

CHEMISTRY THEORY

Date: .. 22 / 06... /2022
Period:.... 8H30-11H30...



END OF TERM III EXAMINATIONS

GRADE / LEVEL: S4
OPTION / Advanced level

DURATION: 3 HOURS

MARKS: /100.....

INSTRUCTIONS

1. There are 2 sections in this paper:

Section A (70 marks): Attempt all questions in this section

Section B (30 marks): Attempt all questions in this section.

2. Do not use periodic tables

3. Non-programmable calculators may be used

4. Answers should be written on blank papers provided

5. Use a blue or black pen only

SECTION A: Attempt all questions in this section (70 marks)

1. Mark each of the following statements **true** or **false**. (3marks)
- A. Electron shells are sometimes called energy levels.
 - B. The shell nearest to the nucleus can contain a maximum of two electrons.
 - C. An orbital is a cloud of electricity formed by electrons around the nucleus of an atom

2. Insert the following oxides in their appropriate position in the table (5marks) below

- a) carbon monoxide
- b) aluminum oxide
- c) phosphorus (V) oxide
- d) Na_2O_2
- e) copper (II) oxide

Classification	acidic	amphoteric	basic	Neutral	peroxide
Oxide					

3. Consider the following data:

Element	Molar mass of atoms
A	12.00g
B	19.00g

A and B combine to form a new substance, X. If four moles of B combine with one mole of A to give one mole of X then the mass of one mole of X is

- a) 31.0g.
- b) 38.0g
- C) 67.0g
- c) 88.0g
- d) 124.0g

Explain using a balanced chemical equation. **(3marks)**

4. Which of the properties listed below are characteristic of an ionic solid?
(2marks)

- a) low melting point.
- b) conducts electricity as a solid.
- c) dissolves in water to form a solution containing mostly ions.
- d) when fused, the melt conducts electricity

5. There are two common oxides of sulfur. One contains 32grams of sulfur for each 32grams of oxygen. The other oxide contains 32 grams of sulfur for each 48grams of oxygen. What are the empirical formulas of these oxides?
(S=32 and O=16) **(4marks)**

6. Complete the missing part of each of the electron configurations below and find the atomic number of the corresponding elements. **(5marks)**. Assume all lower energy levels are filled and the atom is in its lowest energy state.

- a) ..., ..., 3s²
- b) ..., ..., 2p⁶
- c) ..., ..., 3p⁵
- d) ..., ..., 3d¹
- e) ..., ..., 5p⁴

7. Electronegativity values can be used to predict the polarity of bonds.

(a) Explain the term electronegativity. **(1 mark)**

(b) The electronegativity values for some atoms are given below:

H = 2.1, C = 2.5, F = 4.0, Cl = 3.0, I = 2.5

Use these values to predict the polarity of each of the following bonds by copying the bonded atoms shown below and adding $\delta+$ or $\delta-$ above each.

(i) H- I **(1 mark)**

(ii) F- I **(1 mark)**

(iii) C -Cl **(1 mark)**

c) The bond C-Cl is polarized but the compound CCl_4 is non- polar.

Explain why? **(2marks)**

8. The first three ionization energies for an element X are 176, 336 and 1847 kcal/mole respectively.

a) What is meant by “first ionization energy “ ? **(1 mark)**

b) Write an equation showing the third ionization energy of X. **(1 mark)**

c) In which group does X seem to belong? Explain. **(2marks)**

9. Given the following hypothetic equation



State and explain four ways to increase the yield in $\text{XY}_3(\text{g})$ i.e. to produce more $\text{XY}_3(\text{g})$ **(8marks)**

10. The hydrogen sulfite ion (HSO_3^-) is amphoteric.
- Define the term “amphoteric” . (1mark)
 - Write the balanced equation for the reaction of HSO_3^- with water in which the ion acts as
 - an acid (1mark)
 - a base. (1mark)
 - In both cases, identify the conjugate acid and base pairs. (2marks)

11. Complete the following table according to the missing (4marks)

Names(IUPAC)	Formula
	Fe_2O_3
Ammonium nitrate	
	$(\text{CH}_3\text{COO})_2\text{Ca}$
Potassium dichromate (VI)	

