

CHEMISTRY THEORY

Date: 26/June/2023

Period: 8:30 am-11:30 am



END OF TERM III EXAMINATIONS

LEVEL :ORDINARY

GRADE :SENIOR TWO (S2)

DURATION :3 HOURS

MARKS:

/ 100

INSTRUCTIONS

1.This paper comprises two sections **A** and **B**

-Section A: Attempt all fifteen (15) questions. **(70 marks)**

-Section B: Attempt any three (3) out of five (5) questions. **(30 marks)**

2.You do not need the periodic table.

3. Silent-non programmable calculators may be used.

4. Use a **blue** or **black** pen for answering and pencil for drawing.

SECTION A: ATTEMPT ALL QUESTIONS

(70 marks)

1) Solutions in contact with electricity can be categorized as electrolytes or non-electrolytes.

a) Define the term “electrolyte”. **(1 mark)**

b) Choose the correct answer.

(i) Both sucrose and urea are good examples of: **(1 mark)**

A. strong electrolytes

B. weak electrolytes

C. non-electrolytes

D. all of the above

(ii) A weak electrolyte among the following is: **(1 mark)**

A. acetic acid (CH₃COOH)

B. sodium hydroxide (NaOH)

C. nitric acid (HNO₃)

D. hydrochloric acid (HCl)

2) The increase of World population involves a rise in waste materials.

a) List any two sources of wastes in the environment. **(1 mark)**

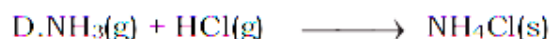
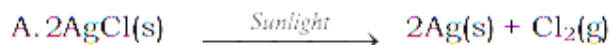
b) Differentiate between recycling and reusing as two techniques used in effective waste management. **(2 marks)**

3) Atoms combine with one another in order to attain stability.

a) What does stability of atoms mean? **(1 mark)**

b) State three possible ways by which atoms get their stability. **(3 marks)**

4) Different categories of chemical reactions exist. Given the following equation of reactions.



Classify each of the above chemical reactions either as; **1.** Combination reaction, **2.** Decomposition reaction, **3.** Single replacement reaction or **4.**

Double displacement reaction. Answers should be like E → 5 **(4 marks)**

- 5) Salt are prepared with use of different types of reactions.
- a) Write a balance chemical equation, with state symbols, to show how calcium carbonate is obtained by passing carbon dioxide gas through lime water (calcium hydroxide solution). **(2 marks)**
- b) Give any one use for each of the following salts:
- (i) Sodium chloride (NaCl) **(1 mark)**
- (ii) Sodium carbonate (Na₂CO₃) **(1 mark)**
- 6) Solutions differ depending on the amount of solute dissolved.
- a) Distinguish between saturated and unsaturated solutions. **(2 marks)**
- b) At 30°C, 7 grams of sugar dissolves in 5 grams of water to form a saturated solution. Find the solubility of sugar. **(2 marks)**
- 7) The physical properties of gases have been studied through gases laws.
- a) Explain what is meant by “ideal gas”. **(1 mark)**
- b) Match each gas law statement on left to the gas law relationship on right.
- Answers should be like 5 → F **(3 marks)**
- | <u>Gas law statement</u> | <u>Gas law relationship</u> |
|---|-----------------------------|
| 1. Pressure remaining constant, the volume of a given mass of gas is directly proportional to its absolute temperature. | A. $V \propto N$ |
| 2. Equal volumes of all the gases under similar conditions of temperature and pressure contain equal number of molecules. | B. $P \propto \frac{1}{V}$ |
| 3. The temperature remaining constant, the volume of a given mass of gas is inversely proportional to the pressure applied to it. | C. $V \propto T$ |
- 8) Given the molecular formula of copper (II) sulphate pentahydrate CuSO₄.5H₂O. (Atomic masses: Cu = 63.5, S=32, O=16, H=1).
- a) Determine the molecular mass for CuSO₄.5H₂O. **(1 mark)**
- b) Calculate the percentage of copper, total oxygen and hydration, in CuSO₄.5H₂O. **(3 marks)**
- 9) Read each of the following statements and answer with True (T) or False (F).
- a) Calcium reacts with oxygen to form calcium hydroxide. **(1 mark)**

