

CHEMISTRY (Theory)

Date: 21/June/2024

Period: 08:30 AM – 11:30 AM



END OF TERM III EXAMINATION, 2023-2024

QUESTION PAPER

LEVEL : ORDINARY

GRADE : SENIOR TWO (S2)

DURATION : 3 HOURS

MARKS : /100 CAMIS (Theory + Practical) /40

INSTRUCTIONS:

- 1) Write your complete identification on the answer sheet.
- 2) This paper consists of **TWO** sections: **A** and **B**.
 - **Section A:** Attempt **ALL** questions. **(70 marks)**
 - **Section B:** Attempt any **THREE** questions. **(30 marks)**
- 3) **You do not need the periodic table.**
- 4) The marks to be recorded into **CAMIS** will result from the sum of theory and practical exam marks, that will be converted to **40 marks**.
- 5) Use only a **blue** or **black** pen for answering and a **pencil** for drawing.

- b) The empirical formula of C_6H_{12} is: **(1 mark)**
- | | |
|----------------|--------------|
| i) C_6H_{12} | iii) CH_2 |
| ii) C_3H_4 | iv) C_2H_3 |

- c) The mathematical relationship between *pressure* and *temperature* was given by: **(1 mark)**
- | | |
|---------------------|-------------------|
| i) Robert Boyle | iii) A.C. Charles |
| ii) Amedeo Avogadro | iv) Gay Lussac |

4) Choose a correct answer for each of the following questions.

- a) Aluminium oxide (Al_2O_3) is an example of: **(1 mark)**
- | | |
|----------------------|-------------------|
| i) basic oxide | iii) acidic oxide |
| ii) amphoteric oxide | iv) neutral oxide |

- b) Generally, non-metals react with oxygen to give: **(1 mark)**
- | | |
|--------------------|------------------------|
| i) acidic oxides | iii) amphoteric oxides |
| ii) neutral oxides | iv) basic oxides |

- c) The products of thermal decomposition of calcium hydroxide, $Ca(OH)_2$ are: **(1 mark)**
- | | |
|----------------------------------|--------------------|
| i) $CaO_2 + H_2$ | iii) $CaO + H_2O$ |
| ii) $CaO + \frac{1}{2}O_2 + H_2$ | iv) $CaO + H_2O_2$ |

- d) Neutral oxides are types of oxides which: **(1 mark)**
- | |
|--|
| i) react with acids only. |
| ii) react with bases only. |
| iii) react with both acids and bases. |
| iv) do not react with neither acids nor bases. |

5) State whether each of the following statements is **true** or **false**.

- a) Alkanes contain only single covalent bonds. **(1 mark)**
- b) The boiling points of alkanes decrease with increasing molecular size. **(1 mark)**
- c) Organic compounds are soluble in water but insoluble in organic solvents. **(1 mark)**
- d) The IUPAC name of an alkane containing four carbon atoms is butane. **(1 mark)**

6) Fill in the blank spaces with an appropriate term from the list: *crystalline, metallic bond, covalent bond, noble gases*.

- a) The chemical bond formed with share of electrons between two atoms is known as a _____ **(1 mark)**
- b) When a bond is formed between two atoms, each atom acquires a stable electron configuration similar to that of _____ **(1 mark)**
- c) Ionic compounds are usually _____ solids. **(1 mark)**
- d) The force which binds various metal atoms together is called _____ **(1 mark)**

7) Wastes can be biodegradable or non-biodegradable. Given a list of some wastes below: *food remains, plastics, cow dung, glass materials*.

- a) What is meant by biodegradable waste? **(1 mark)**
- b) From the list above, state the wastes which are:
- i) Biodegradable. **(2 marks)**
- ii) Non-biodegradable. **(2 marks)**
- c) Explain how non-biodegradable wastes are harmful to the environment. **(1 mark)**

8) Zinc sulphate is a water-soluble salt and can be prepared in laboratory by the action of dilute sulphuric acid on zinc granules.

