KASSU JOINT EXAMINATIONS 2024

KENYA CERTIFICATE OF SECONDARY EDUCATION

CHEMISTRY

(PRACTICAL)

$2\frac{1}{4}$ HOURS

233/3- **-Paper 3**

NAME.....SCHEME.....**ADM. NO**.....**CLASS**.....

INDEX NUMBER..... **DATE**.....**SIGNATURE**.....

INSTRUCTIONS TO CANDIDATES:

- *Write your name, admission number, index number and class in the spaces provided above.*
- *Indicate the date of exam and sign off in the spaces provided above.*
- *Answer all the questions in the spaces provided below each question.*
- *KNEC Mathematical tables and silent electronic calculators may be used.*
- *All working must be clearly shown where necessary.*
- *Candidate should take the first 15 minutes to go through the instructions.*

FOR EXAMINER`S USE ONLY

QUESTIONS	MAXIMUM SCORE	CANDIDATE`S SCORE
1	22	
2(a)	10	
(b)	8	
Grand Total	40	

You are provided with

- **Solid A**
- **2.0M** hydrochloric acid solution **B**
- **0.1M** Sodium hydroxide solution **D**

You are required to determine the enthalpy change **ΔH.** for the reaction between solid **A** and one mole of hydrochloric acid.

Procedure 1

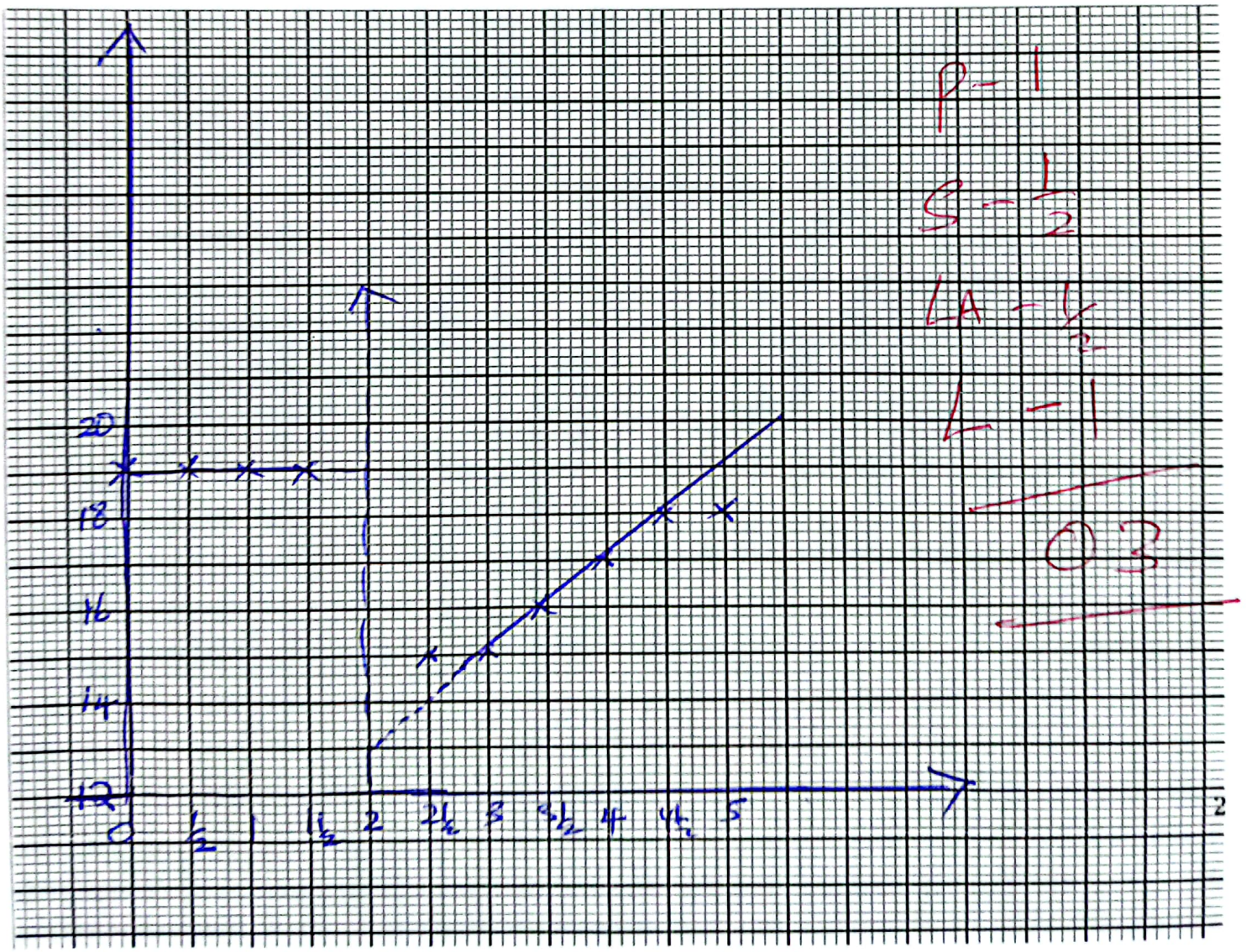
Using a burette, place $20.0cm^3$ of 2.0M hydrochloric acid, solution **B** in a 100ml beaker. Measure the temperature of the solution after every half-minute and record the values in **table 1**. At exactly **2 minutes**, add all of solid **A** to the acid. Stir the mixture gently with thermometer. Measure the temperature of the mixture after every **half-minute** and record the values in **table 1. Retain the mixture for use in Procedure II.**