- b) Oxide of sulphur reacts with water to form an acid. **(1 mark)**
- c) Corrosion is a natural process which converts a refined non-metal to a more stable form of its oxide or hydroxide. **(1 mark)**
- d) An acidic oxide turns a moist red litmus solution into blue. **(1 mark)**
- 10)** Explain the following statements about the properties of metals and nonmetals.
- a) Copper is used in making wires. **(1 mark)**
- b) When an iron nail is beaten with a hammer it bends without breaking down but when a pencil is beaten it breaks down easily. **(2 marks)**
- c) Both fluorine and iodine are group 17 elements. The atomic numbers of fluorine and iodine are 9 and 53 and fluorine is more reactive than iodine. **(2 marks)**
- 11)** Although water is an essential substance for life it is often threatened by pollution.
- a) Define the term “water pollution”. **(1 mark)**
- b) Give any two examples of water pollutants. **(2 marks)**
- 12)** State one environment related and one health hazard due to polluted water. Aqueous barium chloride is added to aqueous sodium sulphate. An insoluble substance of barium sulphate is formed together with an aqueous sodium chloride.
- a) Name the type of the reaction that takes place. **(1 mark)**
- b) Write a balanced chemical equation for this reaction. **(2 marks)**
- c) Deduce the net ionic equation from the equation in (b). **(2 marks)**
- 13)** Fill in the blanks of the text below with the following underlined terms. crude oil, carbon, organic chemistry, hydrogen, hydrocarbons. Each term must be used once. Answers should be like (1) -----
(2) -----
- (1)-- is a discipline of chemistry that is concerned with the study of compounds containing ---(2)---chemically bonded to ---(3)---. The mixture of different ---(4)--- is called ---(5)----. **(5 marks)**

14) Natural gas consists primarily of methane, which makes up 70-90% along with other three hydrocarbon fractions.

- a) Define the term “hydrocarbon”. (1 mark)
- b) Give the names and the formulae for the three other hydrocarbons which compose the natural gas. (3 marks)
- c) Alkanes are insoluble in water and soluble in carbon tetrachloride. Explain. (2 marks)

15) Oxides are classified into acidic, basic, neutral and amphoteric.

- a) Categorize each of the following oxides into the above class:
- (i) ZnO (1 mark)
- (ii) CO (1 mark)
- (iii) NO₂ (1 mark)
- b) Give the compounds **A**, **B**, **C** and **D** in the following chemical equations.
- (i) $\text{CO}_2(\text{g}) + \text{H}_2\text{O}(\text{l}) \longrightarrow \text{A}$ (1 mark)
- (ii) $\text{K}_2\text{O}(\text{s}) + \text{H}_2\text{O}(\text{l}) \longrightarrow \text{B}$ (1 mark)
- (iii) $\text{MgO}(\text{s}) + 2\text{HCl}(\text{aq}) \longrightarrow \text{C} + \text{H}_2\text{O}(\text{l})$ (1 mark)
- (iv) $\text{Al}_2\text{O}_3(\text{s}) + 2\text{NaOH}(\text{aq}) \longrightarrow \text{D} + \text{H}_2\text{O}(\text{l})$ (1 mark)

SECTION B: ATTEMPT ANY THREE (3) QUESTIONS (30 marks)

16) Effective waste management systems are needed to ensure better human health and safety. Consider the hierarchical diagram in the Figure 1 below to answer any related question.

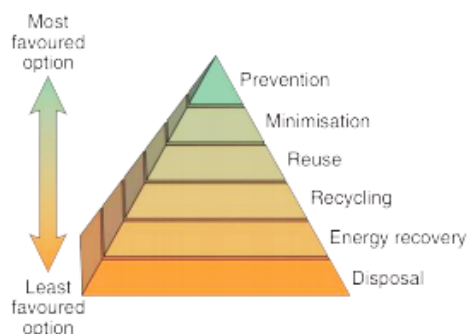


Figure 1

- a) What does “energy recovery” consist of in waste management? **(1 mark)**
- b) Although it is mostly applied, disposal is the least favored on hierarchy diagram above. Suggest any two reasons for this observation. **(2 marks)**
- c) State and explain briefly any one way by which recycling contributes to environment protection. **(2 marks)**
- d) Differentiate between a waste and a by-product. **(2 marks)**
- e) “Waste prevention” is the most environmentally preferred strategy for effective waste management. Suggest any one way in which waste prevention can be applied and explain how its practicability is challenging. **(3 marks)**

17) Ions are tested either by evolution of gases or formation of precipitates.