12. Boron forms only covalent compounds whereas aluminum and other elements of group 13 form even some ionic compounds.
- Concentrated nitric acid reacts with boron to produce boric acid (but no such an action is noticed with other group members) as shown in the unbalanced following chemical equation:

$$\text{B}_{(s)} + \text{HNO}_{3(l)} \rightarrow \text{H}_3\text{BO}_3(\text{aq}) + \text{NO}_{2(g)}$$
 - Balanced this chemical equation using half reactions. (2marks)
 - What is the reducing substance here? Explain. (2marks)
 - What is the cause of the abnormal behavior of boron (atomic number =5)? (2marks)

13. Match the uses to the elements (**3marks**)

Elements	Uses
Aluminum	Used in photographic industry (film manufacture)
Argon	Manufacture of saturated oil, such as margarine
Beryllium	Its vapor lamps are used for street lighting
Bromine	It can be used in manufacture of aircrafts' components
Hydrogen	Used in making cooking utensils
Sodium	Used mainly to provide an inert atmosphere in high temperature metallurgical atmosphere processes

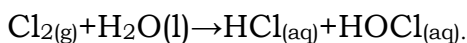
14. Arrange the following salts from the least soluble in water to the most soluble and justify your choice : KCl, NaCl, CsCl, LiCl, (**2marks**)

15. The table below shows the melting points (in K) of the period -3 elements except for silicon

Elements	Na	Mg	Al	Si	P	S	Cl	Ar	
M.P.(K)	371	923	933		317	392	172	84	

- a) Explain in terms of bonding why the M.P. of Mg is higher than that of Na(**2marks**)
- b) Explain why chlorine has a lower M.P. than Sulphur (**2marks**)

16. Bleaching is the process of removing stains or colors in fabrics, especially by the use of agents such as halogens (chlorine and bromine). The bleaching action of chlorine is an oxidizing action of hypochlorous acid, HClO , produced via the following reaction equation :



a) Find the oxidation number of Cl in each Cl-containing substance.

(3marks)

b) What is

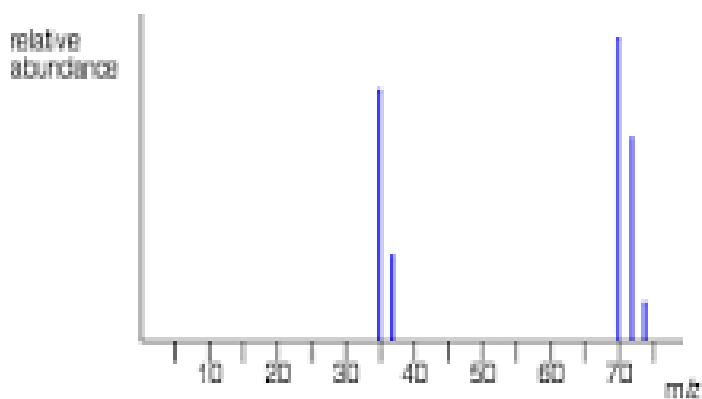
i. the oxidizing substance in this reaction? **(1mark)**

ii. the reducing agent in this reaction? **(1mark)**

c) How do you call such a reaction? **(1mark)**

Section B: attempt all questions from this section /30 Marks

17. Chlorine has 2 isotopes: Cl-35 and Cl-37. The mass spectrum of chlorine shows 5 peaks.



Explain why there are two separate groups of peaks. **(2marks)**

a) State what causes each of the 5 lines. **(2marks)**

b) The height of the line in 35 is approximately 12mm and that in 37 is 3mm.

i. What is the approximate relative abundance of chlorine-35?

(4marks)

ii. What is the relative atomic mass of chlorine? (2marks)

18. The thermite reaction is spectacular and highly exothermic. It involves the reaction between Fe_2O_3 , ferric oxide and metallic aluminum, Al. The reaction produces white-hot, molten iron in a few seconds.

