Candidate's Name: .....

School:.....

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Sign: .....

Centre No.					Personal No.		
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545/2
CHEMISTRY
Paper 2
JULY/AUG. 2022
2 hours

HOIMA DIOCESE EXAMINATIONS BOARD

UCE Mock Examination, 2022

CHEMISTRY
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 and must be in* **blue** *or* **black** *ink.*

Any work done in ***pencil*** *will not be marked except drawings.*

Mathematical tables and silent non-programmable calculators may be used where necessary use;
$H = 1$, $C = 12$, $O = 16$, $N = 14$, $S = 32$, $Cl = 35.5$, $Na = 23$, $Fe = 56$, $Mg = 24$, $Zn = 65$.

1 mole of gas occupies 24 dm^3 at room temperature.

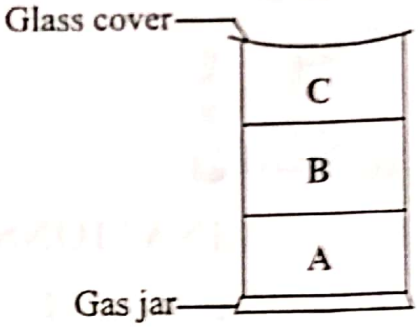
1 mole of gas occupies 22.4 dm^3 at s.t.p

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

SECTION A (50 MARKS)

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

1. Some small quantities of **dry** samples of carbon dioxide and ammonia gases were carefully collected into the same gas jar. The jar was then covered and left to stand for short time such that the gases separately settled in the regions **A**, **B** and **C** as shown below.



(a) In which of the regions **A**, **B** and **C** did

(i) ammonia gas settle? *(0½ mark)*

.....

(ii) carbon dioxide gas settle? *(0½ mark)*

.....

(iii) none of these two gases settled there? *(0½ mark)*

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(b) Briefly explain your answers in (a). *(01½ marks)*

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(c) The glass cover was carefully removed and dry hydrogen chloride gas was also directed into the gas jar.

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

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(ii) Write equation of the rection that took place. *(01½ marks)*

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2. The table below shows the ions and their electronic configuration of elements in the periodic table represented by alphabetical letters ***P***, ***Q***, ***R*** and ***T***.

Ions of elements	Electronic configuration of the ion
P^{2-}	2:8
Q^{3-}	2:8
R^{2+}	2:8:8
T^{+}	2:8:8

(a) To which period in the periodic table do the following elements belong?

(i) ***P*** *(0½ mark)*

.....

.....

(ii) ***R*** *(0½ mark)*

.....

.....

(b) State the group to which element ***Q*** belongs. *(0½ mark)*

.....

.....

(c) (i) Write the formula of the compound formed between ***P*** and ***Q***. *(0½ mark)*

.....

.....

(ii) Give **one** property of the compound formed between ***P*** and ***Q***. *(0½ mark)*

.....

.....

(d) A solution of the compound formed in (c) above whose pH value is 5.7 was added to magnesium carbonate power in a test tube.

(i) State what was observed. *(01½ marks)*

.....

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(ii) Write ionic equation of the reaction that took place. *(01½ marks)*

.....

.....

3. Zinc, iron, copper and magnesium are metals commonly used to make alloys.

(a) What is an alloy? *(01 mark)*

.....

.....

(b) Which of these metal(s) is used to make an alloy used in the making of

(i) medals? *(0½ mark)*

.....

.....

(ii) bodies of aeroplanes? *(0½ mark)*

.....

.....

(c) The metal you named in (b) (i) can react with concentrated nitric acid.

(i) State what is observed. *(01½ marks)*

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.....

(ii) Write equation for the reaction that takes place. *(01½ marks)*

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.....

4. Sodium carbonate solution was added to little amount of hard water in a beaker.

(a) (i) State what was observed. *(0½ mark)*

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.....

(ii) Write ionic equation of the reaction that took place. *(01½ marks)*

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.....

(b) To the resultant content in the beaker, excess dilute nitric acid was added while stirring followed by excess aqueous ammonia.

State what was observed. *(02 marks)*

.....

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.....

(c) Other than the use of sodium carbonate, give one other chemical method and one physical method that can remove all forms of hardness in water.

(i) Physical. *(0½ mark)*

.....

.....

(ii) Chemical. *(0½ mark)*

.....

.....

5. The table below shows the results of the tests that were carried out on a solution of compound *W*. Use the table to answer the questions that follow below.

NO.	TEST	OBSERVATION
I	Sodium hydroxide solution was added drop wise until in excess.	White precipitate insoluble in excess alkali.
II	Ammonium hydroxide solution was added drop wise until in excess.	No observable change.
III	Lead (II) nitrate solution was added and the mixture was heated.	White precipitate soluble on heating but reappears on cooling.