- a) Answer the following statements with True **(T)** or False **(F)**
 - (i) NH_4^+ ions form a white precipitate with aqueous sodium hydroxide. **(1 mark)**
 - (ii) CO_3^{2-} ions release a colorless and odorless gas with dilute acid. **(1 mark)**
- b) Describe a test which could be used to distinguish between each of the following pairs of ions.
 - (i) $\text{Cu}^{2+}(\text{aq})$ and $\text{Fe}^{2+}(\text{aq})$ **(4 marks)**
 - (ii) $\text{Zn}^{2+}(\text{aq})$ and $\text{Pb}^{2+}(\text{aq})$ **(4 marks)**

18) The solubility of salts in water depends on a certain number of factors.

- a) Define the term “solubility”. **(1 mark)**
- b) State any two factors which affect the solubility of salts in water. **(2 marks)**
- c) Explain why sodium chloride (NaCl) is soluble in water but insoluble in carbon tetrachloride (CCl_4). **(2 marks)**
- d) Two salts **A** and **B** have been heated and released gases with the following characteristics.
 - Salt **A** released a colourless and odorless gas, which relights a glowing splint.
 - Salt **B** released a colourless and odorless gas. The gas has pops with a lighted splint. State the names of gases from salts **A** and **B**. **(2 marks)**
- e) The table below shows the values of solubility of a substance **X** at different temperatures.

Solubility of X per 100 g of water	10	15	20	25	30	35	40	45
Temperature/°C	0	10	20	30	40	50	60	70

Plot the curve of solubility on which the temperature is represented along the X-axis and solubility along the Y-axis. **(3 marks)**

19) Zinc metal reacts with hydrochloric acid by the following reaction:



Given that 19.65 g of Zn are added to hydrochloric acid containing 0.52 mol HCl. (Atomic masses: Zn = 65.5, Cl = 35.5, H = 1)

a) What is meant by “limiting reactant (or reagent)” in a chemical reaction?

(1 mark)

b) Determine the number of moles corresponding to 19.65 g of Zn.

(1 mark)

c) Calculate the number of moles of H₂ produced in the reaction.

(1 mark)

d) Find out the limiting reactant.

(3 marks)

e) A compound contains 32.39% sodium, 22.53% sulphur and 45.07% oxygen by mass. (Atomic mass: O = 16, Na = 23, S = 32)

Determine the simplest formula for the compound.

(4 marks)

20) Methane occurs naturally in crude oil but it can be prepared in laboratory by use of the set up in Figure 2.

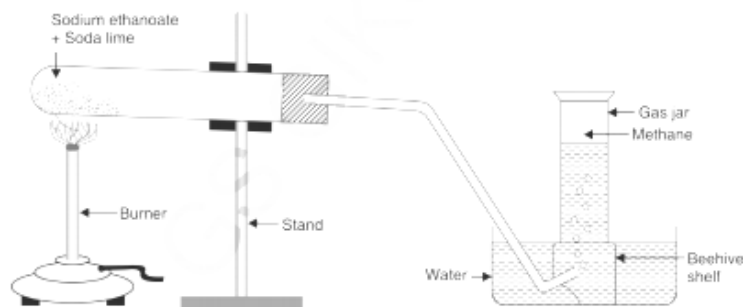


Figure 2

a) Give the general formula of alkanes.

(1 mark)

b) Write the balanced equation of complete combustion of methane gas.

(1 mark)

c) Name a place where methane occurs and is extracted in Rwanda.

(1 mark)

d) Give the chemical formulae for reagents used to prepare methane.

(2 marks)

e) Write the equation taking place in the experiment above.

(1 mark)

f) State any two uses of methane gas.

(2 marks)

g) State the type of method used to collect methane gas and justify why it is preferred for methane.

(2 marks)

-END-

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MARKING GUIDE

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INSTRUCTIONS

This paper comprises two sections **A** and **B**

-**Section A:** Attempt all fifteen (15) questions. (70 marks)

-**Section B:** Attempt any three (3) out of five (5) questions. (30 marks)

This Marking Guide will be used by both Braille and non-Braille Papers.