Given $2\text{Al} + 1.5 \text{O}_2 \rightarrow \text{Al}_2\text{O}_3 + 400\text{kcal}$ and $2\text{Fe} + 1.5 \text{O}_2 \rightarrow \text{Fe}_2\text{O}_3 + 200\text{kcal}$,

a) State Hess's law (3marks)

b) determine the amount of heat liberated in the reaction of one mole of Fe_2O_3 with Al (4marks).

c) How much energy is released in the manufacture of 1.00kg of iron by the thermite reaction. How many grams of water could be heated from 0°C to 100°C by the heat liberated per mole of aluminum oxide formed in the thermite reaction. (Fe=56 ; Al=27) (3marks)

19. Compounds A, B and C are all white crystalline sodium salts.

a) A solution of A reacts with silver nitrate to give a yellow precipitate (D) which is insoluble in dilute nitric acid. An aqueous solution of A reacts with chlorine dissolved in tetra chloromethane (carbon tetrachloride) to give a purple coloration.

b) B reacts with warm dilute hydrochloric acid to liberate a pungent – smelling colourless gas (E), which turns acidified dichromate (VI)solution from orange to green .

c) C reacts with dilute hydrochloric acid to liberate an unpleasant-smelling gas (F) which blackens a filter paper soaked in a lead (II) ethanoate (lead acetate) solution. .

Identify the sodium salts A, B and C and the products D, E and F whose reactions are described above.

S4 Chemistry marking scheme

- 1) Elements in the periodic table are arranged in order of their (b)atomic number.
- 2) Mark each of the following statements true(**T**)or false (**F**) (**3marks**)6
 - A. Electron shells are sometimes called energy levels. T
 - B. The shell nearest to the nucleus can contain a maximum of two electrons. T
 - C. An orbital is a cloud of electricity formed by electrons around the nucleus of an atom. T
- 3) Insert the following oxides in their appropriate position in the table (**3marks**) below

Classification	Acidic	amphoteric	basic	Neutral	peroxide
Oxide	phosphorus (V) oxide	aluminum oxide	copper (II) oxide	carbon monoxide	Na ₂ O ₂

- 4) A and B combine to form a new substance, X according to

$$A+4B \rightarrow X \text{ or } AB_4$$
 (**1mark**)
 According to the law conservation of mass, the mass of X is
 (**1mark**) $12.0+4(19)=88.0\text{g}$ (d) (**1mark**)
- 5) There are two common oxides of sulfur. (**4marks**)

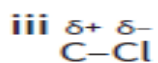
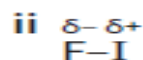
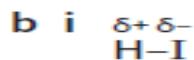
	Symbol	Molar mass	32g	Oxide	mass	moles	oxide
Oxygen	O	16	2moles	SO ₂	48g	3	SO ₃
sulfur	S	32	1mol		32g	1	

6) Complete the missing of each of the electron configurations below and find the atomic number of the corresponding elements. **(5marks)**.

	electron configurations	Atomic number
A	$1s^2 2s^2 2p^6 3s^2$	12
B	$1s^2 2s^2 2p^6$	10
C	$1s^2 2s^2 2p^6 3s^2 3p^5$	17
D	$1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^1$	21
E	$1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^{10} 4p^6$ $5s^2 4d^{10} 5p^4$	52

7 a) The ability of a bonded atom to draw/to attract the pair of electrons in a covalent bond towards itself. **(1 mark)**

b)



(3 marks)

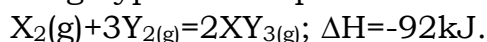
(c) This is because the bond polarity is cancelled out by the symmetry tetrahedral shape or The sum of dipole moments cancel out (gives a null vector.) **(2marks)**

8. a) The first ionization energy of an element is the energy needed to remove the outermost, or highest energy, electron from a neutral atom in the gas phase. (**1mark**).

b) the 3rd ionization of X: $X^{2+}(g) + \text{Energy} \rightarrow X^{3+}(g) + e^{-}$ (**1mark**).

c) The first three ionization energies for an element X are 176,336 and 1847 kcal/mole respectively. The most likely formula for the stable ion of X is $X^{2+}(g)$ (**1mark**) because to extract the third electron needs a high energy. X is a group-2 element. (**1mark**).

