Name…… **Centre/Index No**……/…….

Signature……...

545/2
CHEMISTRY
Paper 2
2023
2 hours

ASK INTERGRATED TEACHERS' MOCK EXAMINATIONS BURREAU

AITEL JOINT MOCK EXAMINATION

Uganda Certificate of Education

CHEMISTRY

Paper 2

2 hours

INSTRUCTIONS TO CANDIDATES:

SECTION A: Consists of 10 structured questions.
Answer **all** questions in this **section**.
Answers to questions in section A should be written in the spaces provided on this question paper.

SECTION B: Consists of Semi – structured questions.
Attempt any **TWO questions** from this section.
Answers to the questions must be written in the answer sheet provided.
In both sections, all working must be clearly shown.

1 mole of a gas occupies 22,400 cm^3 at **s.t.p**
1 mole of a gas occupies 24,000 cm^3 at **room temperature**.
Use the following where necessary
H=1, C=12, O=16, Mg=24, Fe=56

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

SECTION A

Attempt ALL questions in this section.

1. (a) During the industrial manufacture of oxygen from air, water vapour and carbondioxide gas are removed before the process of isolating oxygen from air.

(i) What name is given to this industrial process? (½ mark)

_____

(ii) Explain why water vapour and carbon dioxide are removed from air. (1 ½ marks)

_____

_____

(iii) State the principle of isolation of oxygen from air. (½ mark)

_____

(iv) Give any two practical applications of the process named in (i) above.(1 mark)

_____

_____

2. (a) Sodium carbonate is referred to as a normal salt.

(i) Define the term normal salt. (1 mark)

_____

_____

_____

(ii) State two uses of sodium carbonate. (1 mark)

_____

_____

(d) Sodium carbonate dissolves in water to form carbonic acid and sodium hydroxide solution according to the following equation.

$Na_2CO_{3(q)} + 2H_2O_{(l)} \longrightarrow H_2CO_{3(aq)} + 2NaOH_{(aq)}$

(i) State what is observed if the resultant solution is tested with litmus paper. (½ mark)

_____

_____

(ii) Explain your observation in (i) above. (2 ½ marks)

_____

_____

_____

_____

_____

3. Barium nitrate solution reacts with aqueous sodium hydroxide according to the equation below.

$Ba(NO_3)_{2(aq)} + 2NaOH_{(aq)} \longrightarrow Ba(OH)_{2(s)} + 2NaNO_{3(aq)}$

Excess Barium nitrate solution was added to $20cm^3$ of 2M sodium hydroxide in a beaker, the mixture stirred, filtered and the residue dried.

(a) Calculate the maximum mass of the dried residue. (Ba = 137, O =16, H=1)

_____

_____

_____

_____

_____

_____

(b) The dried residue was strongly heated in a test tube, write equation of reaction.

(1 ½ marks)

_____

_____

4. Equal volumes of different water samples X,Y and Z were separately titrated with soap solution until a permanent lather formed.

	Unboiled water			Boiled water		
Water sample	X	Y	Z	X	Y	Z
Volume of soap required / cm^3	50	4	30	50	4	7

(a) Identify the substances formed in the following water samples and explain your answer.

(i) Sample X (1 ½ marks)

_____

Explanation_____

_____

(ii) Sample Z

_____

Explanation_____

_____

(b) State two techniques that can be applied to water sample X so that the volume of soap solution reduces from $50cm^3$ to $7cm^3$. (1 mark)

_____

_____

(c) Mention two disadvantages of using water sample Y. (1 mark)

_____

_____

5. (a) Chlorine can be prepared in the laboratory by the action of manganese(IV) oxide on substance Q.

(i) Name substance Q (½ mark)

_____

(ii) State the function of manganese(IV) oxide (½ mark)

_____

(iii) Write equation for the reaction. (1 ½ marks)

_____

_____

(b) Chlorine was bubbles through a saturated solution of potassium iodide.