- a) State the type of method of preparation of salts involved. **(1 mark)**
- b) Write the equation of reaction involved. **(2 marks)**
- c) Zn^{2+} ions form white precipitate with aqueous sodium hydroxide.
- i) Write the equation between zinc sulphate and sodium hydroxide solutions. **(2 marks)**
- ii) What is the type of reaction in c(i) above? **(1 mark)**

9) Consider the following substances: *glucose solution, $C_6H_{12}O_6(aq)$, sodium chloride solution, $NaCl(aq)$, urea solution, $(NH_2)_2CO(aq)$, distilled water*.

- a) Differentiate between *electrolyte* and *non-electrolyte*. **(2 marks)**
- b) Classify the above substances into electrolytes and non-electrolytes. **(4 marks)**

- 10) The solubility of a substance at a particular temperature can be determined.
- Define the term *solubility*. **(1 mark)**
 - Explain how the temperature affects the solubility of salts. **(2 marks)**
 - Calculate the solubility of the solution prepared by dissolving 5 grams of salt to form 100g of saturated solution at room temperature and pressure. **(4 marks)**

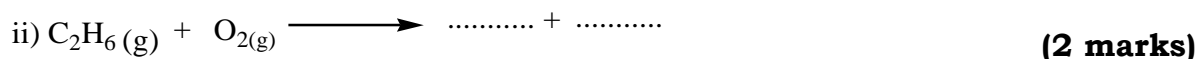
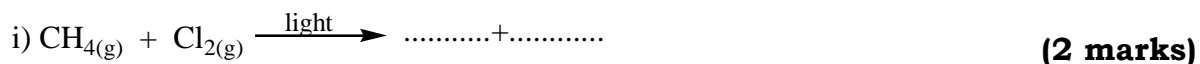
- 11) The quantity of matter is usually determined in terms of number of mole.
- Define the term *mole*. **(1 mark)**
 - Calculate the number of moles corresponding to 5 grams of sodium chloride.
(Atomic masses: Na = 23, Cl = 35.5) **(3 marks)**
 - At constant temperature, a gas occupies 1200 litres at 2 atm pressure. Determine the pressure to which the gas must be compressed to occupy 60 litres. **(3 marks)**

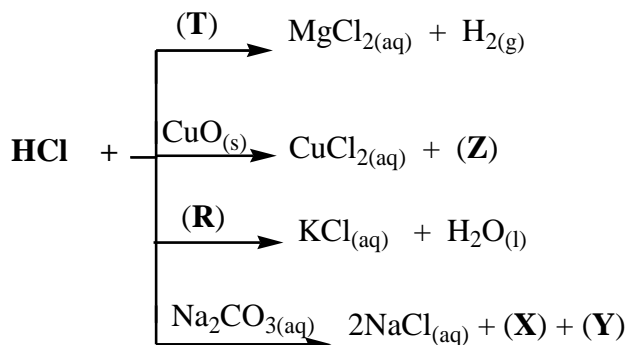
- 12) Solid calcium hydroxide also called slaked lime (ishwagara) is formed by the following equation:



- State:
 - both IUPAC name and usual name for CaO. **(2 marks)**
 - the types of oxides are CaO and H₂O. **(2 marks)**
 - the type of reaction of formation of calcium hydroxide. **(1 mark)**
- Suggest any two (2) uses of slaked lime. **(2 marks)**

- 13) Combustion is one type of chemical reactions.
- What is meant by combustion reaction? **(1 mark)**
 - Write the balanced equation of combustion of methane. **(2 marks)**
 - Complete and balance the following chemical equations:



SECTION B: ATTEMPT ANY THREE (3) QUESTIONS**(30 marks)**14) Some reactions of **HCl** are shown in the chart below.

- a) Give the IUPAC name for HCl. **(1 mark)**
- b) Write the chemical formulae for the substances **(T)**, **(Z)**, **(R)**, **(X)** and **(Y)**. **(5 marks)**
- c) State the type of reaction between:
- i) HCl and **(T)**. **(1 mark)**
- ii) HCl and **(R)**. **(1 mark)**
- d) Describe how you can confirm the presence of H₂ in the reaction between HCl and **(T)**. **(2 marks)**