SECTION A: ATTEMPT ALL QUESTIONS

(70 marks)

01.a) Electrolyte is a substance that breaks up into ions (particles with electrical charges) when it is dissolved in water. **(1 mark)**

b) (i) C. non-electrolytes **(1 mark)**

(ii) A. acetic acid (CH₃COOH) **(1 mark)**

02.a) Sources of waste can be broadly classified into four types:

- Industrial, **0.5 marks**
- Commercial, **0.5 marks**
- Domestic,
- Agricultural. **(Consider any two correct sources)**

b) Reusing: is a technique which consists of using a material for an alternative purpose after its primary use. **(1 mark)**

Recycling: consists of reprocessing an old material into a new one. **(1 mark)**

03.a) The stability of atoms is the state by which atoms attain the octet rule; when the outermost energy level is completely filled or when they have attained inert gas electron arrangement. **(1 mark)**

b) Atoms achieve the inert gas electron arrangement in three ways by:

- losing electrons (transfer electrons to another). **(1 mark)**
- gaining electrons (gain of electrons from another atom). **(1 mark)**
- sharing one or more electrons (with another atom). **(1 mark)**

04. A. →2 **(1 mark)**

B. →3 **(1 mark)**

C. →4 **(1 mark)**

D. →1 **(1 mark)**

05.a) Ca(OH)₂(aq) + CO₂(g) → CaCO₃(s) + H₂O(l)

(0.5 marks) (0.5 marks) (0.5 marks) (0.5 marks)

b) NaCl is used as:

- table salt as a seasoning to enhance flavor. **(1 mark)**
- as a food preservative
- source of sodium metal and chlorine gas
- in manufacturing to make plastics and other products

b) Na₂CO₃ is used: **(1 mark)**

- in the manufacture of glass, borax, soap and caustic soda.

- in the paper, paints and textile industries.
- for softening hard water. (It removes temporary as well as permanent hardness).
- for washing purposes in the laundry.
- as an important laboratory reagent both in qualitative and quantitative analysis.

06.a)

Saturated solution	Unsaturated solutions
A solution that contains as much solute as can dissolve in the given solvent at a given temperature is a saturated solution. (1 mark)	A solution that contains the maximum amount of solute at an elevated temperature is a supersaturated. (1 mark)

b) Mass of solute (sugar) = 7 g

- Mass of solvent (water) = 5 g
- Solubility at 30°C =?
- Formula:
- Solubility = $\frac{\text{Weight of solute (in grams)}}{\text{Weight of solvent (in grams)}} \times 100$ **(0.5 marks)**
- Solubility = $\frac{7g}{5g} \times 100$ **(0.5 marks)**
= 140 grams **(1 mark)**

07.a) Ideal gas is any gas that follows strictly the Boyle's law, Charles' law and Avogadro's law at all conditions. **(1 mark)**

- b)** 1 → C **(1 mark)**
2 → A **(1 mark)**
3 → B **(1 mark)**

08.a) Molecular mass for $\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$:

$$= 63.5 + 32 + (4 \times 16) + (5 \times 18) \text{ (0.5 marks)}$$

$$= 249.5 \text{ u (0.5 marks)}$$

- b)** -Percentage of copper: $\frac{63.5 \times 100}{249.5}$ **(0.5 marks)** = 25.45 % **(0.5 marks)**
- Percentage of total oxygen: $\frac{9 \times 16 \times 100}{249.5}$ **(0.5 marks)** = 57.71 % **(0.5 marks)**
- Percentage of total oxygen: $\frac{5 \times 18 \times 100}{249.5}$ **(0.5 marks)** = 36.07 % **(0.5 marks)**

- 09. a)** False (F) **(1 mark)**
b) True (T) **(1 mark)**
c) False (F) **(1 mark)**
d) False (F) **(1 mark)**

10.a) Copper is a metal and metals are ductile. Ductility for metals means that they are susceptible to be easily drawn into wires. **(1 mark)**

- b) This is because metals (iron nails) are malleable (1 mark) while nonmetals are brittle (1 mark).
- c) The chemical reactivity of non-metals decreases on going down in a group.

