545/2
Chemistry
Paper 2
July - August 2023
2 Hours

UGANDA MUSLIM TEACHERS' ASSOCIATION

UMTA JOINT MOCK EXAMINATIONS-2023

NAME.....

INDEX NO.....SIGN.....

UGANDA CERTIFICATE OF EDUCATION
Chemistry paper 2

Time 2hours

INSTRUCTIONS TO CANDIDATES:

- *Section A consists of 10 structured questions. Answer all questions in this Section.*
- *Answers to these questions must be written in the spaces provided only.*
- *Section B consists of 4 semi-structured questions. Attempt any two questions from this Section.*
- *Answers to these questions must be written in the answer sheets provided only*
- *In both sections all working must be clearly shown.*
  Where necessary use;
  (H = 1; C = 12; O =16; N= 14 Na = 23 S = 32; Pb= 207)

1 mole of gas occupies 24*L* at room temperature
1 mole of a gas occupies 22.4dm^3 at s.t.p

For Examiner's use only														
1	2	3	4	5	6	7	8	9	10	11	12	13	14	Total

SECTION A. (50 MARKS)

Answer all questions in this section.

1. When pieces of calcium metal were added into water in a beaker, bubbles of a colourless gas, **X** and cloudy solution formed.

   (a) Identify

   (i) gas **X** (½ Mark)

   .....

   (ii) Cloudy solution (½ mark)

   .....

   (b) Write the equation for the reaction leading to formation of gas **X** and cloudy solution. (1½ marks)

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   .....

   (c) The cloudy solution was filtered to obtain a colourless solution, of what use is the colourless solution in the laboratory (1 mark)

   .....

   .....

   (d) State what is observed if gas **X** is passed over heated lead(II) oxide. (1½ marks)

   .....

   .....

2. When a mixture of sodium chloride and liquid **L** was heated, hydrogen chloride gas was evolved.

   (a) Write the name of Liquid **L**, (½ Mark)

   .....

   .....

(b) Write an equation of the reaction leading to the formation of hydrogen chloride.

(1½ marks)

.....

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(c) Hydrogen chloride dissolves in both water and carbon tetrachloride, state what is observed when sodium carbonate is added to;

(i) a solution of hydrogen chloride in water. (1 mark)

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.....

(ii) a solution of hydrogen chloride in carbon tetrachloride. (½ mark)

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.....

(d) Give a reason for your answer in C(i) and (ii) above. (1 ½ marks)

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.....

3. The number of protons, neutrons and electrons of different particles **R, S, T, U, V** and **W** are given in the table below.

Particle	Protons	Neutrons	Electrons
R	20	20	18
S	17	18	17
T	6	6	6
U	7	7	10
V	17	19	17
Z	19	20	19

(a) Identify which of the particles in the table is:

(i) an anion (½ mark)

.....

(ii) a cation (½ mark)

.....

(b) Write the

(i) electronic structure of the anion in (a) (½ mark)

.....

(ii) formula of the cation in (a) (½ mark)

.....

(c) Particle **S** separately reacts with particles **Z** and **T** forming compounds **M** and **N** respectively.

(i) State the type of bond that exists in compound **N** (½ mark)

.....

.....

(ii) Using outer most electrons, show how compound **M** is formed from its particles.

(1 ½ mark)

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.....

.....

.....

(iii) State whether compound **M** has low or high boiling point. Give a reason for your answer. (1 mark)

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.....

4. In an experiment to determine the molar heat of neutralization of hydrochloric acid with sodium hydroxide, students reacted $100cm^3$ of 1M hydrochloric acid with $50cm^3$ of 2M sodium hydroxide solution.

They obtained the following results.

Initial temperature of acid=24.8°C Initial temperature of base=25.2°C Highest temperature of acid - alkali mixture obtained =34.0°C

(1 mark)

(a) Define the term molar heat of neutralization.

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.....

.....

(b) Calculate; (1 mark)

(i) the change in temperature (ΔT) of solution

.....

.....

.....

(ii) the molar heat of neutralization of sodium hydroxide

(Specific heat capacity of solution=$4.2 Jg^{-1} K^{-1}$; Density of solution is gcm^{-3}) (3 marks)

(1mark)

5. (a) State the chemical nature of soap

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.....

.....

(b) During the laboratory preparation of a sample of soap, sodium hydroxide solution is heated with suitable oil, to which concentrated sodium chloride is added.

(ii) Name the process leading to the formation of soap solution. (½ mark)

.....

(ii) Name one suitable oil that can be used. (½ mark)

.....

(iii) State the purpose of adding concentrated sodium chloride. (1mark)

.....