(a) Suggest the cation(s) that is/ are present at test **I**. *(01 mark)*

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.....

(b) Identify the

(i) cation present in *W*. *(0½ mark)*

.....

.....

(ii) anion present in *W*. *(0½ mark)*

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.....

(c) A small amount of the solid compound, *W*, was placed on a watch-glass and left in open air for some time.

(i) State what was observed. *(0½ mark)*

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(ii) Name the process that took place. *(0½ mark)*

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(iii) Suggest **one** laboratory use of compound, *W*. *(0½ mark)*

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6. Copper (II) sulphate was added to a reaction of 4.5 g of impure zinc granules with excess dilute sulphuric acid. The reaction produced 580 cm^3 of gas, ***K***, at room temperature.

(a) (i) Identify gas, ***K***. *(0½ mark)*

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(ii) Write equation of the reaction that took place. *(01½ marks)*

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(b) Calculate

(i) the mass of zinc granules that reacted. *(02 marks)*

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(ii) the percentage of zinc in the impure mixture. *(01 mark)*

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7. The compound, $Y_4 . H_2O$ (Formula mass = 236) which is a nitrate of a group II metal, **Z**, was heated strongly in a dry test tube until there was no further change.

(a) (i) Write the formula of part, *Y*, of the compound in terms of the metal, *Z*. *(0½ mark)*

.....

.....

(ii) What does the value "4" represent in the formula of this compound? *(0½ mark)*

.....

.....

(b) (i) State what was observed when the compound was strongly heated. *(01 mark)*

.....

.....

(ii) Write equation of reaction involving metal, *Z*, showing what took place when the compound was heated. *(01½ marks)*

.....

.....

(c) The gaseous product of the heated compound was bubbled through water. Write equation of the reaction that took place. *(01½ marks)*

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(d) Determine the atomic mass of *Z*. *(01 mark)*

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8. 25.0 cm^3 of 4 M solution of dilute hydrochloric acid was reacted completely with 1.2 g of a strip of magnesium that was 10 cm long.

(a) Calculate the number of moles of

(i) magnesium ribbon that reacted. *(01 mark)*

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(ii) hydrochloric acid that reacted. *(01 mark)*

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(b) Deduce the reaction ratio between the acid and magnesium ribbon. *(01 mark)*

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(c) State **two** ways in which this reaction would move at a faster rate. *(01 mark)*

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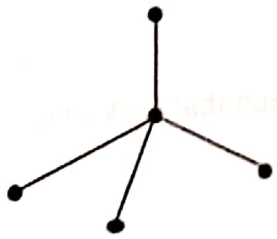
9. The figure below shows a unit of the structure of one of the crystalline allotropes of carbon where " ● " represents a carbon atom.



(a) What are **allotropes**? *(01 mark)*

.....

.....

.....

(b) (i) Which allotrope consists of the unit above in its structure? *(0½ mark)*

.....

.....

(ii) What type of structure is adopted by this unit? *(0½ mark)*

.....

.....

(c) (i) Give **one** physical property of the allotrope you have given in (b) above. *(0½ mark)*

.....

(d) (i) Name one allotrope of carbon which is a different category from the one you have given in (b) (i). *(0½ mark)*

.....

.....

(ii) Give **one** use of this allotrope you have named. *(0½ mark)*

.....

(e) An oxide of carbon can react with purified magnetite.

(i) Name this oxide of carbon. *(0½ mark)*

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(ii) State the role of this oxide in this reaction. *(0½ mark)*

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(iii) Write equation of the reaction that took place. *(01½ marks)*

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10. Coper metal can react with sulphuric acid.

(a) (i) State the condition(s) that can enable the reaction to take place. *(01 mark)*

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.....

(ii) Write equation of the reaction that takes place. *(01½ marks)*

.....

.....

(b) State what is observed when the gaseous product bubbled

(i) through potassium dichromate solution. *(0½ mark)*

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(ii) into a gas jar containing damp blue litmus paper for some time. *(0½ mark)*

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(c) Briefly, explain your answer in (b) (ii). *(01 mark)*

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SECTION B (30 MARKS)

Attempt any **two** *questions from the sheets/booklet provided.*

11. During the treatment and prevention of COVID-19, some components of the substances shown in the table below were used to cure the patients and also kill the COVID -19 germs.