Table 1 **(5marks)**

Time (min)	0	½	1	1½	2	2½	3	3½	4	4½	5
Temperature (c)	19	19	19	19	X	15	15	16	17	18	18

CT-2
PP-1
AC-1
T-1
05

(a) Plot a graph of temperature (y-axis) against time. **(3marks)**



(b) Using the graph determine the change in temperature, ΔT (1mark)

$\Delta T = 19 - 13 = 6^{0}C$ ✓ (From the graph)

(c) Calculate the heat change for the reaction. (Assume that the specific heat capacity of the mixture of the mixture is $4.2 Jg^{-1}K^{-1}$ and the density of the mixture is $1 g/cm^3$). (2marks)

$\Delta H = MC\Delta T$ ✓1 $20 \times 4.2 \times$ Ans (b)

$= 20 \times 4.2 \times 6$ ✓1 OR

$= 504 J$ ✓1

Procedure II

Rinse the burette thoroughly and fill it with sodium hydroxide solution **D**. Transfer all the contents of the 100 ml beaker used in **procedure 1** into a 250ml volumetric flask. Add distilled water to make up to the mark. Label this **solution C**. Using pipette and a pipette filler, place **25.0 cm^3** of solution C into a 250ml conical flask. Add two or three drops of phenolphthalein indicator and titrate against sodium hydroxide until a permanent pink colour just appears. Record your results in table. Repeat titration **two more times** and complete table 2.

Table 2 (4marks).

	I	II	III
Final burette reading (cm^3)			
Initial burette reading (cm^3)			
Average volume **of D used** (cm^3)	20.0	20.0	20.0

CT - 1
DP - 1
AC - 1
PA - 1
FA - 1
05

Calculate the:

(d) Average volume of sodium hydroxide **solution D** used. (1mark)

$\frac{20.0 + 20.0 + 20.0}{3}$ OR Average

$= 20.0 cm^3$

(e) The number of mole of:

i. Sodium hydroxide **solution D used.** (1mark)

$\frac{0.1 \times 20}{1000}$ ✓½ OR $\frac{0.1 \times \text{ans (d)}}{1000}$

$= 0.002$ Moles ✓½

ii. Hydrochloric acid in **25** cm^3 of solution **C**. **(1mark)**

NaOH : HCl
1 : 1 ✓ ½ OR Ans: e(i)
= 0.002 Mols ✓ ½

iii. Hydrochloric acid in **250** cm^3 of solution **C**. **(1mark)**

If 0.02 → 25 cm^3
? → 250 ✓ ½
$\frac{250 \times 0.02}{25}$ = 0.02 mols ✓ ½

OR $\frac{250 \times ans(ii)}{25}$

iv. Hydrochloric acid in 20.0 cm^3 of solution **B**. **(1mark)**

Mols = $\frac{M \times V}{1000}$
= $\frac{2 \times 20}{1000}$ = 0.04 ✓ 1

v. Hydrochloric acid that reacted with sold **A**. **(1mark)**

0.04 − 0.02 ✓ ½
= 0.02 ✓ ½

(f) Calculate the **Molar enthalpy** of reaction between solid **A** and one mole of hydrochloric acid. **(2marks)**