.....

(c) To water containing dissolved magnesium sulphate was added to a known volume of soap solution

(i) State what was observed (½ mark)

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(ii) Write ionic equation of reaction that took place. (1½ marks)

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(iii) State one chemical method that can be used to effectively use soap with water containing magnesium sulphate.

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6. A hydrocarbon **Z** consists of 85.8% by mass of carbon, and $8.39g$ of hydrocarbon occupies $4.47dm^3$ at s.t.p.

(a) Calculate;

(i) the empirical formula of the hydrocarbon **Z** (2 marks)

(ii) molar mass of the hydrocarbon **Z** (1 mark)

(b)(i) Determine the molecular formular of hydrocarbon **Z**. (1 mark)

(ii) Write the structural form of **Z**.

7. When Barium nitrate solution was added to a solution of sodium sulphite, a white precipitate **P** was formed. When a reagent **M** was added to a white precipitate, it dissolved and a gas **Q** was formed which turned the colour of acidified potassium dichromate **(VI)** from orange to green.

(a) Name reagent **M** (½ mark)

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(b) Write Ionic equation leading to the formation of precipitate **P**. (1½ mark)

.....

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.....

.....

(c) (i) Identify gas **Q** (½ mark)

.....

(ii) Write equation leading to formation of gas **Q**. (1½ mark)

.....

.....

.....

(d) State one use of gas **Q**. (1mark)

.....

.....

8. Name the process that takes place in each of the following.

(a) Crystals of calcium chloride changes into solution when exposed in air. (1 mark)

.....

.....

(b) Volume of concentrated sulphuric acid increase when left in an open beaker overnight. (1 mark)

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(c) When crystals of hydrated Iron (II) sulphate are left in the open air, they turn to powder. (1 mark)

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(d) When a solution of Iron (II) chloride is exposed to air, it turns from green to brown. (1 mark)

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.....

Explain the observation in **(d)** above. (1 mark)

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9. During extraction of Iron, Iron metal, ore, coke and limestone are placed into a blast furnace and hot air blasted into the furnace, impurities in the ore are removed as slag.

(a) Name one iron ore from which iron can be extracted and write its formula. (1 mark)

.....

.....

(b) Name one impurity present in the ore. (1 mark)

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.....

(c) Write equations to show how slag is formed (2½ marks)

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(d) Write an equation showing Iron ore named in (a) is reduced to Iron metal (1½ mark)

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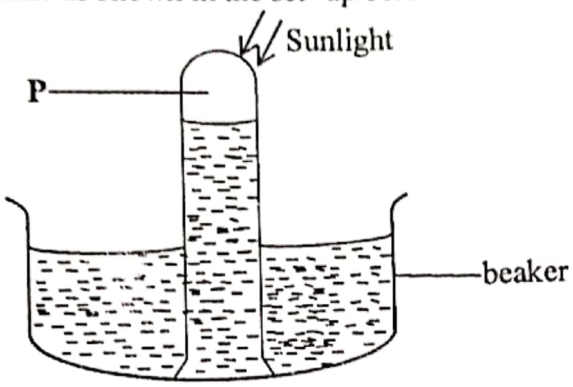
10. Chlorine gas was bubbled through water for some time. The solution formed was exposed to the sun for long time as shown in the set- up below.



(a) What constitutes the solution present in the beaker (1 mark)

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(b)(i) Name substance **P** (½ mark)

.....

(ii) Write equation for the formation of substance **P**. (1½ mark)

.....

.....

(c) (i) State what is observed when chlorine gas is bubbled through sodium bromide solution (1 mark)

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.....

(ii) Write an Ionic equation which took place in the above reaction c(i) above (1½ marks)

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SECTION B: (30 MARKS)

Answer any two questions from this section

11. (a) Define the following terms (1 mark)

