NAME: ..... Teachers Copy ..... ADM NO: .....

SCHOOL : .....DATE : .....

CANDIDATE'S SIGNATURE.....

233/3

CHEMISTRY

PAPER 3

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

Marking scheme

Kenya Certificate of Secondary Education (K.C.S.E)

INSTRUCTIONS TO CANDIDATES:

(i) Write your **name** and **index number** in the spaces provided **above**.
(ii) **Sign** and write the **date** of examination in the spaces provided **above**.
(iii) Answer **ALL** the questions in the spaces provided in the question paper.
(iv) You are not allowed to start working with apparatus for the first 15 minutes of $2\frac{1}{4}$Hours allowed for this paper. This time is to enable you read the question and make sure you have all the chemicals and apparatus required.

(iv) Mathematical tables and silent electronic calculators **may be** used.

(v) All working **must be** clearly shown where necessary.

(vi) Candidates should check the question paper to ascertain that all the pages are printed as indicated and that no questions are missing

FOR EXAMINER'S USE ONLY:

Question	Maximum Score	Candidate's Score
1	20	
2	13	
3	7	
Total Score	40	

QUESTION 1

(a) You are provided with the following

(i) Sulphuric(vi) acid labeled a solution D

(ii) Solution R prepared by dissolving 40g of NaOH in 400cm^3 of distilled water and made up to 1 litre.

You are required to determine the molarity of Sulphuric (vi) acid.

PROCEDURE

(i) Fill the burette with Sulphuric (vi) acid.

(ii) Using pipette and pipette filter place 25cm^3 of solution R into conical flask.

(iii) Add 2-3 drops of phenolphthalein indicator.

(iv) Titrate solution R against solution D.

(v) Repeat the titrations to obtain two concordant titrates

(vi) Record your results in the table below.

	I	II	III
Final burette reading (cm^3)			
Initial burette reading (cm^3)			
Volume of solution D used (cm^3)			

CT = 0
DP = 0
AC = 0
PA =
FA =

(4mks)

i) Calculate the average volume of acid solution D used . (1mk)

$\frac{I + II + III}{3}$ ✓½

Correct ans ½

ii) Calculate the number of moles NaOH solution (Solution R) used.

Molarity = $\frac{40}{40}$

= 1M

No. of moles in 25cm^3

1Mole → 1000cm^3 (1mk)

← 25

$\frac{25 \times 1}{1000}$ ✓½

0.025 Moles ✓½

iii) Calculate the number of moles of acid used. (1mk)

$2NaOH + H_2SO_4 \longrightarrow Na_2SO_4 + 2H_2O$

(aq) (l)

Mole ratio 2 : 1

No. of moles of H_2SO_4 used = $\frac{0.025}{2}$ ✓½ = 0.0125 ✓½

iv) Determine the molarity of Sulphuric (vi) acid. (1mk)

0.0125 Moles → 12.5cm^3

← 1000cm^3

$\frac{1000 \times 0.0125}{12.5}$ ✓½

2

= 1M ✓½

b) You are provided with the following;

(i) 0.85M HCL labeled solution N.
(ii) Sodium hydroxide labeled solution K.

