

545/2
CHEMISTRY
Paper 2
18th July 2022
2 Hours

Name :

Signature : Personal No :



KAMPALA WAKISO GIANT SCHOOLS' ASSOCIATION (KWGSA)

National Joint Mock Examination 2022

Uganda Certificate of Education

CHEMISTRY

Paper 2

2 Hours

INSTRUCTIONS TO CANDIDATES

- *This paper consists of two sections A and B, section A consists of ten(10) structured questions and section B consists of four(4) semi structured questions*
- *Answer **all** questions in section A and any two (2) from section B.*
- *All answers for section A must be written in the spaces provided.*
- *Answers to section B, **must** be written in the answer booklet(s) provided*
- *In both Sections, all workings and calculations must be clearly shown clearly.*

Where necessary

(H=1, C=12, N=14, O=16, Na=23, S=32, Cl=35.5, Pb = 207, Zn = 65, Cu = 64, Al=27)

1 mole of a gas occupies 24dm³ at room temperature.

1 mole of a gas occupies 22.4dm³ at s.t.p

| For Examiner's use only | | | | | | | | | | | | | | |
|-------------------------|----|----|----|----|----|----|----|----|-----|-----|-----|-----|-----|-------|
| Q1 | Q2 | Q3 | Q4 | Q5 | Q6 | Q7 | Q8 | Q9 | Q10 | Q11 | Q12 | Q13 | Q14 | Total |
| | | | | | | | | | | | | | | |

SECTION A (50 MARKS)

*Answer **all** questions in this Section.*

All workings must be shown clearly in the spaces provided

1. (a) Air is considered to be a mixture but not a compound.
- (i) Give any **two** reasons to support the above statement. (01 mark)
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- (ii) Name the **two** major air components in the atmosphere. (01 mark)
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- (iii) Name **one** suitable method that can be used to obtain each of the above air components in their pure state. (½ marks)
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- (b) Magnesium reacts with each of the above components to form compounds **X** and **Y**.
- (i) Name the compounds **X** and **Y**. (01 mark)
- X**
- Y**
- (ii) Name **one** other metallic element that react with air in a similar way as magnesium. (½ mark)
-
2. Oxalic acid ($\text{H}_2\text{C}_2\text{O}_4$) when heated with an acid **P** decomposes to form gases **A** and **B**, Gas **B** turns lime water milky and Gas **A** is collected under card boards.
- (a) Name the;
- (i) Acid **P** (½ mark)
- (ii) Gas **A** (½ mark)
- (iii) Gas **B** (½ mark)

- (iv) type of reaction above ($\frac{1}{2}$ mark)
- (b) Write the equation for the reaction leading to the formation of the gases **A** and **B** from Oxalic acid and acid **P**. (01 mark)

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- (c) (i) State the role of acid **P** in the above reaction. ($\frac{1}{2}$ mark)

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- (ii) Give a reason why gas **A** is collected under card boards. ($\frac{1}{2}$ mark)

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- (d) State the industrial use of;

- (i) Gas **A**. ($\frac{1}{2}$ mark)

.....

- (ii) Gas **B**. ($\frac{1}{2}$ mark)

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3. Ammonia gas can be obtained on large scale from Nitrogen and hydrogen

- (a) Name the;

- (i) process by which ammonia gas can be obtained on large scale. ($\frac{1}{2}$ mark)

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- (ii) source of nitrogen. (1½ marks)

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- (iii) Write the equation leading to the formation of ammonia gas from nitrogen and hydrogen. ($\frac{1}{2}$ mark)

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- (b) Name the acid that react with ammonia to form;

(i) Ammonium Nitrate. (½ mark)

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(ii) Ammonium sulphate. (½ mark)

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(c) Calculate the percentage of Nitrogen in;

(i) Ammonium Nitrate. (1½ mark)

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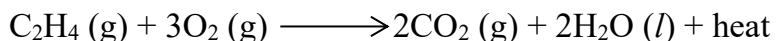
(ii) Ammonium sulphate. (1½ mark)

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4. (a) Define the term **enthalpy of combustion** (02 mark)

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(b) Ethene gas burns in air according to the equation below;



When 8.4g of ethene are burnt in air, 56KJ of heat are produced. Calculate the molar enthalpy of combustion of ethene. (03 marks)

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5. When a green powdered solid **T** was heated strongly, a black residue **R** and a gas **W** which turns water to milky was given out.

(a) Name the;

(i) Solid **T**. (01 mark)

.....

(ii) Residue **R**. (½ mark)

.....

(iii) Gas **W**. (01 mark)

.....

