PRESIDENT'S OFFICE

REGIONAL ADMINISTRATION AND LOCAL GOVERNMENT

ADVANCED CERTIFICATE OF SECONDARY EDUCATION EXAMINATION

FORM FIVE EXAMINATION

132/1 **CHEMISTRY 1**

(For Both School and Private Candidates)

Time: 3 Hours **May**

Instructions

1. This paper consists of sections A and B with a total of **ten(10)** questions.
2. Answer **ALL** questions in section A and **two(2)** questions from section B.
3. Mathematical tables and non-programable calculators may be used.
4. Cellular phones and **any** unauthorized materials are **not** allowed in the examination room.
5. Write your **Examination Number** on every page of your answer booklet(s).
6. The following information may be used.
   (a) Universal gas constant, R=8.314JK^{-1}mol^{-1} or 0.0821atmdm^{3}mol^{-1}.
   (b) Rydberg constant $R_H = 1.09678 \times 10^7 m^{-1}$
   (c) Mass of electron= 9.11×10^{-31}kg
   (d) Velocity of light, C= 3.0×10^8m/s
   (e) Avogadro's constant, N6.022×10^{23}mol^{-1}
   (f) Planks constant, h= 6.63×10^{-34}Js
   (g) Atomic masses
   H=1, C=12, O=16, N=14, Cl=35.5, Br=80, Na=23.

This paper consists of five printed pages

SECTION A (70 MARKS)

Answer **all** questions in this section.

1. (a) State three rules which govern the filling of electrons in orbitals of an atom which is in ground state. **(03 marks)**

   (b) In each of the following electron transition state either it corresponds to the absorption or emission of energy

   (i) $n = 2$ to $n = 5$

   (ii) $n = 4$ to $n = 1$

   (iii) $n = 5$ to $n = 2$

   (iv) $n = 3$ to $n = 5$ **(04 marks)**

   (c) Calculate the energy associated with an electron moving in an orbital of principle quantum number $n = 2$ **(03 marks)**

2. (a) "$C_6H_{12}O_6$ solution do not conduct electricity while NaCl solution conduct electricity". To explain this fact, form five students said it is because $C_6H_{12}O_6$ is a covalent compound and NaCl is ionic compounds formed by covalent bond and electrovalent bond respectively.
   Distinguish covalent bond from electrovalent (Give three points) **(03 marks)**

   (b) By giving example in each case, explain the meaning of iter-molecular hydrogen bond and intra-molecular hydrogen bond. **(03 marks)**

   (c) By applying VSEPR name and draw the shapes of the following molecules

   (i) PCl_5

   (ii) CCl_4 **(04 marks)**

3. (a) Give the meaning of the following

   (i) Colligative properties

   (ii) Cryoscopic constant

   (iii) Osmosis

   (iv) Molality **(04 marks)**

   (b) The boiling temperature of solution prepared by dissolving 5g of an organic solid in 100g of benzene is 82.42°C. If the boiling temperature of pure benzene is 80.10°C. What is the molecular weight of the organic solid? (K_b=2.53°Cm^{-1}) **(06 marks)**

4. (a) The gas laws show the relationship between macroscopic physical properties of gases. You as form five student;
   (i) Name the four macroscopic physical properties of gases.
   (ii) Explain the meaning of those four macroscopic physical properties of gases as used in gas laws. **(04 marks)**

   (b) A flammable gas is found to effuse through a porous barrier in 1.50 mins. Under the same conditions of temperature and pressure, it takes 4.73min for an equal volume of bromine vapour to effuse through the same barrier. Calculate the molar mass of the unknown gas. **(02 marks)**

   (c) (i) Real gases are those which disobey gas laws. Outline two assumptions of Kinetic theory of gases which must be modified for gas to behave ideally. **(02 marks)**

   (ii) In a victor-meyer's method for determining molar mass a 0.156g of volatile liquid displaced 47.0cm^3 of air measured over water at 14°C and 762mmHg pressure. What is the relative molecular mass of the volatile liquid? (Vapour pressure of water at 14°C is 13mmHg). **(02 marks)**

5. (a) With the aid of chemical equation explain the following phenomenon
   (i) Burning of sodium in oxygen
   (ii) Decomposition of metal carbonates by heat
   (iii) Dissolving of sodium oxide in dilute hydrochloric acid
   (iv) Dissolving Aluminium in concentrated nitric acid.
   (v) Dissolving chlorides of aluminium and sodium in water. **(05 marks)**