11.a) **Water pollution** is the contamination of water of rivers, lakes and ponds, etc., with unwanted and harmful substances. (1 mark)

b) Two examples of water pollutants:

- Sewage, (1 mark)
- Nutrient-rich wastewater, (1 mark)
- Chemical Waste,
- Radioactive Waste,
- Oil,
- Plastic,
- Alien species,...

c) **Environment related effect (1 mark):** -Eutrophication

-Acidification

(Accept any other correct answer)

Health hazards (1 mark):

-Bacterial infections (typhoid, cholera, paratyphoid fever, bacillary, dysentery)

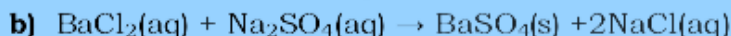
-Viral infections (infectious hepatitis (jaundice) poliomyelitis)

-Protozoal infections (Amoebic dysentery)

-Carcinogenic effects (due to toxicants such as toxic metals)

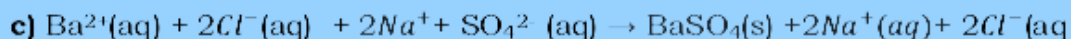
(Accept any other correct answer)

12. a) Double displacement or precipitation reaction (1 mark)



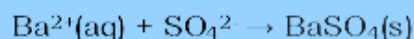
(0.5 marks) (0.5 marks) (0.5 marks) (0.5 marks)

(Here we take into account the ability to write a chemical formula)



(0.5 marks)

(0.5 marks)



(0.5 marks)

(0.5 marks)

13. (1) =organic chemistry (1 mark)

(2) =carbon (1 mark)

(3) =hydrogen (1 mark)

(4) =hydrocarbons **(1 mark)**

(5) =crude oil **(1 mark)**

14.a) Hydrocarbon: organic compound composed of carbon and hydrogen atoms only. **(1 mark)**

b) Ethane **(0.5 marks)** (C_2H_6) **(0.5 marks)**

Propane **(0.5 marks)** (C_3H_8) **(0.5 marks)**

Butane **(0.5 marks)** (C_4H_{10}) **(0.5 marks)**

c) Alkanes are insoluble in water because they are non-polar substances while water is a polar solvent **(1 mark)**. The principle of solubility is that the like dissolves the like.

That is why they (alkanes) are soluble in non-polar solvents **(1 mark)**.

15.a) (i) amphoteric **(1 mark)**

(ii) neutral **(1 mark)**

(iii) acidic **(1 mark)**

b) (i) $H_2CO_{3(aq)}$ **(1 mark)**

(ii) $KOH(aq)$ **(1 mark)**

(iii) $MgCl_{2(aq)}$ **(1 mark)**

(iv) $NaAlO_{2(aq)}$ **(1 mark)**

SECTION B: ATTEMPT ANY THREE (3) QUESTIONS

(30 marks)

16.a) **Energy recovery** also called waste-to-energy (WTE), is one of the techniques applied in waste management which consists of converting non-recyclable waste materials into usable heat, electricity, or fuel through a variety of processes, including heating. **(1 mark)**

b) During disposal process in landfills and incineration:

-We don't get anything back from what we put in the disposal ground. **(1 mark)**

-Some gases like methane, CO_2 or other greenhouse gases may be formed and released into environment. **(1 mark)**

- Disposal can provoke accidents of explosion of gases formed inside the garbage.

- Disposal can induce other environmental pollutants.

c) Recycling reduces deforestation **(1 mark)**: reduces the need for raw materials, so that our forests can be preserved **(1 mark)**.

Recycling helps reduce pollution **(1 mark)**: The more we buy (as opposed to reducing), and the more we throw away (instead of reusing and recycling them), the more wastes we create. This waste releases poisonous gases and chemicals into the environment during the disposal process **(1 mark)**.

Recycling aids in reducing land pollution: With less wastes, there would also be less need for landfills and incinerators. These lands could then be freed up for other uses.

(Accept any other correct answer)

d) Waste is any substance discarded after primary use, or is worthless, defective and of no use **(1 mark)**.

A by-product, is a joint product of relatively minor economic value **(1 mark)**.

e) Waste prevention strategies include:

- use less packaging **(1 mark)**,
- designing products to last longer (for example stop using plastic carrier bags and opt for long-life bags).