9. Given the following hypothetical equation



Four ways to increase the yield in $XY_3(g)$ i.e. to produce more $XY_3(g)$ (**8marks**) are

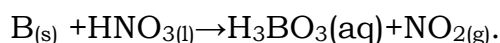
- to increase the pressure (**1mark**) or to reduce the volume. An increase of pressure on a gaseous system always favors a shift toward the side with the lowest total number of gaseous (**1mark**) particles, here from left to right.
- to reduce the temperature (**1mark**). Increasing the temperature causes the equilibrium position of a reaction to shift in the direction that absorbs the heat i. e. favors, here, the backward reaction which is endothermic (**1mark**), reducing it favors the production of $XY_3(g)$
- to increase the concentrations of reactants (**1mark**) (both at the same time or one of them) will favor the forward reaction to consume additional (**1mark**) reagent (s)
- to remove $XY_3(g)$ (**1mark**) it forms : the reaction will tend to restore the equilibrium by producing more products (**1mark**) .

10. The hydrogen sulfite ion (HSO_3^-) is amphiprotic.
- Molecules or ions which can either donate (**0.5mark**) (acidic behavior) or accept(**0.5mark**) a proton (as base), depending on their circumstances, are called amphiprotic species.
 - Balanced equation for the reaction of HSO_3^- with water in which the ion acts as
 - an acid: $\text{H}_2\text{O} + \text{HSO}_3^- \rightleftharpoons \text{H}_3\text{O}^+ + \text{SO}_3^{2-}$ (**1mark**) with (HSO_3^- ; SO_3^{2-}) (**0.5mark**) and (H_3O^+ ; H_2O) (**0.5mark**) as (acid; base) conjugated pairs .
 - a base $\text{H}_2\text{O} + \text{HSO}_3^- \rightleftharpoons \text{OH}^- + \text{H}_2\text{SO}_3$ (**1mark**) with (H_2SO_3 ; HSO_3^-) (**0.5mark**) and (H_2O ; OH^-) (**0.5mark**) as (acid; base) conjugated pairs .

11. Names and formulas (**4marks**)

Names(IUPAC)	Formula
Iron (III) oxide	Fe_2O_3
Ammonium nitrate	NH_4NO_3
Calcium acetate or Calcium ethanoate	$(\text{CH}_3\text{COO})_2\text{Ca}$
Potassium dichromate (VI)	$\text{K}_2\text{Cr}_2\text{O}_7$

12. Boron forms only covalent compounds whereas aluminum and other elements of group 13 form even some ionic compounds.
- Concentrated nitric acid reacts with boron to produce boric acid (but no such an action is noticed with other group members) as shown in the unbalanced following chemical equation:



- I. Oxidation: $B + 3H_2O \rightarrow BO_3^{3-} + 6H^+ + 3e^-$ (**1mark**) and Reduction
 $:NO_3^- + 2H^+ + 1e^- \rightarrow NO_2 + H_2O$ or $3NO_3^- + 6H^+ + 3e^- \rightarrow 3NO_2 + 3H_2O$
(1mark) The overall equation is



- II. B is the reducing substance here : it is oxidized (**2mark**)
 b) Boron has 5 electrons and is the first member of group 13 differs from other members of the group due to its smaller size, comparative high ionization enthalpy and **absence of** the d orbital (**2marks**).

13. Match the uses to the elements (**3mark**)s

Elements	Uses
Aluminum	Used in making cooking utensils
Argon	Used mainly to provide an inert atmosphere in high temperature metallurgical atmosphere processes
Beryllium	It can be used in manufacture of aircrafts 'components
Bromine	Used in photographic industry (film manufacture)
Hydrogen	Manufacture of saturated oil, such as margarine
Sodium	Its vapor lamps are used for street lighting

14. Arrange the following salts from the least soluble in water to the most soluble and justify your choice : LiCl, KCl, NaCl, CsCl (**3mark**) All of this group cations are combined with Chloride ion. They all have the same charge +1. Li^+ is the smallest and Cs^+ the biggest. Thus bond will be more polarized in LiCl and to break the bond will be harder than in CsCl. then the solubility of the chlorides of the alkali metal increases down the group.