   (b) (i) Give two(2)examples of Amphoteric and basic hydroxides
   (ii) With examples explain three(3) uses of metal nitrates in our daily life. **(05 marks)**

6. (a) State Hess's law of constant heat summation. **(02 marks)**

   (b) Differentiate each of the following terms;
   (i) Standard enthalpy of reaction and standard enthalpy of combustion.
   (ii) Standard heat of formation from standard bond dissociation energy of a substance. **(04 marks)**

   (c) Calculate the heat of formation of methane $C_{(s)} + 2H_{2_{(g)}} \longrightarrow CH_{4_{(g)}}$ given that;
   (i) $C_{(s)} + O_{2_{(g)}} \longrightarrow CO_2 \qquad \Delta H = -393.7\text{Kj/mol}$
   (ii) $H_{2_{(g)}} + \frac{1}{2}O_{2_{(g)}} \longrightarrow H_2O_{(l)} \qquad \Delta H = -286.0\text{KJmol}^{-1}$
   (iii) $CH_{4_{(g)}} + 2O_{2_{(g)}} \longrightarrow CO_{2_{(g)}} + 2H_2O_{(l)} \qquad \Delta H = -890.3\text{KJmol}^{-1}.$
   (04 marks)

7. (a) By giving examples in each case differentiate the following pairs of phrases;
   (i) Static equilibrium and dynamic equilibrium
   (ii) Homogenous equilibrium and Heterogenous equilibrium . **(03 marks)**

   (b) During the reaction 11.2g of N_2, 1.4g of H_2 and 1.7g of NH_3 allowed to reach equilibrium in 1 litre closed container at 25°C, by the reaction $N_2 + 3H_2 \rightleftharpoons 2NH3$. If 25% of H_2 were converted to NH_3 of equilibrium calculate
   (i) The equilibrium constant, K_c for the reaction
   (ii) The K_p for the reaction **(07 marks)**

SECTION B (30 MARKS)

Answer **any two** (02) questions in this section

8. (a) Distinguish real gas from ideal gas. **(01 marks)**

   (b) (i) Explain the reasons and conditions for gases to deviate from ideal behaviour
   (ii) Calculate the pressure in atm exerted by 2.2g of CO_2 in 2.4dm^3 closed container at 35°C by Vander waal equation given that for CO_2, "a"=3.593L^3atmmol^{-2} and "b"=0.04267Lmol^{-1}. **(08 marks)**

   (c) A 10dm^3 closed container contain four gas that do not react chemically. In the container there is 5g of CO_2, 2g of H_2, 6g of Methane and 4g of unknown gas. The total pressure i the container is 9.02×10^8mmHg. If the unknown gas exert the pressure of 7.904×10^7mmHg.
   (i) Deduce the molecular mass of unknown gas
   (ii) Give three gas that probably represent the unknown gas. **(06 marks)**

9. (a) Draw the structure formula of each of the following compounds
   (i) 2, 2, 3, 3-tetramethylpentane
   (ii) 2-methylbut-2-ene
   (iii) 3, 3-dimethylbex-1-yne
   (iv) 3-ethylpent-1-yne **(04 marks)**

   (b) Complete and balance the following chemical reactions
   (i) $C_2H_5MgBr + H_2O \xrightarrow{H^+}$
   (ii) $CH_3CH_2Br + Mg \xrightarrow{\text{dryether}}$
   (iii) $C_2H_5MgBr + C_2H_5OH \longrightarrow$
   (iv) $CH_3-\underset{\underset{CH_2}{\|}}{C}-CH_3 + HBr \xrightarrow{H_2O_2}$ **(04 marks)**

(c) Give the formulae of alkenes which on ozonolysis followed by hydrolysis will give the following products

(i) Methanal and ethanal

(ii) Propanal as only product

(iii) Propanone as only product **(03 marks)**

(d) By using chemical equation(s) show how you would carry out the following conversions

(i) Propyne into 2, 2-dibromopropane

(ii) Ethane into butane

(iii) Methane into ethanol **(04 marks)**

10. (a) Aromaticity refers to an extra stability of a highly conjugated unsaturated molecules that exists as a planar ring with circular cloud of delocalization of $\pi-$electrons, in which stability is higher than the corresponding molecules with localised $\pi-$electrons. What are the unique features that aromatic compound posses that differentiates it from localised $\pi-$electron compounds? **(04 marks)**

(b) Write the equations show how would you prepare each of the following compounds starting with benzene and any other inorganic and organic materials.

