STUDENT'S NAME: ……

SCHOOL NAME: …… INDEX NUMBER ……

545/2
CHEMISTRY
Paper 2
(Theory)
July/Aug. 2022
2 Hours

AITEL JOINT MOCK EXAMINATIONS

Uganda Certificate of Education

CHEMISTRY

(THEORY)

Paper 2

2 hours

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.*

Section **B** *consists of* **4** *semi – structured questions. Attempt any* **two** *questions from this section. Any additional question(s) answered will* **not** *be marked.*

Answers to the questions **must** *be written on the answer sheets provided.*

In both sections **all** *working must be clearly shown.*

Where necessary use;

$[H = 1; C = 12; N = 14; O = 16; Na = 23; S = 32; Cl = 35.5; Fe = 56]$

1 mole of gas occupies $24l$ at room temperature.

1 mole of gas occupies $22.4l$ 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)

Attempt **all** *questions in this section in the spaces provided only*.

1. (a) State **one** property which shows that air is a mixture. *(01mark)*

……

(b) Name any **two** gases, other than oxygen, that are constituents of air and give their approximate percentages by volume in air. *(02marks)*

……

……

(c) A piece of burning Sulphur is lowered into a jar of oxygen.

(i) State what was observed. *(01mark)*

……

……

(ii) State **one** use of the gaseous product formed. *(01mark)*

……

2. Table **1** shows the number of protons, electrons and neutrons of atoms **P, *Q, R, S*** and ***U***. Study the table and answer the questions that follow.

Table 1

Atom	**Number of protons**	**Number of electrons**	**Number of neutrons**
P	11	11	12
Q	17	17	18
R	18	18	22
S	19	19	20
U	17	17	20

(a) Which of the above atoms are Isotopes? *(01mark)*

……

(b) Write the electronic configuration of the ion that can be formed by the atom of:

(i) **P** *(01mark)*

……

(ii) **S** *(01mark)*

……

(c) Identify the group in the Periodic Table to which element of atom **R** belongs. *(01mark)*

……

(d) If atom **P** belongs to element **P** and atom **U** belongs to element **U**, write the formula of the compound formed between element **P** and **U**. *(01mark)*

……

3. (a) Sulphuric acid easily ionizes in water.

(i) State the valency of the anion formed when sulphuric acid completely ionizes in water *(½mark)*

……

(ii) Write an equation for the complete ionization of sulphuric acid in water.

(1½marks)

……

(b) 20cm^3 of 0.5M sulphuric acid reacted completely with excess Potassium hydrogen carbonate. Calculate the volume of carbon dioxide produced at s.t.p. *(03marks)*

……

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4. (a) A piece of burning calcium was introduced into a jar of nitrogen.

(i) State what was observed. *(01mark)*

……

(ii) Write an equation for the reaction that took place. *(1½marks)*

……

(b) Water was added to the product of the reaction in (a) and the resultant mixture tested with litmus.

(i) State what was observed *(01mark)*

……

……

(ii) Write an equation for the reaction if the resultant mixture is warmed. *(02marks)*

……

……

(c) Name **one** other metal that reacts with nitrogen in similar way to calcium. *(½mark)*

……

5. Potassium carbonate dissolves in water according to the following equation.

$$K_2CO_3(s) + 2H_2O(l) \longrightarrow 2KOH(aq) + H_2CO_3(aq)$$

(a) Predict the pH of the resultant solution. *(½mark)*

……

(b) Briefly explain your answer in (a) *(3½marks)*

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6. The setup of the apparatus in figure **1** was used to investigate the effect of heat on zinc