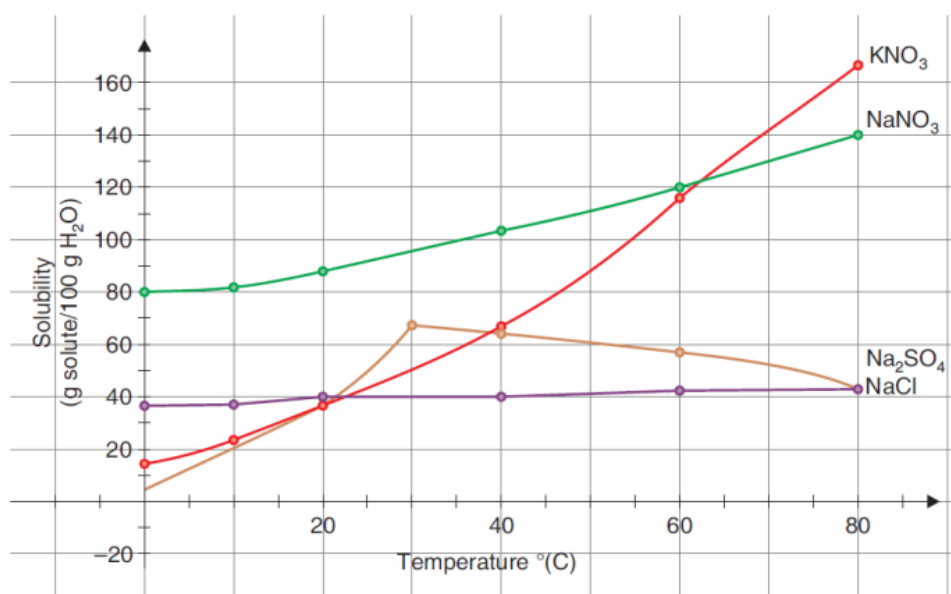
15) The solubility curves of some substances are shown in *Figure 1* below. Study them and answer the questions that follow.

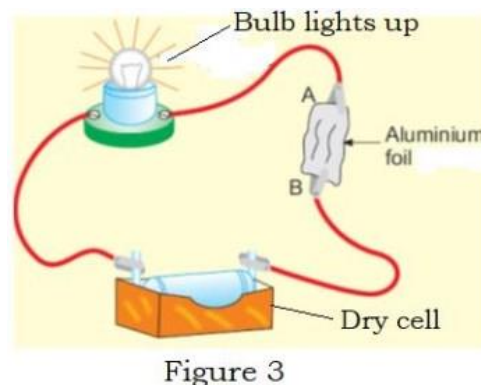
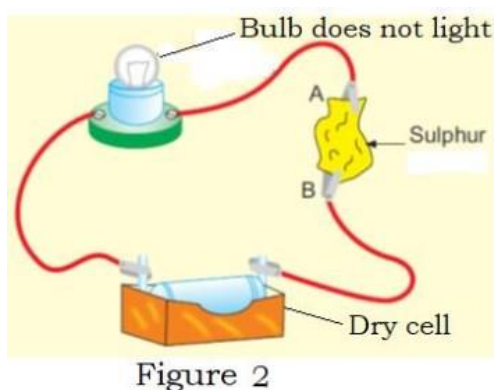
Figure 1

- a) From the Figure 1 above, which salt;
- is the most soluble at 40°C? **(1 mark)**
 - is the least soluble at 40°C? **(1 mark)**
- b) How much is the solubility of sodium chloride (NaCl) at 20°C? **(1 mark)**
- c) How much is the solubility of sodium nitrate (NaNO₃) at 80°C? **(1 mark)**
- d) Which salt shows the most rapid rate of increase of solubility? **(1 mark)**
- e) At 80°C, when heated to crystallization, which of the two salts, Na₂SO₄ or NaCl crystallizes out first? **(1 mark)**
- Na₂SO₄.
 - NaCl.
 - Both Na₂SO₄ and NaCl at the same time.
 - None of Na₂SO₄ or NaCl.
- f) State a reagent that can be used to distinguish between the following pairs of ions and give the observable change in each case:
- CO₃²⁻(aq) and Cl⁻(aq) **(2 marks)**
 - Cu²⁺(aq) and Ca²⁺(aq) **(2 marks)**

16) Given the elements of the third period of the Periodic Table below.

Na	Mg	Al	Si	P	S	Cl
----	----	----	----	---	---	----

- a) Which element(s) are metals, non-metals or metalloids in the table? **(6 marks)**
- b) The *Figure 2* and *Figure 3* shown below. Observe and answer the questions.