(i) Bromobenzene

(ii) Ethylbenzene

(iii) Benzoic acid

(iv) Nitrobenzene

(v) Phenylethanone **(05 marks)**

(c) Two isomeric hydrocarbons P and Q have the same molecular formula C_9H_{12}. On oxidatation, P gives a monocarboxylic acid which when heated with excess soda lime yield benzene. Q is oxidized to give a tricarboxylic acid, which can then react under nitration to give a mononitro derivative

(i) Deduce the structural formula of P and Q

(ii) Write down all chemical equations which have been described

(06 marks)

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REGIONAL ADMINISTRATION AND LOCAL GOVERNMENT

ADVANCED CERTIFICATE OF SECONDARY EDUCATION EXAMINATION

FORM FIVE EXAMINATION

132/2 **CHEMISTRY 2**

(For Both School and Private Candidates)

Time: 3 Hours **May**

Instructions

1. This paper consists of **six (6)** questions.
2. Answer only **five (5)** questions.
3. Each question carries **twenty (20)** marks.
4. Mathematical tables and Non programable calculators may be used.
5. Cellular phones and any unauthorized materials are **not** allowed in the examination room.
6. Write your **Examination Number** on every page of your answer booklet(s).
7. For calculations you may use the following constants:
   - Universal gas constant,R= $8.314 JK^{-1}mol^{-1}$ or $0.0821 K^{-1}atm\ mol^{-1}K^{-1}dm^3$
   - Avogadro's constant, N$6.022 \times 10^{23} mol^{-1}$
   - Standard pressure =1atm =760mmHg =$1.0 \times 10^5 Nm^{-2}$
   - Atomic masses:H= 1, Cl= 35.5, Cr=52, O=16, C=12, F=19, Na=23, Ca=40, S=32, N=14

This paper consists of five printed pages

1. (a) A special type of distillation for temperature sensitive materials having high boiling point organic compounds, such compound can not be distilled at their own boiling point

   (i) Suggest the best terminology that describe a special type of distillation.

   (ii) Explain the meaning of the terminology

   (iii) Why high temperature sensitive materials cannot be distilled at their own boiling point. Give one reason.

   (04 marks)

   (b) Calculate the percentage by mass of bromobenzene(C_6H_5Br) in the distillate when the mixture of bromobenzene and water distils in a steam at 95°C. The vapour pressure of bromobenzene and water at 99°C are $1.59 \times 10^4 Nm^{-2}$ and $8.50 \times 10^4 Nm^{-2}$ respectively.

   (c) (i) State any four(4) conditions that govern the distribution law. **(04 marks)**

   (ii) given that the solubility of iodine in water is 0.34g/L and the aqueous solution of iodine containing 0.0516g/L is in equilibrium with carbon tetra chloride(CCl_4) solution containing 4.412g/L, calculate the solubility of iodine in carbontetrachloride. **(04 marks)**

   (d) State the unique properties of immiscible liquids. Give four reasons.

   (04 marks)

2. (a) The following chemical reaction was carried out at constant temperature $4A_{(g)} + 3B_{(g)} \longrightarrow 2C_{(g)}$. The data obtained when A and B were allowed to react at the same temperature are;

Experiment	[A],M	[B],M	initial rate, Ms^{-1}
1	0.100	0.100	5.00
2	0.300	0.100	45.00
3	0.100	0.200	10.00
4	0.300	0.200	90.00

   (i) Calculate the order of reaction with respect to each reactant.

   (ii) Calculate the value of rate constant (K). **(13 marks)**

   (b) Show the derivation of Arrhenious equation which gives the relation of T_1 and T_2

   (07 marks)

3. (a) What do you understand by the following terms

   (i) Fractional distillation

   (ii) Ideal solution

   (iii) Azeotropic mixture

   (iv) Vapour pressure **(04 marks)**

(b) Give a reason to why mixture of liquids deviate

(i) Positively

(ii) Negatively **(02 marks)**

(c) The nitric acid (B.P 85°C) mixture with water form azeotropic mixture with boiling point of 121°C and Nitric acid composition of 68%.