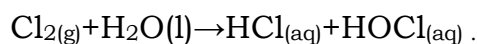
15. The table below shows melting points (in K) of the period -3 elements except for silicon

Elements	Na	Mg	Al	Si	P	S	Cl	Ar
M.P.(K)	371	923	933		317	392	172	84

Ions	electrons	protons	charge
Na ⁺	10	11	+1
Mg ²⁺	10	12	+2

- a) Both Mg and Na have metallic bond. Na⁺ ions and Mg²⁺ ions have the same number of electrons(10) with different number of protons . As the size of Mg²⁺ is smaller than that of Na⁺, the electrostatic attraction sea of electrons and positive ions is greater in Mg than in Na ;
Mg have also more delocalized electrons, and then the melting point of Mg will be higher than that of Na. **(2marks)**
- b) Chlorine consists of divalent compound made of isolated molecules linked together by weak intermolecular (Van der Waals) forces easy to be broken . Sulphur (S₈) **has** a bigger molecule with more electrons and therefore stronger van der Waals forces and a higher melting point higher melting point than Cl₂.

16. Bleaching is the process of removing stains or colors in fabrics, especially by the use of agents such as halogens (chlorine and bromine). The bleaching action of chlorine is an oxidizing action of hypochlorous acid, HClO, produced via the following reaction equation :



- a) The oxidation number of Cl in each Cl-containing substance.

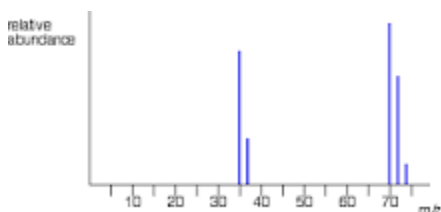
	$\text{Cl}_{2(g)}$	$\text{HCl}_{(aq)}$	$\text{HOCl}_{(aq)}$
Oxidation number	0	-1	+1

(3marks)

- b) What is
- I. the oxidizing substance in this reaction is $\text{Cl}_{2(g)}$ **(1mark)**
 - II. the reducing agent in this reaction $\text{Cl}_{2(g)}$ **(1mark)**
- c) such a reaction is the same as where the same substance acts as the oxidizing substance and the reducing agent, is a disproportionation or dismutation **(1mark)**

Section B

17. There are **five** main peaks of isotopes of chlorine



- a) There are two separate groups of peaks. A **mass spectrometer** ionizes atoms and molecules with a high-energy electron beam and then deflects the ions through a magnetic field based on **their** mass-to-charge ratios. The first group is due to Cl^+ ions and the second is due to Cl_2^+ **(2marks)**
- b) State what causes each of the 5 lines. A **mass spectrum** will usually be presented as a vertical bar graph, in which **each** bar represents an ion having a specific mass-to-charge ratio (m/z) and the intensity (=abundance) **(2marks)**

c) The height of the line in 35 is approximately 12mm and that in 37 is 4mm.

i. the approximate relative abundance of chlorine-35 is given by

(1 mark)

	Cl-35	Cl-37	total
height	12	4	16
Abundance	75	25	100

ii. The relative atomic mass of chlorine is $0.75(35)+0.25(37)=35.5$

a.m.u. **(2 marks)**

18. The thermite reaction is spectacular and highly exothermic. It involves the reaction between Fe_2O_3 , ferric oxide and metallic aluminum, Al. The reaction produces white-hot, molten iron in a few seconds.

Given $2\text{Al}+1.5 \text{O}_2 \rightarrow \text{Al}_2\text{O}_3 +400\text{kcal}$ and $2\text{Fe}+1.5 \text{O}_2 \rightarrow \text{Fe}_2\text{O}_3 +200\text{kcal}$,

a) Statement of Hess's law: The enthalpy change for any chemical change is independent of the intermediate stages , provided the initial and final conditions are the same . **(3 marks)**

b) the amount of heat liberated in the reaction of one mole of Fe_2O_3 with Al is x kcal such as $x+200=400$ or $x=200$. **(4 marks)**.

c) Energy released in the manufacture of 1.00kg of iron by the thermite reaction. (Fe=56 ; Al=27) Thus we write $\text{Fe}_2\text{O}_3 +2\text{Al} \rightarrow \text{Al}_2\text{O}_3 +2\text{Fe} +200\text{kcal}$. **(3 marks)**

2x56g of iron is produced with release of 200kcal

1.000kg of iron are produced with release of $(200 \times 1000) : (2 \times 56) = 1785.7\text{kcal}$

19. Compounds A, B and C are all white crystalline sodium salts.

a) A solution of A reacts with silver nitrate to give a yellow precipitate (D) which is insoluble in dilute nitric acid. An aqueous solution of A reacts with chlorine dissolved in tetra chloromethane (carbon tetrachloride) to give a purple coloration. **A is sodium iodide D is silver iodide**

