

Name..... Signature.....  
 School..... Index No.....



*Kib*

0750-732031 (water)  
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545/2  
**CHEMISTRY**  
 Paper 2  
 July/August 2023  
 2 hours



## WAKISSHA JOINT MOCK EXAMINATIONS

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 these questions **must** be written in the spaces provided.
- Section B consists of 4 semi – structured questions. Answer any **two** questions from this section.
- Answers to section B must be written in the answer booklet/sheets provided and stapled at the back of the question paper.
- Show all your working clearly in both sections.  
 Where necessary use;  
 $[Ca = 40, Na = 23, C = 12, O = 16, H = 1, \text{Molar gas volume at s.t.p} = 22.4\text{dm}^3]$

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

## SECTION A

Answer all questions in this section.

1. (a) Steel and Magnesium oxide are both important chemical substances. (2 marks)

(i) State two properties that make steel different from magnesium oxide. (2 marks)

- Components of steel are separated by physical means while those of Magnesium oxide can not be separated by physical means.
- Components of steel vary in composition with pressure while those of magnesium oxide are of fixed composition.
- Steel components are physically combined while components of magnesium oxide are not physically combined.

(ii) State the method by which the components in steel can be separated. (1 mark)

Use of a magnet. ✓ ok

- (b) Ammonium chloride was dissolved in water to form a uniform solution. (1 mark)

(i) State what was observed when the solution is tested with methyl orange indicator. (1/2 marks)

Orange solution of methyl orange turns to pink. ✓ ok

Accept; Uniform Colourless solution turns to pink. ✓ ok

(ii) Give a reason for your answer. (2 marks)

Ammonium chloride undergoes hydrolysis in water forming ammonia solution, a weak base/alkalis and hydrochloric acid, a strong acid. The excess hydrogen ions from a strong acid formed neutralise the very few hydroxyl ions from a weak alkalis. This makes the resultant solution to have excess hydrogen ions making it acidic, thus turning methyl orange from orange to red. ✓ ok

2. The atom of element Z of mass number 31 has 15 protons. (1 mark)

(a) (i) State the number of neutrons in Z. (1 mark)

16 ✓ ok

(ii) Write the electronic configuration of the ion of Z. (1 mark)

2, 8, 8 ✓ ok Accept; 2, 8, 8 Accept; 2) 8) 8

(b) To which group of the periodic table does Z belong? (1/2 mark)

Group (V) ✓ ok

(c) Write the formula of the oxide of Z and state the type of bond in the oxide. (1 mark)

Formula:  $Z_2O_3$  ✓ ok (1 mark)

Type of bond: Covalent. ✓ ok (1/2 mark)

(d) An atom Q consists of 17 neutrons and 15 protons. Which term is used to describe the relationship between Q and Z? (1 mark)

Isotopes ✓ ok

Reject; Isotopy.

3. (a) Gas W can be prepared using a mixture of Zinc granules, dilute hydrochloric acid and Copper (II) sulphate. (1/2 marks)

(i) Identify gas W. (1/2 marks)

Hydrogen gas ✓ ok

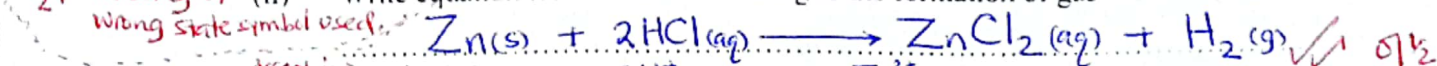
Accept;  $H_2$

Reject; Hydrogen( $H_2$ )



No mark for wrong chemical symbol used.  
No mark for unbalanced equation.

$\frac{1}{2}$  for missing or (ii) Write equation for the reaction leading to the formation of gas W. (1½ marks)



Accept ionic equation. (iii) State the role of copper (II) sulphate in the mixture. (½ marks)

To speed up the rate of reaction. Reject; To catalyse the reaction.

(b) Give a reason why nitric acid cannot be used instead of hydrochloric acid in the production of gas W. (1 mark)

Nitric acid is a strong oxidising agent that will oxidise the produced hydrogen to water. 01

(c) Gas W was burnt in excess air. State how the product formed can be identified in the laboratory. (1½ marks)

Reject wrong spelling of anhydrous.