(i) Sketch a temperature-composition curve for water nitric acid mixture

(ii) What type of deviation is this? Explain.

(iii) It is possible to separate water-nitric acid mixture into pure water but not into pure Nitric acid. **(14 marks)**

4. (a) Mendeleef is a father of periodic table since was the founder of many feature present in the current periodic table. Explain the merits and demerits of Mendeleev's periodic table. (Give three points in each case). **(06 marks)**

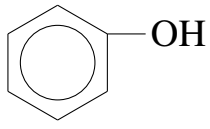
(b) Halogens react differently with cold and hot sodium hydroxide solution. Describe this with the aid of chemical reactions. **(04 marks)**

(c) Beryllium react differently comparing to other group II elements. Give three(3) reasons to why Beryllium react differently. Give two(2) reactions that Beryllium differ to other group II elements. **(05 marks)**

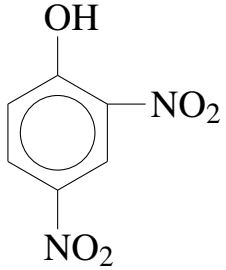
(d) Form five students observed the similarity of reaction shown by magnesium and lithium. What do we call this phenomenone in the periodic table? Explain the two causes of this phenomenone. Give example of two reactions in which Lithium and Magnesium react similar. **(05 marks)**

5. (a) By using IUPAC system name the following compounds;

(i)

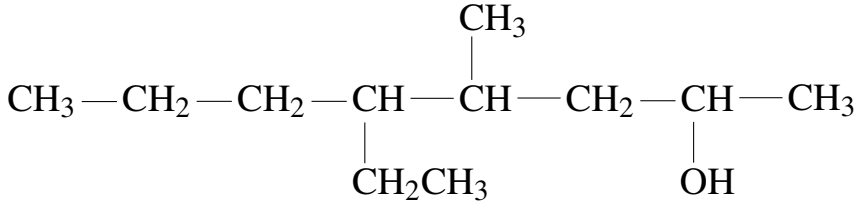


(ii)



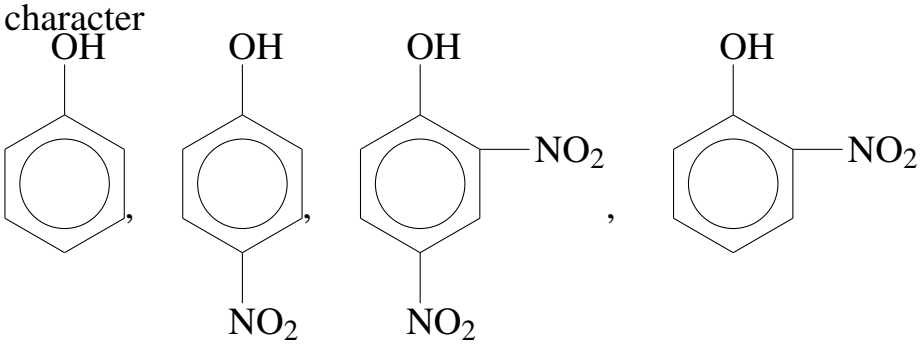
(iii) $HO-CH_2-CH_2-OH$

(iv)



(04 marks)

(b) (i) Arrange the following molecule according to increasing of acidic character



(**02 marks**)

(ii) By using one chemical test show how you can distinguish phenol from alcohol. (**02 marks**)

(c) Explain the following phenomenone

(i) Alcohols have higher boiling point than alkyl halides or alkanes of comparable molecular weight.

(ii) Ethanol is more soluble in water than alkane.

(iii) Phenol is more acidic than ethanol.

(iv) Why alcohols with large number of carbons are less soluble compared to the lower one.