(b) Write the equation leading to the formation of gas **W** and residue **R**. (01 mark)

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(c) The residue above was dissolved in dilute hydrochloric acid

(i) State what was observed. (½ mark)

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(ii) Write the equation for the reaction that took place. (01 mark)

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6. (a) Define the term **electrolyte**. (01 mark)

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(b) Molten copper (II) bromide was electrolysed using graphite electrodes,
State what was observed at the;

(i) Cathode. (½ mark)

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(ii) Anode (½ mark)

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(c) Write the ionic equation for the reaction that took place at;

(i) Cathode. (01 mark)

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.....

(ii) Anode (01 mark)

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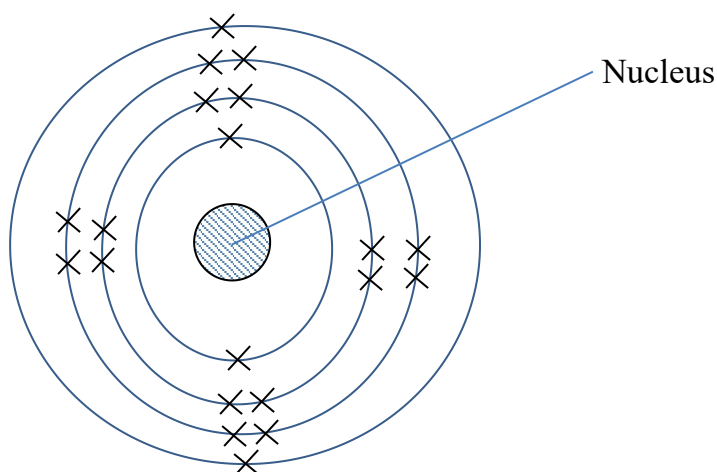
(d) Give a reason why molten copper (II) bromide conduct electricity but a solid of copper (II) bromide. (01 mark)

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7. (a) Distinguish between **atomic number** and **mass number** of an element. (01 mark)

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(b) The diagram below shows the electronic structure of an atom **T**.



(i) With a reason, state the group in the periodic table where atom **T** belong. (01 mark)

.....

(ii) With a reason, state the period in the periodic table where **T** belong. (01 mark)

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(iii) Write the electronic configuration of **T**. (½ mark)

.....

(iv) How many electrons does **T** contain if it has a mass number of 43. (½ mark)

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(c) (i) Write the formula of the nitride of **T**. (½ mark)

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(ii) State the type of bond that exists in the above nitride. (01 mark)

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8. Natural rubber is very soft and slippery but it can be made hard before use by heating it with an element **Z** to form a hard solid **N**.

(a) (i) Name the above process. (½ mark)

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(ii) Name the element **Z**. (½ mark)

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(iii) Name the solid **N** after heating rubber with **Z**. (½ mark)

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(b) State any **two** uses of solid **N**. (01 mark)

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(c) Distinguish between natural polymer and synthetic polymer. (01 mark)

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(d) Complete the table below.

(02 marks)

| Polymer | Monomer |
|-----------|---------|
| Polythene | |
| Cellulose | |
| Protein | |
| PVC | |

9. Sulphuric acid is a strong dibasic acid.

(a) Define the terms

(i) Strong acid.

(01 mark)

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.....

(ii) Dibasic acid.

(01 mark)

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(b) Write the ionic equation to show how Sulphuric acid ionise in water.

(01 mark)

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(c) Dilute Sulphuric acid was added to barium nitrate followed by dilute nitric acid in a test tube.

(i) State what was observed.

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(ii) Write an ionic equation for the reaction that took place.

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10. (a) A hydrated salt **T** contains 22.65% Zinc, 11.15% Sulphur, 22.30% Oxygen and 43.90% water of crystallization. Calculate the simplest formula of the salt. (03 marks)

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- (b) 7.18g of **T** were dissolved in 250cm³ of water to make 0.1M of a solution. Calculate the molecular mass of the salt **T**. (03 marks)

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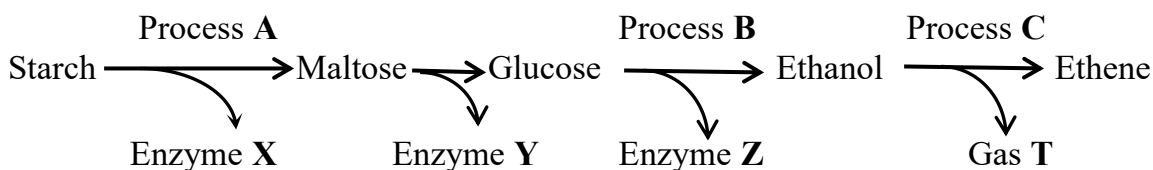
SECTION B (30 MARKS)