(2+1.5)marks

b) B reacts with warm dilute hydrochloric acid to liberate a pungent – smelling colorless gas (E), which turns acidified dichromate (VI) solution from orange to green. **B is sodium sulphide and E is Sulphur dioxide**

(2+1.5)marks

c) C reacts with dilute hydrochloric acid to liberate an unpleasant-smelling gas (F) which blackens a filter paper soaked in a lead (II) ethanoate (lead acetate)solution. **C is sodium sulphide and F is hydrogen sulphide**

(2+1)marks

CHEMISTRY PRACTICAL EXAM

Date: ... 28 / 06... /2022

Period:.. 8H30-10H00...



END OF TERM III EXAMINATIONS

GRADE / LEVEL: S4
OPTION / Advanced level

DURATION: 1 HOUR 30 minute

MARKS: /25.....

INSTRUCTIONS

1. Please read carefully before you start and make sure that you have all the apparatus and chemicals that you may need.
2. This paper has one question.
3. Answer the questions in this paper and record your answers in the spaces provided. If necessary ask for a paper.

Chemistry lab

A. You are provided with the followings:

- a. FA1 which is a solution prepared by dissolving BA, a 0.1M sodium hydroxide (NaOH) solution.
- b. Phenolphthalein indicator solution

B. Procedure

- a. Pipette 10.0cm³ of FA1 into a conical flask and add 2 drops of phenolphthalein indicator.
 - b. Titrate the resultant solution by 0.1M sodium hydroxide solution from the burette.
- a. Record your results in the table below. **(5 marks)**

The pipette of the volume used is **(0.5mark)**

Experiment n ^o	1	2	3
Final burette readings (cm ³)			
Initial al burette readings (cm ³)			
Volume of BA used			

The average volume of 0.1M NaOH used is

.....**cm³**

I. The balanced chemical equation for the reaction between metal carbonate and the hydrochloric acid, HCl is.....
.....**(3marks)**

II. The balanced chemical equation for the reaction between **sodium hydroxide (NaOH)** and the hydrochloric acid, HCl is.....
..... **(3marks)**

III. The number of moles of sodium hydroxide present in 15.25cm³ 0.1M NaOH solution is
.....
.....**(2marks)**

IV. The number of mole of pure hydrogen chloride acid present in 10cm³ that have reacted with NaOH in (iii) is
.....
.....**(1mark)**

V. The total number of HCl present in 200cm³ is
..... **(1mark)**

VI. The number of mole of pure hydrogen chloride acid that have reacted effectively reacted with solid MCO₃ is
.....
..... **(2marks)**

VII. The number of mole of pure solid MCO₃ present in 7.12 g is
.....
.....**(3marks)**

VIII. The molar mass of MCO_3 is then

.....
.....**(3marks)**

IX. Therefore, atomic mass of M is

.....**(2marks)**

**MARKING SCHEME CHEMISTRY PRACTICAL, S4: PRACTICAL
(experiment) 2022**

Use the teacher's results of the experiment as a reference to mark observations as well as drawing conclusions of the students work.

-If the results of the students show a wide difference in observations from the teacher's results, deduct a half of the marks to be awarded.

-For the calculations; see the marking scheme of alternative o practical question paper.

ALTERNATIVE TO PRACTICAL EXAM

Date: ... 28 / 06... /2022
Period:.. 8H30-10H00...



END OF TERM III EXAMINATIONS

GRADE / LEVEL: S4
OPTION / Advanced level

DURATION: 1 HOUR 30 minute

MARKS: /20.....

INSTRUCTIONS

1. Please read carefully before you start answering.
2. This paper has ONE question. **(20 marks)**
3. Answer the questions in your answer booklet.

PRACTICAL EXAM-2022

7.12g of solid MCO_3 were dissolved in 200cm^3 of 1.0M hydrochloric solution. The resultant solution was titrated against 0.1M NaOH solution in presence of phenolphthalein to react with unreacted acid. The average of volume of sodium hydroxide required for complete reaction with 10.00cm^3 of the resultant solution is 15.25cm^3 .