(**06 marks**)

(d) By using not more than two(2) steps show how can carry out the following conversions

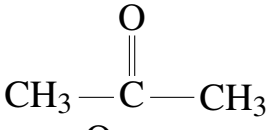
(i) Benzylalcohol into Benzoic acid

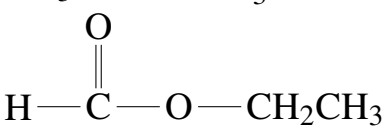
(ii) Chlorobenzene into P-nitrophenol

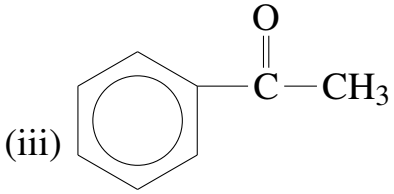
(iii) Toluene into benzylalcohol

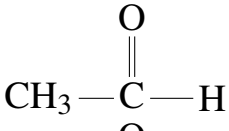
(iv) 2-chloropropane into 1-propanol. (**06 marks**)

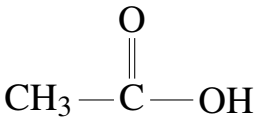
6. (a) Give the IUPAC names of the following compounds

(i) 

(ii) 

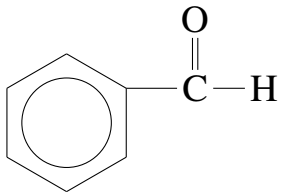
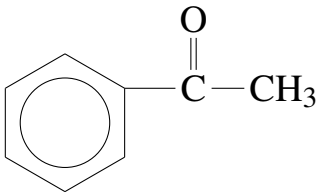
(iii) 

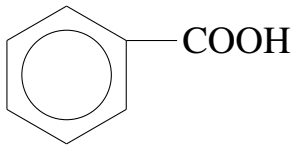
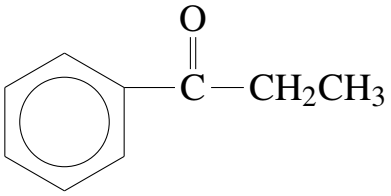
(iv) 

(v) 

(**05 marks**)

(b) By using one chemical test show, how would you distinguish the following

(i)  from 

(ii)  from 

(iii) $CH_3CH_2-\overset{\overset{O}{\|}}{C}-CH_2CH_3$ from $CH_3CH_2-\overset{\overset{O}{\|}}{C}-H$ (**06 marks**)

(c) A carbonyl compound A was reduced with $LiAlH_4$ to give compound B. Compound B was dehydrated with Conc.H_2SO_4 to give one product, C (molecular formula C_5H_{10}). Ozonolysis of C gave ethanal and other compound D with molecular formulae C_3H_6O. Compound D gives a positive iodoform test

(i) Identify compound A to D

(ii) Give the chemical reactions for the above reaction. (**07 marks**)

(d) Explain why carboxylic acids has higher boiling point(s) than alcohol.

(**02 marks**)

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FORM FIVE EXAMINATION

132/3 **CHEMISTRY 3**
(For Both School and Private Candidates)

(ACTUAL PRACTICAL)

CHECKLIST OF APPARATII

1.0 **IMPORTANT:**

The Joint Examination Southern Zone (Mtwara and Lindi) has prepared a checklist of apparatii for Chemistry actual practical Examination. As Head of school, **make sure that all the apparatii** indicated in checklist are available in the laboratory. Some of the Apparatii will be used for Joint Examination Southern Zone (Mtwara and Lindi) (ACSEE) May, 2023 Chemistry practical. The 3 Hours Advance Instruction will be provided.

2.0 **LIST OF APPARATII:**

In addition to the normal fitting and reagents of ACSEE Chemistry laboratory, each candidate will require some of the list apparatii as will be prescribed in the 3 hours advance instruction:

2.1. APPARATII

- burette 50ml
- pipette (20 or 25ml)
- plastic beaker 100ml
- spatula
- petri dish/ watch glass
- glass rod
- white tile per student
- filter paper
- conical flask
- tripod stand
- test tube holder

- measuring cylinder 100ml
- 2 measuring cylinder 10ml
- thermometer$(0^\circ - 100^\circ)$C
- retort sand and its accessories
- 1 test tube per student
- Heat source for sharing in ratio 1:4