- Predict why the bulb lights up in Figure 3 but doesn't light up in Figure 2. **(2 marks)**
- When sulphur is replaced with phosphorus in Figure 2, the bulb lights up. Yes, or not. Justify your answer. **(2 marks)**

17) The diagram (*Figure 4*) shows a waste hierarchy for effective waste management steps.

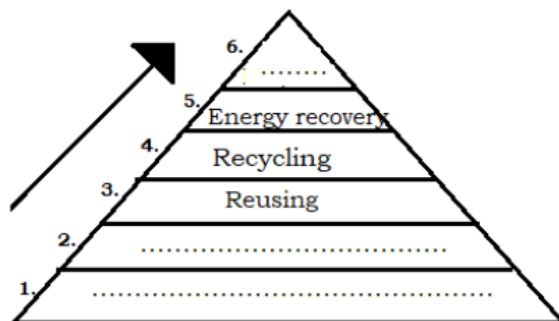


Figure 4

- a) State the steps (1), (2) and (6). **(3 marks)**
- b) Explain what does “energy recovery” or “waste-to-energy” mean? **(2 marks)**
- c) Give any one example of energy recovery process. **(1 mark)**
- d) Which of the steps (1) and (6) is the:
 - i) most favored? Why? **(2 marks)**
 - ii) least favored? Why? **(2 marks)**

18) Some salts are soluble while others are not.

- a) Use the rules of solubility of salts to classify the following compounds as soluble and insoluble salts: CaCO_3 , BaSO_4 , NaCl and NH_4NO_3 . **(4 marks)**
- b) Use the substances Mg, Na, C, S and O_2 , as the only starting raw materials and show how you can obtain each of the following compounds, through steps of equations. [Steps 1 and step 2: formation of acidic oxide and basic oxide, step 3: combination of the two oxides].
 - i) $\text{MgCO}_3(\text{s})$ **(3 marks)**
 - ii) $\text{Na}_2\text{SO}_3(\text{s})$ **(3 marks)**

END

CHEMISTRY (Theory)

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END OF TERM III EXAMINATION, 2023-2024

MARKING GUIDE

LEVEL : **ORDINARY**

GRADE : **SENIOR TWO (S2)**

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SECTION A: ATTEMPT ALL QUESTIONS**(70 marks)****1) Matching**

SN	Water pollutant		SN	Water pollutant description	
a)	Sewage		i)	A water carrying waste that generally consists of faeces, urine and laundry waste.	(1 mark)
b)	Plastics		ii)	Excess nitrates and phosphates.	(1 mark)
c)	Chemical wastes		iii)	Detergents, polychlorinated biphenyls (PCBs) and toxic metals such as mercury, cadmium, lead, arsenic and nickel.	(1 mark)
d)	Nutrient-rich wastewater		iv)	Polythenes are the most common agents.	(1 mark)

OR:**a) → i)****b) → iv)****c) → iii)****d) → ii)****2) a) iv) supersaturated (1 mark)****b) iii) Sodium carbonate (1 mark)****c) iii) BaSO₄ (1 mark)****d) ii) NaHCO₃ (1 mark)****3) a) i) Particles, mass (2 marks)****b) iii) 6.022×10^{23} (1 mark)****c) iv) Gay Lussac (1 mark)****4) a) ii) amphoteric oxide (1 mark)****b) i) acidic oxides (1 mark)****c) iii) CaO + H₂O (1 mark)****d) iv) do not react with neither acids nor bases. (1 mark)****5) a) True (1 mark)****b) False (1 mark)****c) False (1 mark)**

d) True **(1 mark)**

6)a) *covalent bond* **(1 mark)**

b) *noble gases* **(1 mark)**

c) *crystalline* **(1 mark)**

d) *metallic bond* **(1 mark)**

7)a) **Biodegradable waste** is of a type of waste material typically from plant or animal source, susceptible to be decomposed by other living organisms. **(1 mark)**

b) i) Biodegradable wastes are:

-Food remains **(1 mark)**

-Cow dung **(1 mark)**

ii) Non-biodegradable wastes:

-Plastics **(1 mark)**

-Glass materials **(1 mark)**

c) -Non-biodegradable wastes do not decompose. **(1 mark)**

-They accumulate in soil and water where they pollute the environment.

