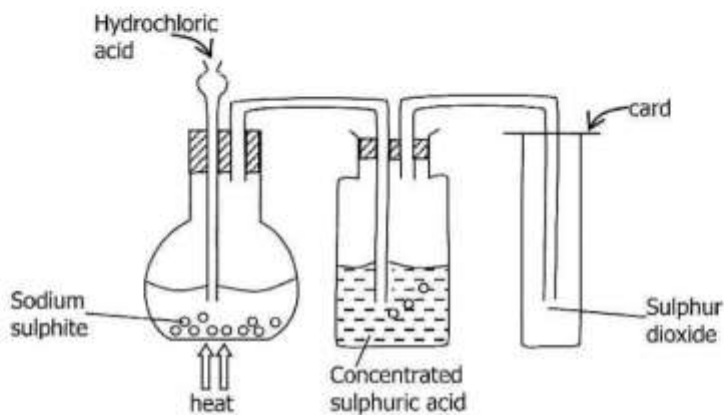
- B9 (a)** Copper (II) sulphate crystals can be prepared in the laboratory by reacting copper (II) carbonate with a dilute acid.
- (i) Name the dilute acid which reacts with copper (II) carbonate to form copper (II) sulphate.
- (ii) Write a balanced chemical equation with state symbols for the reaction.
- (iii) Describe the procedure for the preparation of copper (II) sulphate solution from copper (II) carbonate and the named acid in (i) above. [5]
- (b) Describe what is observed when an excess of sodium hydroxide solution is added to a solution containing copper(II) ions and name one product formed. [3]
- (c) Describe a chemical test to show the presence of sulphate ions in the solution and state what would be observed. [2]

[Total 10]

B10 A student prepared a sample of sulphur dioxide in the laboratory by the action of dilute hydrochloric acid on sodium sulphite according to the equation below



The diagram below shows the apparatus used.



- (a) (i)** What is the purpose of concentrated sulphuric acid?
- (ii)** Describe a chemical test for sulphur dioxide.
- (iii)** Sulphur dioxide is one of the major pollutant gases of air. It dissolves in rain water in the presence of oxygen to form sulphuric acid making the rain acidic.
Write a balanced chemical equation for the formation of sulphuric acid by reaction of water with sulphur dioxide and atmospheric oxygen.
State one hazardous effect of acid rain on the environment. [5]
- (b)** One of the uses of sulphur dioxide is in the manufacture of sulphuric acid. Sulphur dioxide is reacted with oxygen to form sulphur trioxide according to the equation $2\text{SO}_2(\text{s}) + \text{O}_2(\text{g}) \rightleftharpoons 2\text{SO}_3(\text{g}) \Delta H = -385 \text{ kJ/mol}$
- (i)** State the conditions used in the Contact process to get a good yield of sulphur trioxide.
- (ii)** Describe how the sulphur trioxide is safely converted into sulphuric acid.
- (iii)** State one commercial use of sulphuric acid. [5]

[Total 10]

B11 Common metals extracted in industry include aluminium, copper and zinc.

- (a) Copy the table below and complete it by naming the main ore and method of extraction of the metal from the ore.

Element	Name of ore	Method of extraction
Aluminium		
Copper		
Zinc		

[3]

- (b) (i) Which of the metals in the table is quickly coated with an oxide layer when exposed to air making it unreactive?
- (ii) Bronze is an alloy. Which two metals are alloyed to produce bronze?
- (c) State two reasons why alloys are preferred to pure metals.
- (d) Two of the metals in the table form oxides which react with acids and alkalis.
- (i) What products are formed when the metal oxides react with an acid and an alkali?
- (ii) Write an equation for the reaction when one of the metal oxides reacts with dilute hydrochloric acid.

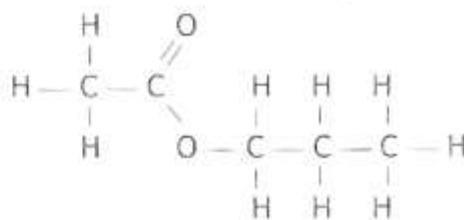
[2]

[2]

[3]

[Total 10]

B12 The structural formula of an ester is given below



- (a) (i) Describe how the above ester can be prepared in the laboratory by naming the reagents and the conditions needed for successful reaction.
- (ii) What observation will confirm that an ester has been formed in the reaction?
- (b) Terylene is a polyester formed from carboxylic acid and alcohol units.
- (i) Name two monomers used to make terylene.
- (ii) Draw the structural formula of terylene showing only four (4) monomer units.
- (iii) State one use of terylene.