2.2. CHEMICALS

- 4.5g hydrochloric acid
- 2g magnesium carbonate($MgCO3_{(s)}$)
- 2g sodium hydroxide
- 3g Zinc (II) chloride ($ZnCl_2$)
- 3g Calcium carbonate ($CaCO_3$)
- 1g magnesium ribbon ($Mg_{(s)}$)
- 2g Ammonium chloride (NH_4Cl)
- 4g Sodium Hydrogen carbonate
- 10g sodium carbonate
- 2g Iron (II) chloride ($FeCl_2$)
- 3g of Zinc sulphate
- 3g of Ammonium sulphate
- 1g of silver nitrate acid
- 2g of nitric acid
- 2g of Magnesium sulphate
- 3g of Hydrated ammonium oxalate
- 2g of Ammonium solution
- 1g phenolphthalein indicator
- 1g Methyl orange indicator
- 250cm^3 distilled water
- 5g copper chloride
- 1.3g sulphuric acid
- 0.5g iron sulphate
- 2 strips of both blue and red litmus paper
- 2g barium chloride
- 2g potassium hexacyanoferate (II)

3.0 OTHER REQUIREMENTS

3.1 LABELS

Prepare the following standby labels per candidate

A_1, A_2, A_3, A_4, A_5, A_6, A_7, C_1, C_2, C_3, C_4, G_1, G_2, G_3, Z, MO, POP

3.2 BENCH REAGENT

Ensure that, all bench reagents are available and fresh.

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FORM FIVE EXAMINATION

132/3A **CHEMISTRY 3A**

(For Both School and Private Candidates)

(ACTUAL PRACTICAL A)

3 HOURS ADVANCE INSTRUCTIONS

1.0 IMPORTANT

1.1 GREAT CARE MUST BE TAKEN NOT TO DIVULGE THIS INSTRUCTIONS TO BOTH CANDIDATE AND UNAUTHORIZED PERSONAL EITHER DIRECTLY OR INDIRECTLY.

1.2 MAKE SURE THAT THE CANDIDATES ARE PROVIDED WITH THE SPECIMENS, CHEMICALS AND APPARATII INDICATED IN THESE ADVANCE INSTRUCTIONS ONLY AND NOT OTHERWISE.

2.0 PREPARATIONS AND LABELLING OF SOLUTIONS AND CHEMICALS.

Question 1

(i) Prepare 0.03M of NaOH and 0.025 of $NaCO_3$ as a mixture. Label it A_1, allow $150cm^3$ per student.

(ii) Prepare 0.07M of HCl solution. Label it A_2. Allow $150cm^3$ per students

(iii) Phenolphthalein(POP) and methyl orange(MO) indicators

Question 2

(i) Prepare 5g of hydrated ammonium oxalate. Label it C_1 per students

(ii) Prepare 5g of anhyadrous sodium carbonate. Label it C_2 per student

(iii) Provide 200cm^3 of distilled water. Label C_3 per student.

(iv) Provide a student with stirrer, thermometer and 10cm^3 measuring cylinder.

Question 3

(i) Prepare a mixture containing equal amounts of $ZnCl_2$ and $CaCO_3$ salts label it as Z, provide 3g per students.

(ii) Prepare and provide the following reagents dil HCl, conc $HCl_{(aq)}$, $AgNO_{3_{(aq)}}$, $MgSO_4$ solution, ammonium oxalate solution, sodium hydroxide solution, dil.HNO_3, ammonia solution, filter paper, blue and red litmus paper and a source of heat in a ratio of 1:4.

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ADVANCED CERTIFICATE OF SECONDARY EDUCATION EXAMINATION

FORM FIVE EXAMINATION

132/3B **CHEMISTRY 3B**

(For Both School and Private Candidates)

(ACTUAL PRACTICAL B)

TIME: 3:20 HOURS **May**

Instructions

1. This paper consists of **Three (3)** questions.
2. Answer **all** questions.
3. Question **one (1)** caries **(20 marks)**, questions **two (2)** and **three (3)** each caries **(15 marks)**.
4. Qualitative analysis guide (QAG) sheet authorized by NECTA may be used
5. Mathematical tables and Non programable calculator may be used.
6. Write your **Examination Number** on every page of your answer booklet(s).
7. For your calculations the following constants may be useful:
   - Atomic masses:H=1, C=12, O=16, Cl=35.5, Na=23, S=32, Mg=24, K=39, N=14, Mn=55.
   - Universal gas constant,R= $8.314 JK^{-1}mol^{-1}$ or $0.0821 L.atm\ mol^{-1}K^{-1}$
   - Density of water,ρ=$1 g/cm^3$
   - Specific heat capacity of water, C=$4.2 Jg^{-1}{}^{\circ}C^{-1}$

This paper consists of four printed pages

1. You are provided with the following:

   G_1: A solution containing a mixture of 2.28g of Na_2CO_3 and $NaHCO_3$ in 0.4dm^3 of solution

   G_2: A solution containing 0.876g ofHCl in 0.4dm^3 of solution.