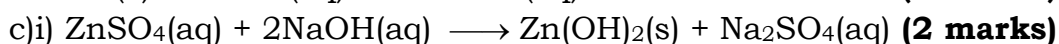
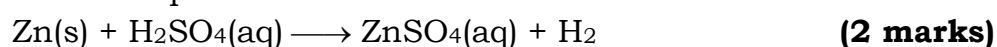
- Non-biodegradable wastes, such as pesticides, deplete soil fertility as they penetrate it.

-Most of biodegradable wastes are burned and pollute the air.

(Accept any correct explanation)

8) a) Preparation of salts from *dilute acid with active metal*. **(1 mark)**

b) Reaction equation:



ii) Precipitation reaction. **(1 mark)**

9)a) Difference

Electrolyte	Non-electrolyte
Substance whose aqueous solution contains ions. (1 mark)	Substance whose aqueous solution does not contain ions. (1 mark)
Substances that dissociate into ions when they are dissolved in water.	Substance that does not dissociate into ions when dissolved in water. They dissolve in water as molecules.

(Consider any one difference)

b) Classification

Electrolyte	Non-electrolyte
<i>sodium chloride solution, NaCl(aq)</i> (1 mark)	-Glucose solution, C ₆ H ₁₂ O ₆ (aq) (1 mark) -Urea solution, (NH ₂) ₂ CO(aq) (1 mark) -Distilled water (1 mark)

10)a) **Solubility** is amount of solute that is dissolved in 100grams of solvent to form a saturated solution at a given temperature. **(1 mark)**

b) -As the temperature increases, the amount of salt that dissolves in water increases. **(1 mark)**

-Therefore, the increase of temperature increases the solubility of salts.

(1 mark)

c) Given:

Mass of salt (solute) = 5 g

Mass of solvent = 100-5 = 95g **(1 mark)**

Solubility = $\frac{\text{mass of solute (g)}}{\text{mass of solvent (g)}} \times 100$ **(1 mark)**

Solubility = $\frac{5g}{95g} \times 100$ **(1 mark)**
= 5.26 **(1 mark)**

11)a) A mole is defined as the amount of matter that contains as many particles (atoms, molecules, ions) as the number of atoms in exactly 12g of pure carbon-12. **(1 mark)**

b) Molecular mass of NaCl= 23+35.5 = 58.5g/mol **(1 mark)**

$n = \frac{m}{Mm}$ **(1 mark)**

= $\frac{5}{58.5}$ **(0.5 marks)**

= 0.085moles **(0.5 marks)**

c) Solution

V₁ = 1200 L, V₂ = 60 L

P₁ = 2 atm, P₂ = ?

From Boyle's law,

P₁V₁ = P₂V₂ **(1 mark)**

P₂ = $\frac{P_1 \times V_1}{V_2}$ **(1 mark)**

$$= \frac{1200 \times 60}{2}$$

$$= 40 \text{ atm} \quad \text{(1 mark)}$$

12) a)i) CaO

IUPAC name: Calcium oxide (1 mark)

Usual name: lime or quicklime (1 mark)

ii) CaO: Basic oxide (1 mark)

H₂O: Neutral oxide (1 mark)

iii) Combination reaction or exothermic reaction (1 mark)

b) Two (2) uses of slaked lime:

- White washer of walls (construction) (1 mark)
- Neutralize the soil acidity (agriculture) (1 mark)
- Paper production
- Sewage treatment

13) a) Combustion reaction is a reaction in which a substance reacts with oxygen gas, releasing energy in the form of heat and light. (1 mark)

b) $\text{CH}_4 + 2\text{O}_2 \longrightarrow \text{CO}_2 + 2\text{H}_2\text{O} + \text{Energy}$ (2 marks)

c) i) $\text{CH}_{4(g)} + \text{Cl}_{2(g)} \xrightarrow{\text{light}} \text{CH}_3\text{Cl} + \text{HCl}$ (2 marks)

ii) $\text{C}_2\text{H}_6(g) + 7/2\text{O}_2(g) \longrightarrow 2\text{CO}_2 + 3\text{H}_2\text{O}$ (2 marks)