(i) State what is observed. (1 mark)

_____

_____

(ii) Give a reason for your observation. (1 mark)

_____

_____

(c) Give a reason why chlorine belongs to group(VII) in the periodic table. (½ marks)

_____

6. When 0.6gm of Zinc powder was added to $40cm^3$ of 0.15M Copper(II) nitrate solution in a plastic beaker, the temperature of the solution rose from 24^0c to 33^0c.

(a) (i) Other than increase in temperature, state what else was observed. (1 mark)

_____

_____

(ii) Write the ionic equation for the reaction that took place. (1 ½ marks)

_____

_____

(b) Calculate:

(i) the heat change that occured during the reaction. (1 ½ marks)

(Density of solution = $1gmcm^3$, specific heat capacity = $4.2J/g/^0C$

_____

_____

_____

_____

(ii) the molar heat of reaction. (2 marks)

_____

_____

_____

_____

_____

_____

7. (a) (i) State the conditions under which magnesium can react with water. (1 marks)

_____

_____

(ii) Write equation for the reaction between water and magnesium. (1 ½ marks)

_____

_____

(b) The product from (a) was shaken with water. State what was observed. (1 mark)

_____

_____

(c) Dilute nitric acid was added to the product in (b).

Write equation for the reaction. (1 ½ marks)

_____

_____

8. (a)(i) What is an allotrope? (1 mark)

(ii) Name two crystalline allotropes of carbon (1 mark)

_____

_____

(b) State:

(i) One property of each of the allotropes of carbon named in (a) (1 mark)

_____

_____

(ii) one use of each of the allotropes named in (a) (1 mark)

_____

_____

(c) Name one allotrope of carbon that is used

(i) For making shoe-polish (½ mark)

_____

(ii) In sugar industry (½ mark)

_____

9. (a)(i)Deifne the term water of crystallization (1 mark)

_____

_____

_____

(ii) State two physical properties of salts that can be affected by the presence of water of crystallization (1 mark)

_____

_____

(b) A hydrated salt contains 16.10% sodium, 4.20% carbon, 16.80% oxygen and 62.90% water of crystallization.

(i) Calculate the formular of the salt. (2 marks)

_____

_____

_____

_____

_____

_____

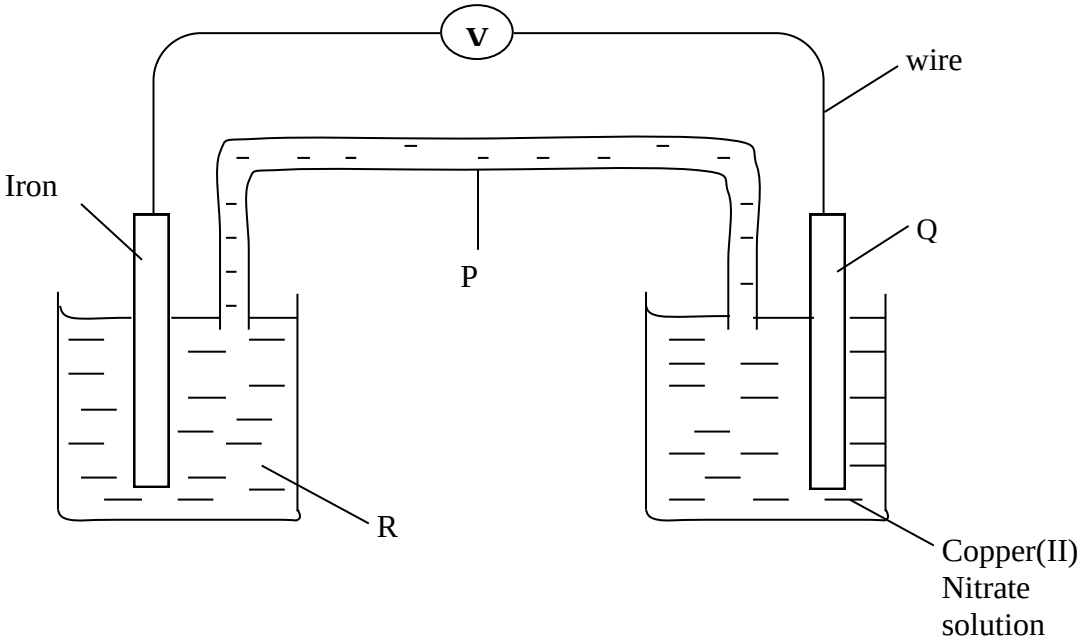
(ii) State what would be observed when the crystals of the salt in b(i) above are allowed to stand in air for a long time. Give a reason. (1 mark)