It is challenging because;

- It is very expensive **(1 mark)**.
- It requires research to completely avoid or replace a substance or process **(1 mark)**
- It is like, completely stopping life in the dream to stop pollution. (for example stopping vehicles, airplane,...)

17. a) (i) False **(1 mark)**

(ii) True **(1 mark)**

b) (i) Cu^{2+} and Fe^{2+}

Reagent: $\text{NH}_3(\text{aq})$ **(1 mark)**

Observation: Cu^{2+} , formation of a blue precipitate **(1 mark)**, soluble in excess to give a deep blue solution **(1 mark)**

Fe^{2+} , formation of a green precipitate, insoluble in excess **(1 mark)**.

(ii) Zn^{2+} and Pb^{2+}

Reagent: $\text{NH}_3(\text{aq})$ **(1 mark)**

Observation: Zn^{2+} , formation of a white precipitate **(1 mark)**, soluble in excess to give a colorless solution **(1 mark)**

Pb^{2+} , formation of a white precipitate, insoluble in excess **(1 mark)**.

18. a) Solubility: is the property of a substances by which they tend to dissolve in water (or any other solvent). **(1 mark)**

Or is the maximum amount of solute in grams which is soluble in 100 g of solvent at a certain temperature.

b) Factors affecting the solubility of salts in water:

- Temperature, (1 mark)
- polarity, (1 mark)
- molecular size

c) -NaCl is an ionic compound, polar compound. (0.5 marks)

-Water is a polar solvent (0.5 marks)

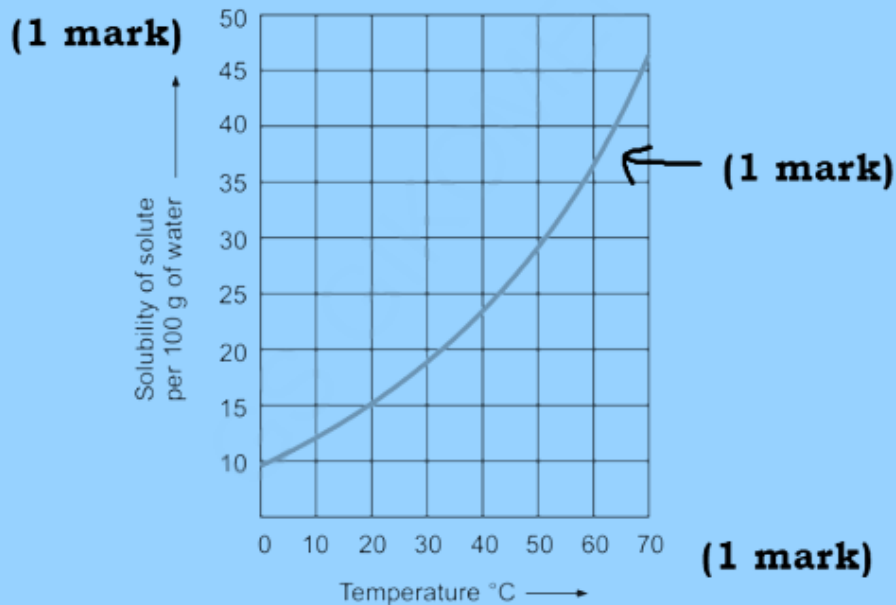
-CCl₄ is a nonpolar solvent (0.5 marks)

-The principle is that the like dissolves the like that is why NaCl dissolves in water instead in CCl₄ (0.5 marks)

d) Gas from **A** is oxygen (1 mark)

Gas from **B** is hydrogen (1 mark)

e) Solubility curve for X:



FOR BRAILLE:

18.e)

-The solubility increases with increase of temperature. (1 mark)

- From the table data, 10°C induce an increase of 5 g/ 100g of solubility of the salt. (1 mark)

19.a) The limiting reactant (or limiting reagent) is the reactant that gets consumed first in a chemical reaction and therefore limits how much product can be formed. **(1 mark)**

b) Number of moles of Zn:

$$n = \frac{m}{Mm} \text{ (1 mark)} = \frac{19.65 \text{ g}}{65.5 \text{ g/mol}} \text{ (0.5 marks)} = 0.3 \text{ mol of zinc (0.5 marks)}$$

c) From the equation:

1 mole of Zn produces 1mole of H₂ **(0.5 marks)**

0.3 mole of Zn produces 0.3 mole of H₂ **(0.5 marks)**

Accept any other correct working procedure

d) - Moles present in reactional medium:

Moles of Zn = 0.3 moles

Moles of HCl = 2 x 0.52 = 1.04 moles **(0.5 marks)**

-Reaction according to stoichiometry:

1 moles of Zn react with 2 moles of HCl **(0.5 marks)**

0.3 moles of Zn produce 2 x 0.3 = 0.6 moles of HCl **(0.5 marks)**

- Moles remaining in reactional medium:

Moles of Zn = 0.3 - 0.3 (moles) = 0 **(0.5 marks)**

Moles of HCl = 1.04 - 0.6 (moles) = 0.44 moles **(0.5 marks)**

- The limiting reactant (reagent) is **Zn. (0.5 marks)**

e)

Symbol of the elements	Na	S	O
Percentage composition	32.39	22.53	45.07
Number of atoms	$\frac{32.39}{23} = 1.408$ (0.5 marks)	$\frac{22.53}{32} = 0.704$ (0.5 marks)	$\frac{45.07}{16} = 2.817$ (0.5 marks)
Simplest ratio	$\frac{1.408}{0.704} = 2$ (0.5 marks)	$\frac{0.704}{0.704} = 1$ (0.5 marks)	$\frac{2.817}{0.704} = 4$ (0.5 marks)

The simplest formula of the compound is Na₂SO₄ **(1 mark)**

20. a) C_nH_{2n+2} (1 mark)

b) $CH_4 + 2O_2 \rightarrow CO_2 + 2H_2O$ (1 mark)

c) Methane occurs and is extracted in Lake Kivu. (1 mark)

d) Sodium ethanoate: CH_3COONa (1 mark)

Soda lime: $NaOH$ (1 mark)

e) $CH_3COONa + NaOH \rightarrow CH_4 + Na_2CO_3$ (1 mark)

f) Methane is used as:

- fuel to make heat and light (1 mark)
- raw material to manufacture organic chemicals (1 mark)

g) Methane is collected over water. (1 mark)

Because it is less dense than water and it is insoluble in water. (1 mark)

-END-

**ALTERNATIVE TO
PRACTICAL CHEMISTRY**

Date: 23/June/2023

Period: 8:30 am-10:00 am



END OF TERM III EXAMINATIONS

LEVEL :ORDINARY

GRADE :SENIOR TWO (S2)

DURATION :1 HOUR 30 MINUTES

MARKS:

/20

INSTRUCTIONS

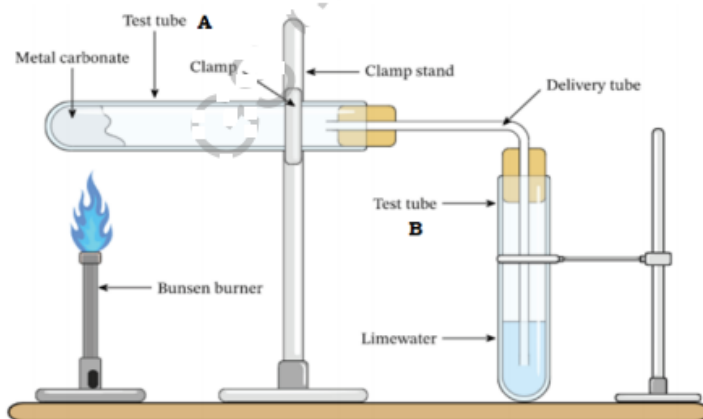
- 1) Please read carefully before you start answering.
- 2) This paper consists of **one (1) compulsory question**.
- 3) All answers should be written in the spaces provided in the question paper.
- 4) You do not need a Periodic Table.

You are provided with:

- Compound **MCO₃**
- Lime water: Ca(OH)₂(aq)
- Dilute sulphuric acid, H₂SO₄
- Dilute sodium hydroxide, NaOH
- Heating source (Bunsen burner)
- Strips of Blue and Red litmus papers
- Other Laboratory materials (weighing balance, spatula, watching glass, boiling test tubes, delivery tube, retort stand, clamps)

Experimental procedure

- About 0.5 g of compound **MCO₃**, was weighed.
- **MCO₃** is a green-blue salt compound.
- The weighed amount was introduced in the test tube **A**.
- Apparatuses were arranged according to the set up shown in the Figure below.