To the product formed, anhydrous copper(II) sulphate powder is added. Observation: The product formed turns anhydrous copper(II) sulphate from white to blue. 0½

Accept; Anhydrous Cobalt(II) chloride; from blue to pink.

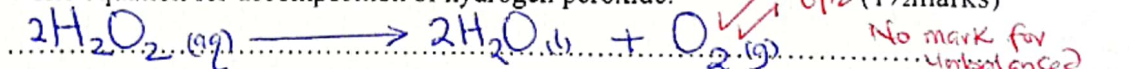
4. (a) Define the term rate of reaction. (1 mark)

Accept any other correct alternative definition.

Is the amount of products formed per unit time in a given reaction.  
OR Is the increase in concentration of products formed per unit time in a given reaction.  
OR Is the amount of reactants used up per unit time in a given reaction.  
OR Is the decrease in concentration of reactants used up per unit time in a given reaction.

(b) Oxygen can be prepared in the laboratory by decomposition of hydrogen peroxide.

(i) Write equation for decomposition of hydrogen peroxide. (1½ marks)



No mark for unbalanced equation.  
 $\frac{1}{2}$  for missing or wrong state symbol used.

(ii) State two factors that can affect the rate of production of oxygen gas. (2 marks)

Accept any two correct alternative

Temperature ✓  
Concentration of hydrogen peroxide  
Presence of a catalyst. Accept; Catalyst

(c) Name one other substance other than hydrogen peroxide that can be used to produce oxygen in the Laboratory. (½ marks)

Sodium peroxide ✓  
Accept; Acidified water

Accept; Potassium chlorate (though highly exothermic)

5. A compound R of formula mass 106 consists of 43.40% Sodium, 11.32% Carbon by mass and the rest being oxygen.

(a) Determine the molecular formula of R (Na = 23, C = 12, O = 16) (2 marks)

% of O =  $100 - (43.40 + 11.32) = 45.28\%$  ✓

Elements	Na	C	O
Composition	43.40	11.32	45.28
Moles	$\frac{43.40}{23}$	$\frac{11.32}{12}$	$\frac{45.28}{16}$ ✓
	1.887	0.943	2.830 ✓
Mole ratio	$\frac{1.887}{0.943}$	$\frac{0.943}{0.943}$	$\frac{2.830}{0.943}$ 02
	2	1	3

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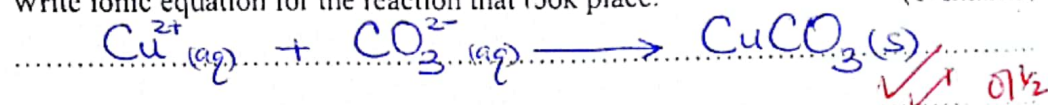
∴ Empirical formula is  $\text{Na}_2\text{CO}_3$  ✓

- (b) To an aqueous solution of R was added a solution containing copper (II) ions (1 1/2 marks)

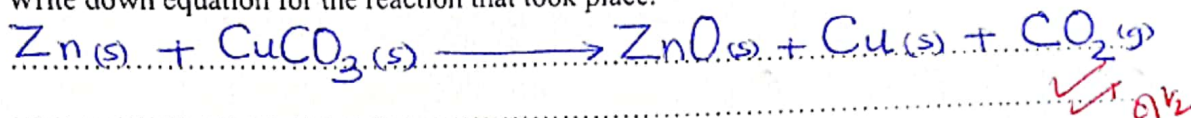
(i) State what was observed.

Green precipitate ✓ 0 1/2

(ii) Write ionic equation for the reaction that took place. (1 1/2 marks)



(c) Zinc dust was added to the product in (b) and the mixture warmed. Write down equation for the reaction that took place. (1 1/2 marks)



6. Sodium Sulphite and Calcium Carbonate when separately treated with dilute hydrochloric acid, gaseous products were formed.