*Attempt any two questions from this section
Any additional question(s) answered will not be marked.*

11. (a) (i) Draw a labeled diagram to show how a pure dry sample of hydrogen chloride can be prepared in the laboratory from sodium chloride. (03 marks)
- (ii) Write the equation leading to the formation of hydrogen chloride from sodium chloride. (1½ marks)
- (b) Explain why;
- (i) hydrogen chloride is prepared by upward displacement method.
- (ii) hydrogen chloride is not prepared over water. (01 mark)
- (c) State what is observed and write equations in each case when hydrogen chloride is bubbled through;
- (i) hot iron gauze (02 marks)
- (ii) acidified silver nitrate solution. (2½ mark)

- (d) 25.0cm^3 of hydrous sodium carbonate required 17.5cm^3 of 0.2M hydrochloric acid for complete reaction. Calculate the molar concentration of sodium carbonate used. (05 marks)

12. Ethanol can be prepared from starch powder according to the process below.



- (a)
 - (i) Name the processes **A**, **B** and **C**. (1½ marks)
 - (ii) Name the enzymes **X**, **Y** and **Z**. (1½ marks)
 - (iii) Name the gas **T**. (½ mark)
 - (b) Write the equation that took place in;
 - (i) Process **B**. (01 mark)
 - (ii) Process **C**. (01 mark)
 - (c) State the;
 - (i) main source of the enzymes **X**, **Y** and **Z**. (½ mark)
 - (ii) conditions necessary for the process **C** to take place (01 mark)
 - (d)
 - (i) An organic compound **T** contains 85.7% carbon and 14.3% hydrogen. Calculate the empirical formula of the compound. (03 marks)
 - (ii) If 0.21g of **T** occupies a volume of 0.08dm^3 at room temperature, calculate the molecular formula of the compound **T**. (03 marks)
 - (iii) Write the structural formula of **T**. (01 mark)
 - (e)
 - (i) Name **one** reagent that can be used to distinguish between ethene and ethane. (01 mark)
 - (ii) State what is observed in each case when the reagent above is treated separately with ethene and ethane. (03 marks)
13. (a) Describe how a pure dry sample of ammonia gas can be prepared from calcium hydroxide in the laboratory. (No diagram is required but write the equations leading to the formation of ammonia gas). (01 mark)
- (b) Outline the equations only to show how the ammonia gas above can be converted to nitric acid. (03 marks)
- (c) A gas jar of ammonia was inverted into a gas jar of hydrogen chloride gas.
- (i) State what was observed. (01 mark)

- (ii) Write the equation for the reaction that took place. (1½ marks)
- (d) Lead (II) Nitrate crystals were strongly heated until there was no further change.
- (i) State what was observed. (1½ marks)
- (ii) Write the equation that took place. (1½ marks)
- (e) Write the equation for the reaction to show how silver Nitrate crystals decompose when heated strongly. (01 mark)
14. (a) Define the term **rate of a chemical reaction**. (01 mark)
- (b) State and explain how each of the following factors affect the rate of a chemical reaction
- (i) Temperature. (02 marks)
- (ii) Concentration. (02 marks)
- (c) In an experiment, magnesium ribbons were added to 100cm³ of 2M hydrochloric acid in a beaker.
- (i) Write the equation that took place. (01 mark)
- (ii) State any **two** ways in which the reaction can be made faster than before. (01 mark)
- (iii) Sketch a graph to show how the volume of a gas vary with time. (02 marks)
- (d) In an experiment, the rate of reaction between sodium thiosulphate and hydrochloric acid was measured at different concentrations of the sodium thiosulphate and recorded in the table below

| | | | | | | |
|---|------|------|------|------|------|------|
| Concentration of $\text{S}_2\text{O}_3^{2-} (\text{mol}^2 \text{dm}^{-6})$ | 0.01 | 0.04 | 0.09 | 0.16 | 0.25 | 0.36 |
| Rate of reaction (S^{-1}) | 0.16 | 0.32 | 0.48 | 0.64 | 0.80 | 0.96 |
| Square root of concentration of the $\text{S}_2\text{O}_3^{2-} (\text{mol} \text{dm}^{-3})$ | | | | | | |

- (i) Complete the table above by determining the square roots of concentration of the thiosulphate. (03 marks)
- (ii) Plot a graph of rate reaction against square roots of the concentration of the $\text{S}_2\text{O}_3^{2-} (\text{mol}^2 \text{dm}^{-6})$ (04 marks)
- (iii) Describe the shape of the graph. (01 mark)

END