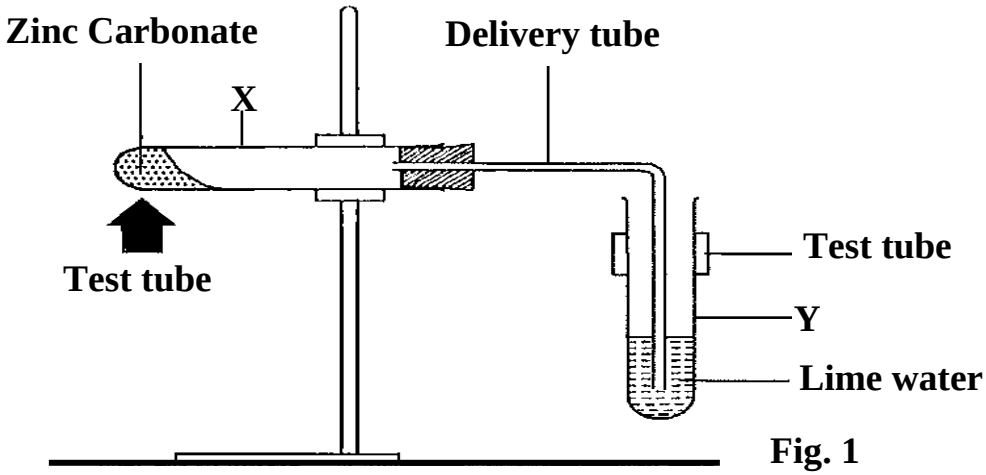

Fig. 1

(a) State what was observed in:

(i) Test tube **X** *(01mark)*

……

(ii) Test tube **Y** *(01mark)*

……

(b) Write an equation for the change that occurs in

(i) Test tube **X** *(1½marks)*

……

(ii) Test tube **Y** *(1½marks)*

……

(c) State **one** use of the solid product in b(ii). *(01mark)*

……

7. Copper (II) sulphate solution was electrolyzed using carbon electrodes.

(a) State what was observed at the:

(i) Cathode *(01mark)*

……

(ii) Anode *(01mark)*

……

(b) Explain your observation at the cathode. *(1½marks)*

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……

(c) Write equation (s) for the reaction (s) that took place at the anode. *(1½marks)*

……

……

8. A substance **T** reacts with solid sodium chloride to produce hydrogen chloride gas.

(a) Identify **T**. *(½mark)*

……..……

(b) Write an equation for the reaction leading to the formation of hydrogen chloride gas. *(1½marks)*

……

……

(c) Hydrogen chloride gas was bubbled into water.

(i) Name the substance formed. *(½mark)*

……

(ii) Explain why an aqueous solution of hydrogen chloride is an electrolyte whereas the

solution of the gas in methylbenzene is a non – electrolyte. *(1½marks)*

(Equations not required)

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……

9. A certain mass of Zinc powder was reacted with hydrochloric acid at room temperature. (a) Sketch a graph to show how the volume of the gaseous product varies with time. *(02marks)*

(b) State what would happen if copper (II) sulphate solution is added to the reaction mixture at room temperature. *(01mark)*

……

……

(c) Explain what would happen if zinc granules were used instead of zinc powder. *(02marks)*

……

……

……

10. (a) Write an equation for the complete combustion of methane. *(1½marks)*

……

……

(b) A litre of methane gas costs **UGX. 9500**. Calculate the cost of methane required to produce 445000J of heat energy at room temperature. *(03marks)*

($The\ enthalpy\ of\ combustion\ \ of\ Methane\ is - 890kJmol^{-1}$)

……

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……

(c) State **one** constituent of natural gas other than methane. *(½mark)*

……

SECTION B (30 MARKS)

Answer any **two** *questions from this section.*

11. (a) The atomic numbers of the elements **P, *Q*** and **R** are 14, 19 and 17 respectively.

(i) What is **atomic number**? *(01mark)*

(ii) Write the electronic structures of **P, *Q*** and **R**. *(03marks)*

(b) **P** and **R** can each combine with ***Q*** to form compounds.

(i) Use valency electrons to explain briefly how the atoms **P** and ***Q***, **R** and ***Q*** form compounds. *(06marks)*

(ii) Write the structural formula of the compound formed when **R** combines with ***Q***. *(01mark)*

(c) State **two** properties of the compounds formed between:

(i) **P** and ***Q*** *(02marks)*

(ii) **R** and ***Q*** *(02marks)*

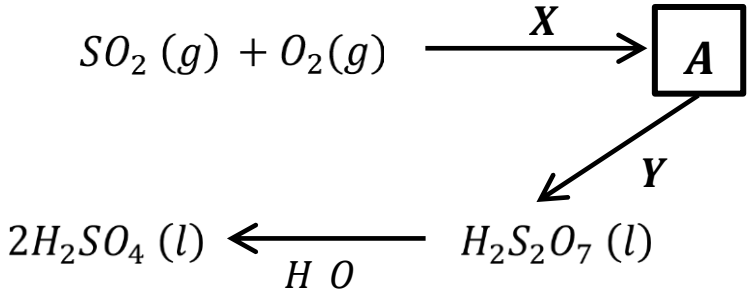
12. (a) Sulphur dioxide can be prepared in the laboratory using sodium sulphite and sulphuric acid.