SECTION B: ATTEMPT ANY THREE (3) QUESTIONS

(30 marks)

14) a) Hydrochloric acid. (1 mark)

b) (T) = Mg_(s) (1 mark)

(Z) = H₂O_(l) (1 mark)

(R) = KOH_(aq) (1 mark)

(X) = CO_{2(g)} or H₂O_(l) (1 mark)

(Y) = H₂O_(l) or CO_{2(g)} (1 mark)

c) i) Simple replacement reaction. (1 mark)

ii) Double displacement reaction/ Acid-base neutralization reaction. (1 mark)

d) -Bring the lighted splint (like candle) in contact with the source of H₂ gas.

(1 mark)

-The gas burns with the *pop sound*. **(1 mark)**

15)a) i) Sodium nitrate (NaNO₃) (1 mark)

ii) Sodium chloride (NaCl) **(1 mark)**

b) Sodium chloride (NaCl) → 40g/100g H₂O **(1 mark)**

c) Sodium nitrate (NaNO₃) → 140g/100g H₂O **(1 mark)**

d) Potassium nitrate (KNO₃) **(1 mark)**

e) **iii) Both Na₂SO₄ and NaCl at the same time (1 mark)**

f) i) CO₃²⁻ and Cl⁻

-Reagent: dilute hydrochloric acid (HCl) **(1mark)**

Observations:

-With CO₃²⁻ : effervescence (bubbling) **(0.5 marks)**

-With Cl⁻: no observable change **(0.5 marks)**

(Accept any other correct test)

ii) Cu²⁺ and Ca²⁺

-Reagent: aqueous ammonia (NH₃) **(1 mark)**

Observations:

-With Cu²⁺ a deep blue precipitate of copper hydroxide soluble in excess to give a deep blue solution. **(0.5 marks)**

-With Ca²⁺ no observable change **(0.5 marks)**

(Accept any other correct test)

16)a) Metals: Na, Mg, Al (3 marks)

Non-metals: P, S, Cl **(3 marks)**

Metalloid: Si **(1 mark)**

b) i) Because aluminium is a metal which is *a good conductor of electricity*. **(1 mark)** while

Sulphur is a non-metal which is *a poor conductor of electricity*. **(1 mark)**

ii) No. **(1 mark)**

Because phosphorus is as non-metal as sulphur and poor conductor of electricity. **(1 mark)**

17)a) (1): Prevention (1 mark)

(2): Minimization (1 mark)

(3): Disposal (1 mark)

b) *Energy recovery* or *waste-to-energy (WTE)* is the conversion of non-recyclable waste materials into usable heat, electricity, or fuel through a variety of processes, including heating. **(2 marks)**

c) - Biogas **(1 mark)**

- Briquetting

d)i) The most favored is **(1)**: Prevention. **(1 mark)**

Even though it is more expensive it is the most effective way of waste management because it ensures that zero waste is found in environment. No effect from wastes is yet there. **(1 mark)**

ii) The least favored is **(6)**: Disposal **(1 mark)**

Disposal of wastes is done on wastes which have been already in environment. Wastes have left some in environment and they will require additional funds for disposal. **(1 mark)**

18) a) Classify salts:

Soluble salts	Insoluble salts
- NaCl (1 mark)	- CaCO ₃ (1 mark)
- NH ₄ NO ₃ (1 mark)	- BaSO ₄ (1 mark)

b)i) $\text{Mg}_{(s)} + \frac{1}{2}\text{O}_{2(g)} \longrightarrow \text{MgO}_{(s)}$ **(1 mark)**

$\text{C}_{(s)} + \text{O}_{2(g)} \longrightarrow \text{CO}_{2(g)}$ **(1 mark)**

$\text{MgO}_{(s)} + \text{CO}_{2(g)} \longrightarrow \text{MgCO}_{3(s)}$ **(1 mark)**

ii) $\text{Na}_{(s)} + \frac{1}{2}\text{O}_{2(g)} \longrightarrow \text{Na}_2\text{O}_{(s)}$ **(1 mark)**