(a) Identify the gaseous products formed when dilute hydrochloric acid reacts with: (1 mark)

(i) Sodium sulphite

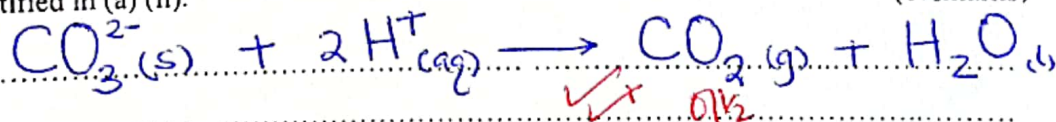
Sulphur dioxide ✓ @ Accept;  $\text{SO}_2$  Reject; Sulphurdioxide

(ii) Calcium carbonate (1 mark)

Carbon dioxide ✓ @ Accept;  $\text{CO}_2$  Reject; Carbon dioxide

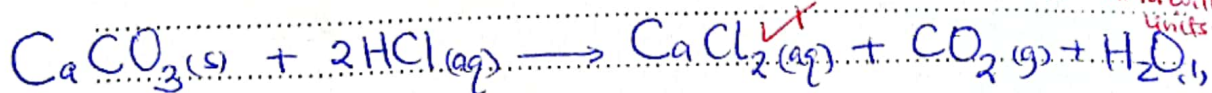
(b) Write ionic equation for the reaction leading to the formation of the gaseous products identified in (a) (ii). (1 1/2 marks)

No mark for Unbalanced equation  
- 1/2 for missing or wrong state symbol used.



(c) When 1.55 g of a mixture of calcium sulphate and calcium carbonate was treated with dilute hydrochloric acid, 22.4 cm<sup>3</sup> of carbon dioxide gas was evolved at s.t.p. Find the mass of calcium carbonate in the mixture. (2 1/2 marks)

Molar mass of  $\text{CaCO}_3 = 40 + 12 + (3 \times 16) = 100\text{g}$  ✓



From Equation;

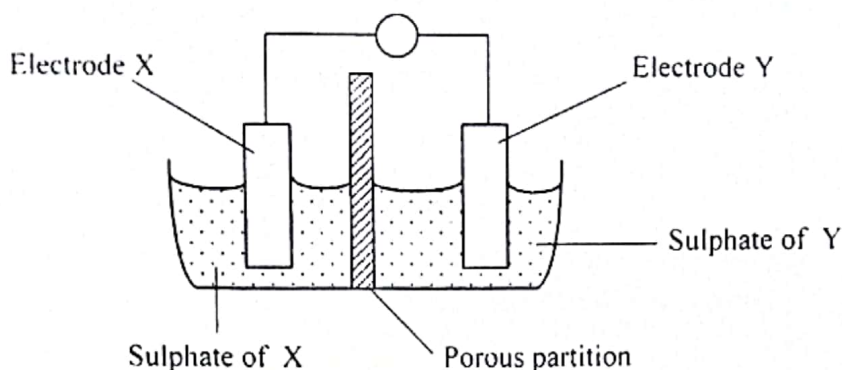
1 mole of  $\text{CO}_2$  is produced by 1 mole of  $\text{CaCO}_3$   
22400 cm<sup>3</sup> of  $\text{CO}_2$  is produced by 100 g of  $\text{CaCO}_3$  0 2 1/2

22.4 cm<sup>3</sup> of  $\text{CO}_2$  is produced by  $\left(\frac{22.4 \times 100}{22400}\right)$  g of  $\text{CaCO}_3$   
= 0.1 g of  $\text{CaCO}_3$  ✓

Reject final answer if not to 2 dp.



7 The diagram below shows a setup of a Daniell cell.



(a) Given that X and Y form divalent ions. Identify the metals that can be used as electrode X and Y.

- (i) X Zinc ✓  $\text{0 1/2}$  (1/2 mark)  
 (ii) Y Copper ✓  $\text{0 1/2}$  (1/2 mark)

(b) Write half cell equations for the reactions that took place at the electrode.

- (i) X  $\text{Zn(s)} \longrightarrow \text{Zn}^{2+}(\text{aq}) + 2\text{e}^-$  ✓  $\text{0 1}$  (1 mark)

- (ii) Y  $\text{Cu}^{2+}(\text{aq}) + 2\text{e}^- \longrightarrow \text{Cu(s)}$  ✓  $\text{0 1}$  (1 mark)

(c) Suggest with a reason the electrode acting as the cathode. (2 marks)

Y Accept: Copper ✓ It is lower in electrochemical series than Zinc. (X)  
 Accept equivalent correct response. } - less electropositive  
 } - less reactive

8. (a) Define the term **heat of combustion**. (1 mark)

Is the heat given out when one mole of a substance is completely burnt in excess oxygen. ✓  $\text{0 1}$

(b) Methane burns in oxygen according to the equation.



Given that the enthalpy of combustion of methane is  $-890 \text{ kJ mol}^{-1}$ .