   Methyl orange indicator

   Phenolphthalein indicator

Procedure

(i) Put G_2 in the burette.

(ii) Pipette 20 or 25cm^3 of G_1 in a conical flask, then add to it three drops of POP.

(iii) Titrate G_1 in the conical flask against G_2 in the burette until there is colour change. Record the burette reading.

(iv) Add four drops of MO to the same solution in the conical flask then continue titrating until another colour change is observed. Record the second titre volume.

(v) Repeat procedure (i) to (iv) three times more times and tabulate your results as shown below

Burette readings

Titration number	**Pilot**	**1**	**2**	**3**
Initial volume (cm^3)				
Final volume during POP (cm^3)				
Final volume during MO (cm^3)				
Volume used during POP (cm^3)				
Volume used during MO (cm^3)				

Summary:

_____cm^3 of G_1 required _____cm^3 of G_2 during POP and _____cm^3 of G_2 during MO for complete reaction.

Questions

(a) What were the colour change;

(i) During POP

(ii) During MO

(b) What were the chemical reactions during;

(i) POP

(ii) MO

(c) Calculate the molarity of G_2

(d) Calculate the concentration of Na_2CO_3 in G_1 in g/dm^3

(e) Calculate the concentration of $NaHCO_3$ in G_1 in g/dm^3

(f) Calculate the percentage of $NaHCO_3$ in the solution G_1

2. You are provided with the following

A_5: Solution of 1MHCl

A_6: 0.2g of Magnesium ribbon

A_7: 1g of Magnesium carbonate

You are required to determine the heat of $MgCO_3$ in the first case determine the heat enthalpy change for the reaction

$Mg_{(s)} + HCl_{(aq)} \longrightarrow MgCl_{2_{(aq)}} + H_{2_{(g)}}$: ΔH

And in the second case determine the heat change for the reaction

$MgCO_{3_{(s)}} + HCl_{(aq)} \longrightarrow MgCl_{2_{(aq)}} + CO_2 + H_2O_{(l)}$: ΔH

Procedure A

(a) Measure out $50cm^3$ of 1M HCl acid solution into a $100cm^3$ plastic beaker

(b) Determine the initial temperature T_1

(c) Add 0.2g of Mg ribbon in (a) above swirl the mixture and still by using thermometer and reord the final temperature T_2

(d) Calculate the heat evolved during the reaction

Procedure B

(a) Measure $50cm^3$ of 1M HCl acid solution into a $100cm^3$ plastic beaker.

(b) Determine the initial temperature T_3

(c) Add 1g of Magnesium carbonate still by using thermometer then read the final maximum temperature reached T_3

(d) Calculate heat evolved during the reaction in all calculation neglect the heat absorbed by the container given

The enthalpy of formation of CO_2=-394KJ/mole

The enthalpy of formation of H_2O=-286KJ/mole

The specific heat capacity of the solution=4.2$Jg^{-1}K^{-1}$

The heat evolved can be calculated from the following formula.

Heat evolved= $-C\rho V\Delta T$; where

C=Specific heat capacity of water

ρ =density of solution

V=volume of solution

ΔT=Temperature change.

(e) Calculate the enthalpy of formation of magnesium carbonate($MgCO_3$)

3. Salt **Z** containing two cations and common anion. Perform the following experiments to deduce the cations and anions in **Z**.

S/N	Experiment	observations	Inferences
1	Observe the appearance of Z		
2	Heat the salt Z in a test tube strongly		
3	Add dilute HCl to salt Z in a test tube		
4	Add concentrated H_2SO_4 to salt Z in the test tube		
5	To solution of Z in a test tube add $AgNO_3$ solution solution followed by dil.HCl		
6	To solution of Z in a test tube add $BaCl_2$ solution followed by dil.HCl		
7	To solution of Z in test tube add NaOH solution then heat		
8	To solution Z in a test tube add potassium hexacynoferate(II) solution		

Questions:

(a) The cations in Z are _____ and _____.

(b) The anions in Z is _____.

(c) The salts mixed are _____ and _____.

(d) Write the two equations happened in experiment 7.