$\text{S}_{(s)} + \text{O}_{2(g)} \longrightarrow \text{SO}_{2(g)}$ **(1 mark)**

$\text{Na}_2\text{O}_{(s)} + \text{SO}_{2(g)} \longrightarrow \text{Na}_2\text{SO}_{3(s)}$ **(1 mark)**

END

**ALTERNATIVE TO
CHEMISTRY PRACTICAL**

Date: 20/June/2024

Period: 08:30 AM – 10:00 AM



END OF TERM III EXAMINATION, 2023-2024

QUESTION PAPER

LEVEL : ORDINARY

GRADE : SENIOR TWO (S2)

DURATION : 1 HOUR 30 MINUTES

MARKS : /20

INSTRUCTIONS:

- 1) Write your identification in the reserved space here below.
- 2) All answers should be written in the spaces provided in the question paper.
- 3) This paper consists of **ONE compulsory** question.
- 4) **You do not need the periodic table.**
- 5) Use only a **blue** or **black** pen for answering.

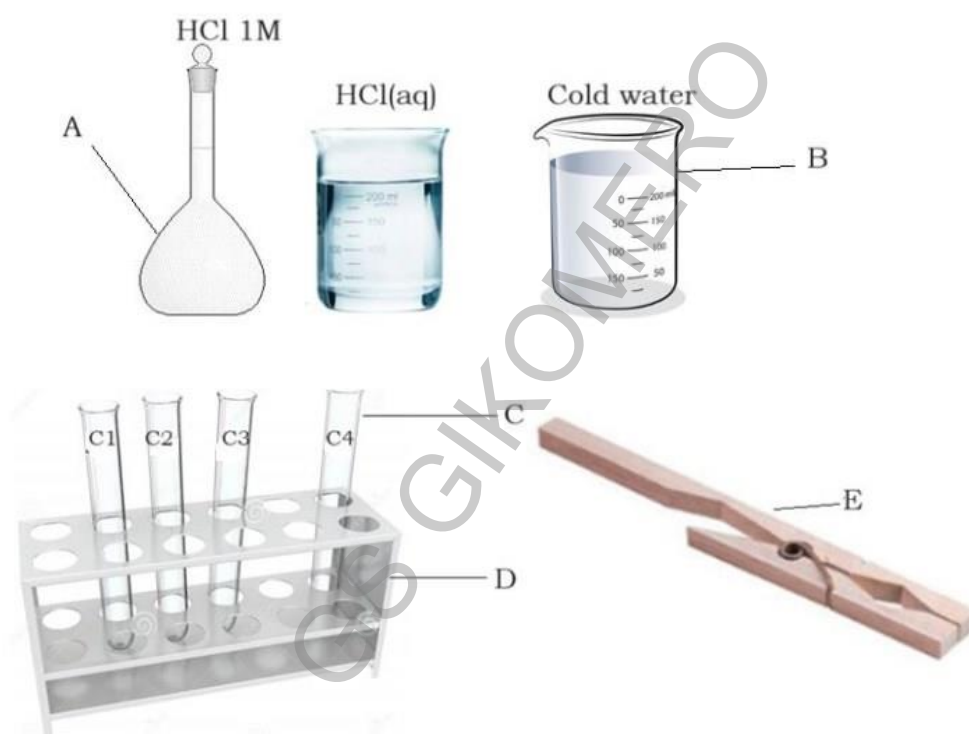
School _____

Student's names _____

Class _____

The following materials were provided:

SN	Apparatus/student	Quantity	Chemicals/student	Quantity
1	Apparatus A	4	Magnesium (Mg)	1g x 2
2	Apparatus B	1	Zinc (Zn)	1g x 2
3	Apparatus C	1	Distilled water (H ₂ O), (Cold)	10mL x 2
4	Spatula	1	HCl (1M,)	10mL x 2
5	Match box	1		
6	Beaker	2		