(i) Calculate the mass of methane that must be burnt to produce  $-5050 \text{ kJ}$  of heat (2 1/2 marks)

Molar mass of  $\text{CH}_4 = 12 + (1 \times 4) = 16 \text{ g}$  ✓

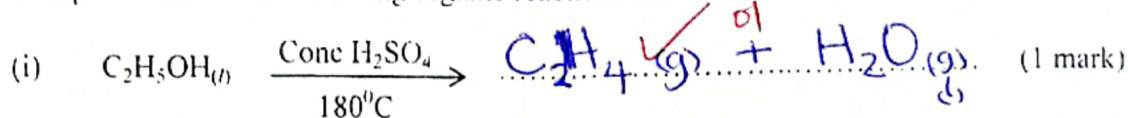
$890 \text{ kJ}$  of heat is produced by  $16 \text{ g}$  of  $\text{CH}_4$  ✓  $\text{0 2 1/2}$   
 $5050 \text{ kJ}$  of heat is produced by  $\left(\frac{5050 \times 16}{890}\right) \text{ g}$  of  $\text{CH}_4$  ✓  
 $= 90.79 \text{ g}$  of  $\text{CH}_4$  ✓

- (ii) Which of the two substances, methane and ethane, would produce more heat? Briefly explain your answer. (1½marks)

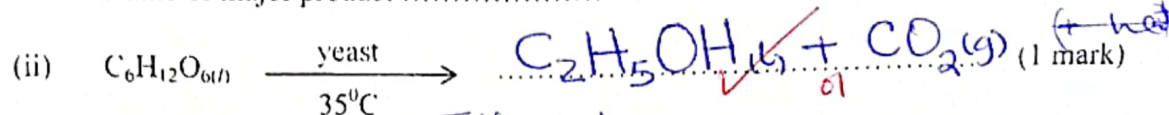
Ethane ✓

Ethane (C<sub>2</sub>H<sub>6</sub>) has more number of Carbon atoms than methane (CH<sub>4</sub>). The more number the Carbon atoms in a hydrocarbon the more heat evolved. 0½

9. (a) Complete each of the following organic reactions and in each case name the major product.



Name of major product Ethene ✓ 0½



Name of major product Ethanol ✓ 0½

- (b) Name a reagent that can be used to identify the major product in (a) (i) above. (1 mark)

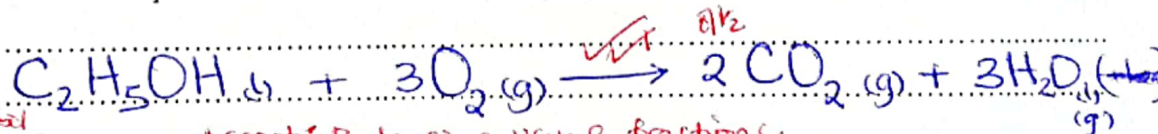
Bromine water ✓

Accept: Bromine liquid

or Acidified potassium manganate(VII) solution

or alkaline potassium manganate(VII) solution. (1½marks)

- (c) Write the equation for combustion of the major product in (a) (ii) above. (1½marks)



Accept: Balancing using fractions.

-½ for wrong or missing state symbols  
No mark for unbalanced equation

10. (a) Common salt is prepared in the laboratory by reacting Sodium hydroxide and hydrochloric acid.

Name the process of salt formation used. (1 mark)

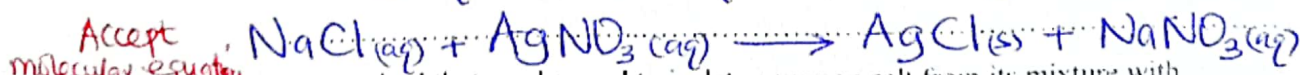
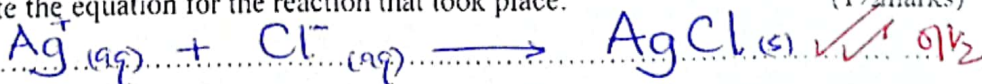
Neutralisation. ✓

- (b) To an aqueous solution of common salt was added silver nitrate solution followed by dilute nitric acid.

- (i) State what was observed. (1 mark)

white precipitate insoluble in acid. ✓

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



- (c) Name one method that can be used to isolate common salt from its mixture with Sodium Carbonate. (½marks)

Fractional crystallisation.

Reject wrong spelling