If 0.02 → 504
1 | 1
$\frac{1 \times 504}{0.02}$ ✓ 1
+25,200 J/mol ✓
or 25.2 kJ/mol

OR If Ans(v) → Ans 1(c)
1 → ?
$\frac{1 \times Ans\ 1(c)}{Ans(v)}$

(I) You are provided with **solid Q**. Carry out the tests below and record your observations and inferences in the spaces provided.

(a) Strongly heat a spatula-end full of **solid Q** in a dry test tube.

Observation	Inference
- Droplets of a colourless liquid formed at the cooler surface. ½ - White Residue ½ **(1mark)**	- Hydrated solid, 1 or - Presence of water of crystallisation **(½mark)**

(b) (i) Place the remaining **solid Q** in a boiling tube. Add 10 cm^3 of distilled water. Divide the solution into five portions.

Observation	Inference
Dissolves ½ to form a colourless solution ½ **(½mark)**	- Soluble solid. 1 - Cu^{2+} Fe^{2+}, Fe^{3+} present. **(1mark)**

(ii) To the first portion, add universal indicator solution.

Observation	Inference
pH = 3.0 ½ **(½mark)**	strongly acidic ½ **(½mark)**

(iii) To the second portion, add aqueous lead (II) nitrate solution.

Observation	Inference
White precipitate. ½ **(½mark)**	SO_4^{2-}, SO_3^{2-}, CO_3^{2-}, Cl^- present. **(1mark)**

4 ion – 1
3 – ½
2 – 0

(iv) To the third portion, add dilute nitric (V) acid followed by barium nitrate solution.

Observation	Inference
- No bubbles/Effervescence ✓½ - White Precipitate ✓½ (1mark)	SO_4^{2-} ✓½ Confirmed. Present. (½mark)

(v) To the forth portion, add few drops of sodium hydroxide until in excess.

Observation	Inference
White precipitate ✓½ Soluble in excess ✓½ (1mark)	Al^{3+}, Zn^{2+} present. 2 – 1 1 – ½ (1 mark)

(vi) To the firth portion, add few drops of aqueous ammonia until in excess.

Observation	Inference
White precipitate ½ Insoluble in excess. ✓½ (1 mark)	Al^{3+} present ✓! (1 mark)

(II) You are provided with **solid R.** carry out the tests below and record your observations and inferences.

(a) Place a spatula-end full of **solid R** in dry boiling tube and add about 10 cm^3 of distilled water. Shake thoroughly ~~and heat to boil. Divide~~ the solution into **five** portions.

Observation	Inference
Dissolves to form a colourless solution ✓1 **(1 mark)**	Polar substance present. ✓½ **(½ mark)**

(b) (i) Test the first portion with the universal indicator solution provided.

Observation	Inference
pH = 3.0 ✓½ **(½ mark)**	Strongly Acidic. ✓½ **(½ mark**

(ii) to the second portion, add a few drops of acidified potassium manganate (VII) solution.

Observation	Inference
Purple $H^+/KMnO_4$ decolurized ✓½ **(½ mark)**	$-C=C-$, $-C\equiv C-$ ✓½ or R-OH ✓½ Present. **(1 mark)**

(iii) To the third portion, add few drops of bromine water.

Observation	Inference
Yellow bromine water decolourized ✓½ **(½ mark)**	$-C=C-$, $-C\equiv C-$ ✓½ Present. **(½ mark)**

(iv) To the fourth portion, add all the sodium hydrogen carbonate provided.

Observation	Inference
Effervescence / Fizzing / Bubbles ✓1 **(1 mark)**	R-COOH present. ✓1 **(1mark)**

(v) To the fifth portion in a boiling tube, add $5cm^3$ of ethanol followed by few drops of concentrated sulphuric (VI) acid. Warm the mixture.

Observation	Inference
Pleasant ~~sp~~ smell ✓1 ✓½ **(½ mark)**	R-COOH present. ✓½ **(½ mark)**

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