- 1) The test tube **A** was heated on a Bunsen burner until there was no further change. Both blue and red litmus papers and lime water were used to test the gas released. Observations:

- Effervescence of a colourless and odourless gas from test tube **A**.
- The gas turns red the blue litmus paper.
- The gas has no effect on the red litmus paper.
- The gas turns milky the limewater in the test tube **B**.
- A black residue remains in the test tube **A**.

Questions:

- a)** The released gas on heating MCO_3 is likely to be: **(1 mark)**
- (i) acidic
 - (ii) basic
 - (iii) neutral
 - (iv) amphoteric

Why?

(1 mark)

- b)** State the name and write the chemical formula for the gas released from test tube A. **(2 marks)**

- c)** State any two uses of the gas named in (b) above. **(2 marks)**

- d)** Write the relevant equation which takes place in test tube A, when MCO_3 is heated. Use M to represent the metal present. **(2 marks)**

e) Write the relevant equation which takes place in test tube B, when the gas in (b) gets into contact with lime water. **(2 marks)**

2) To the residue in test tube A, excess dilute sulphuric acid, $\text{H}_2\text{SO}_4(\text{aq})$ was added and warmed gently.

Observations:

- The black solid residue dissolved to give a blue solution containing the metal **M**.

f) Write the complete chemical equation which takes place. Use M to represent the metal present. **(2 marks)**

3) To the solution in (2) above, a dilute solution of sodium hydroxide, $\text{NaOH}(\text{aq})$ was added drop wise until in excess.

Observations:

- A pale blue precipitate insoluble in excess was formed.

g) Refer to the observations in (2) and (3) and give the name and chemical representation of the metal **M** which is likely to be found in the carbonate, MW. **(2 marks)**

h) Write the relevant equation which takes place when a dilute solution of sodium hydroxide, $\text{NaOH}(\text{aq})$ is added to the solution in (2). Use the actual symbol of the metal. **(2 marks)**

i) Give any two environmental hazards caused by the gas in (b). **(2 marks)**

j) Suggest preventive measures to minimize the hazards stated in (i) above.

(2 marks)

**ALTERNATIVE TO
PRACTICAL CHEMISTRY**

Date: 23/June/2023

Period: 8:30 am-10:00 am



END OF TERM III EXAMINATIONS

MARKING GUIDE

LEVEL

:ORDINARY

GRADE

:SENIOR TWO (S2)

DURATION

:1 HOUR 30 MINUTES

MARKS:

/ 20

Answers:

(1)

a) The released gas on heating MCO_3 is likely to be:

-Acidic **(1 mark)**

-Because the gas turns red the blue litmus paper. **(1 mark)**

b) The name and chemical formula for the gas.

-Carbon dioxide **(1 mark)**

- CO_2 **(1 mark)**

c) Uses of the gas named in (b) above.

Carbon dioxide is used:

-in fire extinguishers, **(1 mark)**

-in promoting the growth of plants, **(1 mark)**

-in photosynthesis of green plants

-as a refrigerant,

-for inflating life rafts and life jackets

-blasting coal,

-in greenhouses,

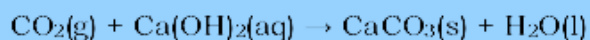
-in carbonated beverages,

d) Equation taking place in test tube A, when MCO_3 is heated.



(1 mark) (1 mark)

e) Equation which takes place in test tube B.



(1 mark) (1 mark)

(2)

f) Equation which takes place:



(1mark) (1mark)

(3)

g) M is more likely to be copper **(1 mark)**

Cu **(1 mark)**

h) $\text{CuSO}_4(\text{aq}) + 2\text{NaOH}(\text{aq}) \rightarrow \text{Cu}(\text{OH})_2(\text{s}) + \text{Na}_2\text{SO}_4(\text{aq})$

(1mark) (1mark)

i) - Greenhouse effect **(1mark)**

- Global warming **(1mark)**

- Climate change

j) -Limit your use of fossil fuels **(1mark)**

-Use renewable and clean energy sources **(1mark)**

-Reducing travel by car or plane

-Buying long-lasting products

-Shopping seasonally and locally

-END-