_____

_____

_____

10. The diagram below shows Copper-Iron electro-chemical cell



(a) Name (1 ½ marks)

(i) P_____

(ii) Q_____

(iii) R_____

(b) (i) State the purpose of P. (½ mark)

_____

_____

(ii) Name one substance contained in P (½ mark)

_____

(c) Indicate on the diagram the direction of flow of electrons. (½ mark)

(d) Write the equation of reaction at the cathode. (1 ½ marks)

_____

_____

SECTION B (30 MARKS)

Answer any two questions from this section.

Additional questions answered will not be marked.

11. (a) What is meant by the term "rate of a chemical reaction? (1 mark)

(b) Explain how the following factors affects the rate of a chemical reaction

(i) Temperature. (2 marks)

(ii) Surface area (2 ½ marks)

(iii) Concentration of reactants (2 marks)

(c) The table below shows the variation of volume of hydrogen gas collected at various time intervals when 2gm of Zinc powder was reacted with excess 2M hydrochloric acid.

Time (minutes)	0	1	2	3	4	5	6	7	8
Volume of hydrogen / cm^3	0	40	56	65	71	75	77	78	78

(i) Plot a graph of volume of hydrogen collected (vertical axis) against time.(3 marks)

(ii) State why excess 2M hydrochloric was used (1 mark)

(iii) From the graph, determine the rate of reaction at 2 minutes and at 5 minutes.

(3 marks)

(iv) Comment on the values of the rate obtained. (1 ½ marks)

12. (a)(i) Describe how a dry sample of calcium nitrate can be prepared in the laboratory from calcium carbonate. (7 marks)

(ii) Calcium nitrate was strongly heated in a dry test tube. State what was observed and write the equation for the reaction. (4 marks)

(b) Calcium nitrate reacts with aqueous sodium hydroxide according to the following equation.

$Ca(NO_3)_{2(aq)} + 2NaOH_{(aq)} \longrightarrow Ca(OH)_{2(s)} + 2NaNO_{3(aq)}$

When excess aqueous sodium hydroxide was added to $50cm^3$ of calcium nitrate solution, 1.85gm of calcium hydroxide was formed.

(i) State what is observed when excess sodium hydroxide is added to calcium nitrate solution in a test tube. (1 mark)

(ii) Calculate the concentration of calcium nitrate solution in moles per litre. (3 marks)

13. (a) In the Haber process, nitrogen reacts with Hydrogen according to the equation:

$N_{2(g)} + 3H_{2(g)} \rightleftharpoons 2NH_{3(g)} \qquad \Delta H = -ve$

Explain how the yield of ammonia is affected by;

(i) High pressure (2 marks)

(ii) Low temperature (2 marks)

(b) State one other factor that affects the yield of ammonia (½ mark)

(c) Ammonia can be oxidized in the presence of a catalyst to nitric acid.

(i) Name the catalyst used (½ mark)

(ii) Outline using equations only the reactions leading to the formation of nitric acid from ammonia (4 ½ marks)

(d) Ammonium nitrate is widely used as a fertilizer. It dissolves in water according to the following equation

$NH_4NO_{3(s)} + H_2O_{(l)} \longrightarrow NH_4OH_{(aq)} + HNO_{3(aq)}$

(i) What is a fertilizer? (1 mark)

(ii) Explain why calcium nitrate is often used as a fertilizer. (4 ½ marks)

14. (a) Name the common ore of sodium and write its formula. (1 mark)

(b) Briefly describe how sodium can be extracted from the named ore in(a) and write equations(s) to illustrate your answer (5 marks)

(c) State what would be observed and write equation when sodium metal

(i) reacts with oxygen (3 marks)

(ii) is dropped in a beaker of cold water (3 ½ marks)

(iii) reacts with chlorine gas (2 ½ marks)