- I. Write down the balanced chemical equation for the reaction between metal carbonate and the hydrochloric acid, HCl. **(3marks)**
- II. Write down the balanced chemical equation for the reaction between sodium hydroxide and the hydrochloric acid, HCl. **(3marks)**
- III. Why do they write “average “volume? **(1mark)**
- IV. How many moles of sodium hydroxide are in 15.25cm^3 ? **(2marks)**
- V. Calculate the number of mole of pure hydrogen chloride acid in 200cm^3 **(1mark)**.
- VI. Calculate the number of mole of pure hydrogen chloride acid that have reacted effectively with solid MCO_3 .**(2marks)**
- VII. Deduce the number of mole of pure solid MCO_3 present in 7.12g. **(3marks)**
- VIII. Calculate the molar mass of MCO_3 . **(3marks)**
 - I. Then deduce the atomic mass of M. **(2marks)**

S4 Alternative to practical –Marking Scheme-Chemistry

- i. 7.12g of solid MCO_3 were dissolved in 200 cm^3 of 1.0M hydrochloric solution i.e
 $200 \text{ cm}^3 \times 1.0\text{M} = 2 \times 10^{-1} \text{ mole HCl} .$
- ii. Solid MCO_3 and HCl reacted according to
 $2\text{HCl} + \text{MCO}_3 \rightarrow \text{MCl}_2 + \text{H}_2\text{O} + \text{CO}_2$
- iii. **NaOH** and the hydrochloric acid, HCl reacted as follows
 $\text{NaOH} + \text{HCl} \rightarrow \text{H}_2\text{O} + \text{NaCl} .$
- iv. We write average got after 2 or 3 trials with consistent results .
- v. 15.25 cm^3 of 0.1M NaOH contain
 $15.25 \text{ cm}^3 \times 0.1\text{M} = 15.25 \times 10^{-4} \text{ mol NaOH} .$
- vi. As NaOH and HCl reacted in the mole ratio 1:1, the number of mole of pure hydrogen chloride acid that have reacted with NaOH in (iii) is $15.25 \times 10^{-4} \text{ mol}$.
- vii. Thus in 200 cm^3 of resultant solution we have
 $15.25 \times 10^{-4} \text{ mol} \times 20 = 305 \times 10^{-4} \text{ mol of HCl}$
- viii. The number of mole of pure hydrogen chloride acid that have reacted effectively reacted with solid MCO_3 is
 $2 \times 10^{-1} \text{ mole HCl} - 305 \times 10^{-4} \text{ mol of HCl} = 1695 \times 10^{-4} \text{ mol of HCl}$.
- ix. As HCl and MCO_3 in (ii) reacted in the mole ratio 2:1, the number of mole of pure solid MCO_3 present in the
7.12 g is
 $(1695 \times 10^{-4} \text{ mol}) : 2 = 847.5 \times 10^{-4} \text{ mol of MCO}_3$
- x. By the way, the molar mass of MCO_3 is
 $7.12 \text{ g} : 847.5 \times 10^{-4} \text{ mol} = 84.01 \text{ g/mol}$.
- xi. And the molar mass of M is such as
 $x + 12 + 48 = 84$ i.e. $x = 24$

CONFIDENTIAL AND PRACTICAL EXAMINATION, 2022

S4 END OF YEAR EXAM, 2022

SUBJECT: CHEMISTRY PRACTICAL

ADVANCE INSTRUCTIONS

(A) CONFIDENTIAL

Great care should be taken that information given below does not reach the candidates either directly or indirectly.

Candidates are not allowed to use reference books during the examination.

(B) MANAGEMENT OF CHEMISTRY PRACTICAL

Section I:

The teacher must try the question and used his/her results as a reference to mark students work.

PRACTICAL CHEMISTRY EXAMINATION S4, 20122

CONFIDENTIAL

Each student will require:

CONFIDENTIAL

- a. Prepare FA1 which is a solution prepared by dissolving 7.12g of solid MCO_3 in 200cm^3 of 1.0M hydrochloric solution. BA, a 0.1M sodium hydroxide (NaOH) solution.**
- b. Phenolphthalein indicator solution**

Every candidate will need 35cm^3 of FA1 and 50cm^3 of BA, a conical flask, a burette, 2 beakers, Retort sand, filter funnel, dropper, 3 labels to mark the solutions, indicator.