(i) Electrolyte (1 mark

(ii) Electrode

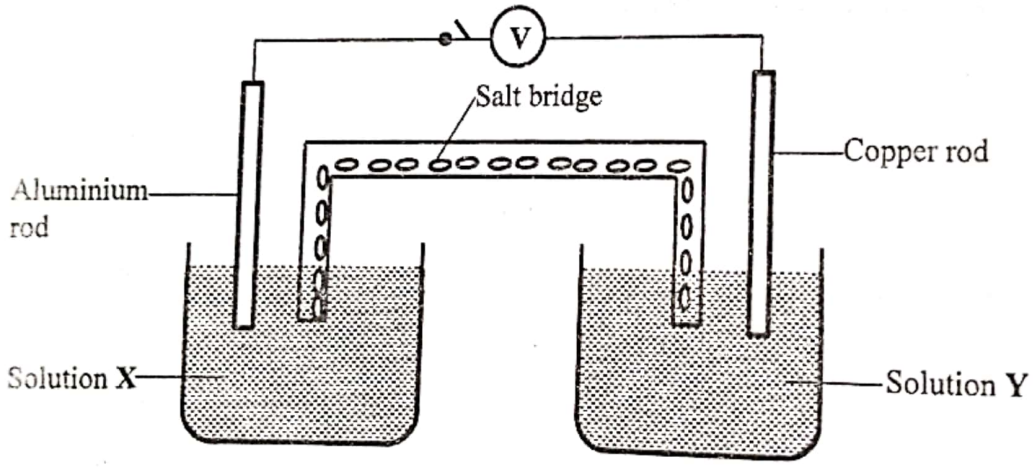
(b) Draw a well labelled diagram of an electrolytic cell showing flow of electrons and electricity (2 marks)

(c)(i) Describe how the products will be formed at each electrode during electrolysis of **dilute** sodium chloride solution using carbon electrodes. (6 marks)

(ii) Name the product that will be formed at each electrode if the above electrolysis was repeated using **concentrated** sodium chloride solution. (1 mark)

(iii) State the application of electrolysis of concentrated sodium chloride solution (1 mark)

(d) The diagram below is an electro-chemical-cell.



(i) State the function of salt bridge. (1 mark)

(ii)Identify solution **X** and **Y** (1 mark)

(ii) Write an equation taking place at aluminium electrode and copper electrode. (2 marks)

12. (a) (ii)Draw a well labelled diagram to show how dry sample of ammonia gas can be prepared in the laboratory from calcium hydroxide and ammonium chloride.
(3½ marks)

(ii) Write equation for the reaction that took place leading to the formation of ammonia gas in(a) (i) . (1½ marks)

(b) Write equations for reaction of combustion of ammonia without catalyst.
(1½ marks)

(c) In the Harber process, nitrogen and hydrogen are reacted over a catalyst to give ammonia gas.

(i) Name the process by which nitrogen gas used in the process is obtained. (1 mark)

(ii) Write equation for the formation of ammonia gas from the raw materials.
(1½ marks)

(d) Explain how the following factors would affect the yield of ammonia.

(i) High pressure (1½ mark)

(ii) Presence of catalyst. (1 mark)

(e) $0.34dm^3$ of ammonia gas at s.t.p reacted with dilute sulphuric acid to form ammonium sulphate according to the following equation.

$$2NH_3(s) + H_2SO_4(aq) \longrightarrow (NH4)_2SO_4(aq)$$

Determine the mass of the ammonium sulphate produced.

(H=1; N=14;0=16; S=32, Molar gas volume at s.t.p =$22.4dm^3$) (3 marks)

13. (a) In the manufacture of sulphuric acid on industrial scale, sulphur dioxide gas is first purified and then covered to sulphur trioxide gas in a presence of catalyst which is finely divided.

(i) Name the catalyst used. (½ mark)

(ii) State why the catalyst is finely divided? (1 mark)

(iii) Write equation for the reaction leading to formation of sulphur trioxide (1½ marks)

(b) Write equation(s) to show how sulphur trioxide is converted into sulphuric acid.
(3 marks)

(c) State the conditions under which sulphuric acid reacts with each of the following substances below. Write equation of reaction that took place in each case (2 marks)

(i) Copper (2 marks)

(ii) Aluminium oxide (2 marks)

(iii) Potassium nitrate crystals

(d) Name **one** reagent that can be used to distinguish between sulphate ions and carbonate ions, and in each case state what would be observed if each ion is treated with the reagent separately. (3 marks)

14. (a) Describe how you would prepare a sample of Iron (II) chloride crystals from Iron metal. (5 marks)

(b) Write an equation for the reaction that take place in (a) above. (1½ marks)

(c) Iron (II) chloride was dissolved in water and the resultant solution divided into **two** portions.

(i) To the first portion, sodium hydroxide solution was added dropwise until in excess. State what was observed and write an ionic equation for the reaction that occurred (2½ marks)

(ii) To the second portion, a few drops of silver nitrate solution were added. State what was observed and write an ionic equation for the reaction that occurred. (2 ½ marks)

(d) Lead (II) iodide is an insoluble salt.

(i) Name **two** compounds that can be used to form lead (II) iodide. (1 mark)

(ii) State what is observed when the two compounds are added. (1 mark)

(iii) Write an ionic equation for the reaction in d (ii) above. (1½ marks)

END