[5]

[5]

[Total 10]

Turnover

DATA SHEET
The Periodic Table of the Elements

Group		I	II	III	IV	V	VI	VII	0	
		1 H Hydrogen							2 He Helium	
7	2	3 Li Lithium	4 Be Beryllium		5 B Boron	6 C Carbon	7 N Nitrogen	8 O Oxygen	9 F Fluorine	10 Ne Neon
11	12	13 Al Aluminium	14 Si Silicon	15 P Phosphorus	16 S Sulphur	17 Cl Chlorine	18 Ar Argon			
19	20	21 K Potassium	22 Ca Calcium	23 V Vanadium	24 Cr Chromium	25 Mn Manganese	26 Fe Iron	27 Co Cobalt	28 Ni Nickel	29 Cu Copper
37	38	39 Rb Rubidium	40 Sr Strontium	41 Nb Niobium	42 Mo Molybdenum	43 Tc Technetium	44 Ru Ruthenium	45 Rh Rhodium	46 Pd Palladium	47 Ag Silver
55	56	57 Cs Caesium	58 Ba Barium	59 Ta Tantalum	60 W Tungsten	61 Re Rhenium	62 Os Osmium	63 Ir Iridium	64 Pt Platinum	65 Hg Mercury
87	88	89 Fr Francium	90 Ra Radium	91 Zr Zirconium	92 Hf Hafnium	93 Rf Rutherfordium	94 Y Yttrium	95 Ru Ruthenium	96 Rh Rhodium	97 Pd Palladium
				98 Ti Titanium	99 Hf Hafnium	100 Rf Rutherfordium	101 La Lanthanum	102 Ce Cerium	103 Pr Praseodymium	104 Nd Neodymium
				105 V Vanadium	106 Ta Tantalum	107 Rf Rutherfordium	108 Yb Ytterbium	109 La Lanthanum	110 Ce Cerium	111 Pr Praseodymium
				112 Cr Chromium	113 Hf Hafnium	114 Rf Rutherfordium	115 Lu Lutetium	116 Ce Cerium	117 Pr Praseodymium	118 Nd Neodymium
				119 Mn Manganese	120 Ta Tantalum	121 Rf Rutherfordium	122 Hf Hafnium	123 Pr Praseodymium	124 Ce Cerium	125 Nd Neodymium
				126 Fe Iron	127 Hf Hafnium	128 Rf Rutherfordium	129 Yb Ytterbium	130 La Lanthanum	131 Ce Cerium	132 Pr Praseodymium
				133 Co Cobalt	134 Ta Tantalum	135 Rf Rutherfordium	136 Lu Lutetium	137 Ce Cerium	138 Pr Praseodymium	139 Nd Neodymium
				136 Ni Nickel	137 Hf Hafnium	138 Rf Rutherfordium	139 Yb Ytterbium	140 La Lanthanum	141 Ce Cerium	142 Pr Praseodymium
				141 Cu Copper	142 Ta Tantalum	143 Rf Rutherfordium	144 Lu Lutetium	145 Ce Cerium	146 Pr Praseodymium	147 Nd Neodymium
				146 Zn Zinc	147 Hf Hafnium	148 Rf Rutherfordium	149 Yb Ytterbium	150 La Lanthanum	151 Ce Cerium	152 Pr Praseodymium
				151 Ga Gallium	152 Ta Tantalum	153 Rf Rutherfordium	154 Lu Lutetium	155 Ce Cerium	156 Pr Praseodymium	157 Nd Neodymium
				156 Ge Germanium	157 Hf Hafnium	158 Rf Rutherfordium	159 Yb Ytterbium	160 La Lanthanum	161 Ce Cerium	162 Pr Praseodymium
				161 As Arsenic	162 Ta Tantalum	163 Rf Rutherfordium	164 Lu Lutetium	165 Ce Cerium	166 Pr Praseodymium	167 Nd Neodymium
				166 Se Selenium	167 Hf Hafnium	168 Rf Rutherfordium	169 Yb Ytterbium	170 La Lanthanum	171 Ce Cerium	172 Pr Praseodymium
				171 Br Bromine	172 Ta Tantalum	173 Rf Rutherfordium	174 Lu Lutetium	175 Ce Cerium	176 Pr Praseodymium	177 Nd Neodymium
				176 Te Tellurium	177 Hf Hafnium	178 Rf Rutherfordium	179 Yb Ytterbium	180 La Lanthanum	181 Ce Cerium	182 Pr Praseodymium
				181 I Iodine	182 Ta Tantalum	183 Rf Rutherfordium	184 Lu Lutetium	185 Ce Cerium	186 Pr Praseodymium	187 Nd Neodymium
				186 Xe Xenon	187 Hf Hafnium	188 Rf Rutherfordium	189 Yb Ytterbium	190 La Lanthanum	191 Ce Cerium	192 Pr Praseodymium
				191 At Astatine	192 Ta Tantalum	193 Rf Rutherfordium	194 Lu Lutetium	195 Ce Cerium	196 Pr Praseodymium	197 Nd Neodymium
				196 Rn Radon	197 Hf Hafnium	198 Rf Rutherfordium	199 Yb Ytterbium	200 La Lanthanum	201 Ce Cerium	202 Pr Praseodymium

The volume of one mole of any gas is 24 dm³ at room temperature and pressure (r.t.p.).

NA = 6.0 × 10²³/mol; 1F = 96500C.

Chemistry/5070/2/2016

Key
 a = relative atomic mass
 x = atomic symbol
 b = proton (atomic) number

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