(i) Outline how a pure dry sample of Sulphur dioxide can be prepared in the laboratory from the above reaction. **(Diagram not required)**. *(06marks)*

(ii) Name **one** other suitable substance that reacts with sodium sulphite to produce sulphur dioxide in the laboratory. *(01mark)*

(b) Write an equation for the reaction in a(ii). *(1½marks)*

(c) The flow diagram below shows a series of chemical reactions in order to prepare sulphuric acid from Sulphur dioxide.



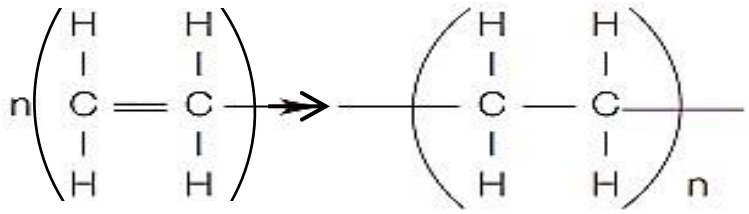
(i) Name the chemical reagents ***X*** and ***Y***. *(01mark)*

(ii) State the condition leading to the formation of substance ***A*** other than addition of ***X***. *(01mark)*

(d) Explain the reaction of Sulphur dioxide with acidified potassium dichromate. *(3½marks)*

(e) State **one** use of Sulphur dioxide gas in the paper industry. *(01mark)*

13. (a) The equation below shows formation of a synthetic polymer.



(i) Name the polymer formed. *(01mark)*

(ii) State **one** use of the above polymer. *(01mark)*

(iii) Give **two** examples of synthetic polymers other than the one you have named in (a)(i). *(02marks)*

(b) State what would be observed if concentrated sulphuric acid was added to:

(i) ethanol at 180^0. *(01mark)*

(ii) sugar. *(01mark)*

(c) (i) Write an equation for the reaction in b(i) *(01mark)*

(ii) Explain your observation in b(ii) and illustrate your answer with an equation. *(03marks)*

(d) Alcohols are globally used in the manufacture of sanitizers. Briefly describe how concentrated ethanol can be obtained from millet flour. *(05marks)*

14. The diagram in figure **2** shows a setup of the apparatus that can be used to prepare a salt **X**.

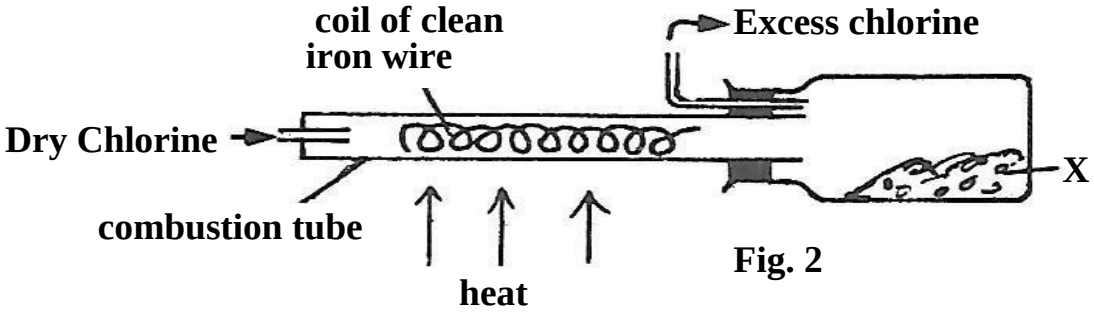


Fig. 2

(a) (i) Identify salt **X**. *(01mark)*

(ii) Briefly describe how salt **X** is formed from the apparatus above.
(03marks)

(iii) Write an equation leading to the formation of salt **X**. *(1½marks)*

(b) (i) State what happens when **X** is dissolved in water. *(01mark)*

(ii) State what would be observed if aqueous ammonia was added to the solution in b(i) until in excess. *(01mark)*

(iii) Write an ionic equation for the reaction in (b)(ii). *(1½marks)*

(c) Hydrogen gas was used to reduce 65g of **X**. Calculate the minimum volume of hydrogen required to react completely with **X** at room temperature.
(06marks)

END