1) Procedure

- a) About 10mL of distilled water (cold) was put in apparatus **C1** and **C2**,
- b) About 10mL of 1M HCl was put in apparatus **C3** and **C4**,
- c) One spatula endful of magnesium (Mg) or 2 to 4 ribbons were added to apparatus **C1** and put a glowing matchstick closer to the mouth of **C1**,
- d) There was no observable change from **C1**,
- e) One spatula endful of magnesium (Mg) or 2 to 4 ribbons were added in apparatus **C3** and a glowing matchstick was put closer to the mouth of **C3**,
- f) From **C3**, there is effervescence (release of a colorless gas) which makes a *pop sound* in contact with the glowing matchstick,
- g) One spatula endful of zinc (Zn) or 2 to 4 ribbons were added in apparatus **C2** and put a glowing match stick closer to the mouth of **C2**,
- h) There was no observable change from **C2**,
- i) One spatula endful of zinc (Zn) or 2 to 4 ribbons were added in apparatus **C4** and put a glowing matchstick closer to the mouth of **C4**,
- j) From **C4**, there is effervescence (release of a colorless gas) which makes a *pop sound* in contact with the glowing matchstick.

2) Caution:

When handling this experiment, the necessary precautions had to be taken to ensure effective safety in laboratory.

3) Questions:

- i) Name the apparatus **A**, **B**, **C**, **D** and **E**. **(5 marks)**
A:
B:
C:
D:
E:
 - ii) State the use of apparatus **A**. **(1 mark)**
-

iii) Explain why there was no observable change from **C1**. **(1 mark)**

iv) Explain the observation in (f), from **C3**. **(2 marks)**

v) Write the reaction equation that takes place in **C3**. **(2 marks)**

vi) Explain why there was no observable change from **C2**. **(1 mark)**

vii) Explain the observation in (j), from **C4**. **(2 marks)**

viii) Write the reaction equation taking place in **C4**. **(2 marks)**

ix) Predict what will happen in **C1** and **C2**, when cold water is replaced with hot water.

x) Suggest any two (2) necessary safety precautions that need to be taken when handling the above experiment. **(2 marks)**

END

**ALTERNATIVE TO
CHEMISTRY PRACTICAL**

Date: 20/June/2024

Period: 08:30 AM – 10:00 AM



END OF TERM III EXAMINATION, 2023-2024

MARKING GUIDE

LEVEL	: ORDINARY	
GRADE	: SENIOR TWO (S2)	
DURATION	: 1 HOUR 30 MINUTES	
MARKS	: <table border="1" style="display: inline-table; vertical-align: middle;"><tr><td style="text-align: center;">/20</td></tr></table>	/20
/20		

INSTRUCTIONS:

- 1) All answers should be written in the spaces provided in the question paper.
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Answers:

i) Apparatus **A, B, C, D** and **E**:

A: Volumetric flask **(1 mark)**

B: Beaker **(1 mark)**

C: Test tube **(1 mark)**

D: Test tube rack **(1 mark)**

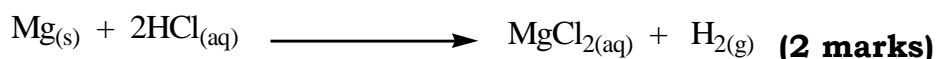
E: Test tube holder **(1 mark)**

ii) **A** is used to prepare solutions with accurate concentration. **(1 mark)**

iii) C1: Because magnesium (Mg) does not react with cold water. **(1 mark)**

iv) C3: Because magnesium (Mg) reacts with dilute hydrochloric acid and there is release of H₂ gas. **(2 marks)**

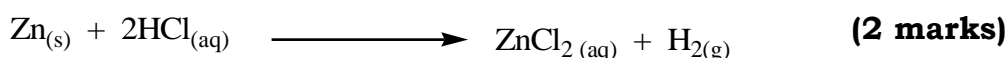
v) Reaction equation in C3:



vi) C2: Because zinc (Zn) does not react with cold water. **(1 mark)**

vii) C4: Because zinc (Zn) reacts with dilute hydrochloric acid and there is release of H₂ gas. **(2 marks)**

viii) Reaction equation in C4:



ix) When the cold water is replaced with hot water,

Both magnesium and zinc will react with hot water and there will be release of the hydrogen gas (H₂) which will cause the pop sound. **(2 marks)**

x) Some precautions need to be taken because:

- Be carefully when manipulating the experiment because most of them are glasses and can break easily and harm. **(1 mark)**

- Wear gloves to protect against any injury. **(1 mark)**

-Wear lab coat so that if the chemicals spill up, one is protected.

(Accept any other correct precaution)

-END-