SUBSTANCES	COMPONENT
Atmospheric air	Gas, ***Q***
Sanitizer	Ethanol
Soap	Sodium stearate

(a) (i) Name gas ***Q***. *(0½ mark)*

(ii) Other than industrially getting gas, ***Q*** from the atmosphere, an oxide of sodium was reacted with water as an emergency to get this gas that was required urgently.
Name this oxide and write equation of the reaction that takes place. *(02 marks)*

(iii) If 70.56 litres of gas, ***Q***, was required by each COVID – 19 patient at room temperature, calculate the mass of the oxide of sodium needed to produce gas, ***Q*** in order to treat 25 patients. *(04 marks)*

(b) (i) Name one raw material in your locality from which component of sanitizer is obtained. *(0½ mark)*

(ii) State the process leading to the formation of this component from the substance you have named in (b) (i) and write equation of the reaction that takes place. *(02 marks)*

(iii) Write equation of the reaction that takes place when the component of sanitizer is reacted with sulphuric acid and give **one** of the conditions for the reaction to take place. *(01½ marks)*

(c) The component of soap can be obtained according the reaction stages below;

$$\text{Muton} + N \xrightarrow{\textbf{Boil}} \text{Mixture, } L \xrightarrow{\textbf{Solution } K} \text{Sodium Stearate.}$$

(i) Name substance, ***N***. *(0½ mark)*

(ii) Why is solution, ***K*** added to mixture, ***L*** in this reaction? *(01 mark)*

(iii) Give **one** other substance that can be used instead of muton. *(0½ mark)*

(iv) Write equation of the reaction between sodium stearate and magnesium sulphate. *(01½ marks)*

(v) State **one** application of the reaction in (c) (iv) above. *(0½ mark)*

(d) Name **one** substance other than those stated in the table that was also used to prevent the people from getting infected with COVID -19. *(0½ mark)*

12. Molten sodium chloride is an industrial electrolyte where chlorine gas is produced at the anode.

(a) What do you understand by the terms;

(i) **Electrolyte?** *(01 mark)*

(ii) **Anode?** *(01 mark)*

(b) In which other industrial form of this electrolyte is chlorine produced at the anode? *(0½ mark)*

(c) Name other product(s) produced industrially when sodium chloride is in the

(i) molten form. *(0½ mark)*

(ii) form you have given in (b). *(0½ mark)*

(d) Name the materials used as the cathode for the two industrial forms of the electrolyte given above. *(01 mark)*

(e) Write equation of the reaction that takes place at the cathode for **one** form of the electrolyte given above. *(01½ marks)*

(f) Describe an experiment to show how dry choline gas can be prepared in the laboratory using potassium manganate (iv) as one of the reagents. **(No diagram required).** *(05 marks)*

(g) 600 cm^3 of chlorine completely oxidizing a certain amount of iron metal at s.t.p.

(i) Write equation of the reaction that takes place. *(01½ marks)*

(ii) Calculate the mass of the product that was obtained in this reaction. *(02½ marks)*

13. Ammonia gas is a common reducing agent that can reduce copper (ii) oxide.

(a) (i) What is a "**reducing agent**"? *(01 mark)*

(ii) State what is observed when ammonia gas is passed over copper (II) oxide under suitable conditions. *(01 mark)*

(iii) Write equation of the reaction that takes place. *(01½ marks)*

(b) Name **one** other gas that can reduce copper (II) oxide. *(0½ mark)*

(c) Describe how a dry sample of ammonia gas can be prepared in the laboratory. *(06½ marks)*

(d) The flow diagram below shows how nitric acid is manufactured.

$$P + NH_3 \xrightarrow[\Delta]{} \text{Catalyst Chamber} \xrightarrow{Q} \text{Cooler} \xrightarrow{P + R} \text{Water} \rightarrow \text{Nitric acid.}$$

(i) Identify ***P*** and ***R***. *(01 mark)*

(ii) Write equation of the leading to the formation of gas, ***Q***. *(01½ marks)*

(iii) State **one** large scale use of nitric acid. *(0½ mark)*

(e) Name any **one** raw material and the conditions used during the manufacture of ammonia gas. *(01½ marks)*

14. (a) Define the term "**solubility of a salt**". *(01½ marks)*

(b) Zinc sulphate crystals readily dissolve in water. Given that 77.5 g of saturated solution of zinc sulphate contains 37.0 g of the salt.

(i) Calculate the solubility of Zinc sulphate. *(02 marks)*

(ii) Describe how a dry sample of zinc crystals can be obtained from sulphate crystals can be obtained from a suitable acid and a compound of zinc. (**No diagram is required**). *(05½ marks)*

(c) The data below shows the solubilities of Zinc sulphate at various temperatures.

Temperature, °C	0	20	40	60	80	100
Solubilities of $ZnSO_4$, grams per 100 g of water	4.0	5.5	12.0	20.5	36.5	60.0

Plot the graph of solubility of Zinc sulphate against temperature. Use the graph to determine the mass of zinc sulphate that would crystalize out if a saturated solution of Zinc sulphate at **75°C** is cooled down to **15° C**. *(06 marks)*

END