You are required to determine the molar heat of neutralization **of** solution N

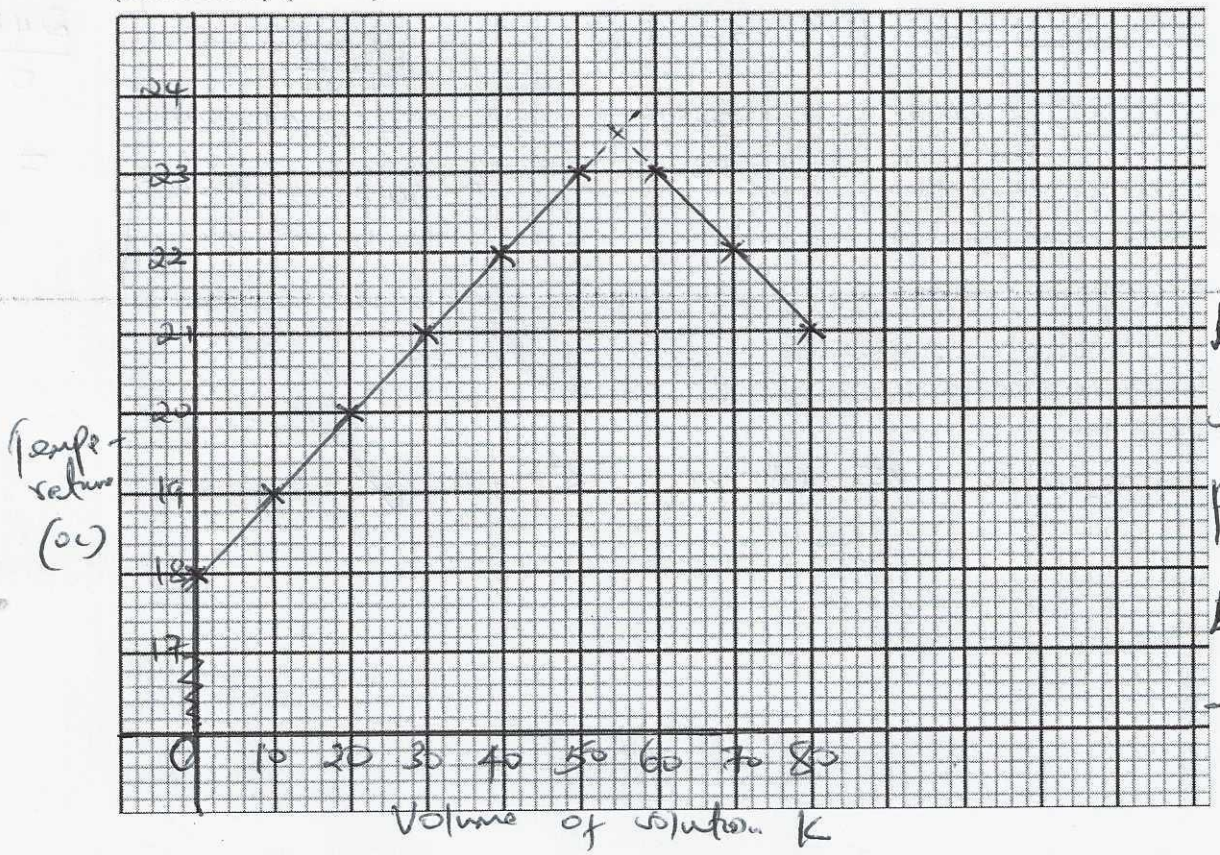
Procedure

i. Measure $50cm^3$ of solution N and transfer it into a 250cm plastic beaker provided.
ii. Record the initial temperature of solution N to the nearest 0.5^0c.
iii. Rinse the burette thoroughly with distilled water and fill it up to the $0.0cm^3$ mark with sodium hydroxide solution (Solution K)
iv. From the burette add $10cm^3$ of solution K to solution N in the beaker. Stir gently with the thermometer and record the new temperature in the table below.
v. Continue adding $10cm^3$ portions of Solution K recording new temperature after each addition until $80cm^3$ of K has been added

Volume of Solution K added (cm^3)	0	10	20	30	40	50	60	70	80
Temperature ^0C	18.0	19.0	20.0	21.0	22.0	22.0	23.0	22.0	21.0

(3mks)

a) Plot a graph of temperature (y-axis) against total volume of sodium hydroxide (Solution K) (x-axis) (3mks)



i) From the graph determine the maximum temperature reached. (1mk)

$23.5^{\circ}C$ ✓1 $\pm 2.0^{\circ}C$

ii) What is the temperature change? (1mk)

$23.5 - 18 = 5.5^{\circ}C$ ✓1 ± 2.0

b) From the graph determine the volume of sodium hydroxide required for complete neutralization of hydrochloric acid. (1mk)

$= 55\,cm^3$ ✓1 $\pm 3.0\,cm^3$

c) Write an Ionic equation for the neutralization reaction. (1mk)

$H^+_{(aq)} + OH^-_{(aq)} \longrightarrow H_2O_{(l)}$ ✓1

d) Calculate the heat evolved when volume of sodium hydroxide in (c) was neutralized. Density of solution $1g/cm^3$, C=4.2j/g/k. (1mk)

Heat change = $105 \times 4.2 \times 5.5$ ✓½

$= 2425.5\,J$ ✓½

e) Calculate the molar heat of neutralization. (1mk)

Moles of HCl reacted

0.85 moles = $1000\,cm^3$

? = $50\,cm^3$

$\frac{0.85 \times 50}{1000} = 0.0425$ moles

0.0425 → 2425.5

1 mole → ?

$\frac{2425.5}{0.0425}$ ✓

$= -57\,0$ ✓

J/mol

QUESTION 2

You are provided with solid D. Carry out the following tests and record your observation and inferences in the spaces provided.

a) Describe the appearance of Solid D. (1mk)

White crystaline solid ✓1

b) Place about half of solid D in dry test. Heat it strongly and test for any gas produced using a blue and red litmus paper.

Observation	Inferences
Colourless ~~vapour~~ liquid forms on cooler parts of test tube ½ Blue litmus remains blue ½ Red litmus remains red 1mk	Hydrated salt ½ Neutral gas ½ 1mk

c) Place the rest of Solid D in boiling tube and add about $10cm^3$ of distilled water. Shake well and add about $2cm^3$ portions for each of the test below.

Observation	Inferences
Dissolve to form colourless solution ✓ 1mk	Soluble salt ✓1 Coloured ions Fe^{2+}, Cu^{2+} and Fe^{3+} absent 1mk

i) To one portion, add aqueous NaOH drop wise until in excess

Observation	Inferences
White precipitate ✓1 soluble 1mk	Zn^{2+} ½, Al^{3+} and Pb^{2+} present $1/_2$mk

ii) To the second portion, add aqueous ammonia drop wise until in excess

Observation	Inferences
White Precipitate ✓1 dissolves ✓1	Zn^{2+} ✓½ Confirm Present
1mk	½mk

iii) To a third portion add about 5 drops of sodium chloride solution.

Observation	Inferences
No white Precipitate formed ✓1	Pb^{2+} absent ✓½
1mk	½mk

iv) To a fourth portion, add dilute Barium nitrate solution.

Observation	Inferences
No white Precipitate ✓1	SO_4^{2-} ✓½ or SO_3^{2-} or CO_3^{2-} absent
1mk	½mk

v) To a fifth, add lead (ii) nitrate solution, warm mixture

Observation	Inferences
White precipitate dissolve on warming ✓1	Cl^- present ✓1
1mk	1mk

QUESTION 3

i) You are provided with solid J. carry out the tests below and record your observation and inferences to the spaces provided.
Place a half of Solid J in a clean metallic spatula and ignite it on Bunsen burner flame.

Observation	Inferences
Melt and burn in a yellow and sooty flame ✓1	Long chain hydrocarbon ✓ $C=C$ or $-C\equiv C-$ ✓½ ✓½ present
1mk	1mk

Put the remaining portion of solid J in a boiling tube and add about $8cm^3$ of distilled water. Shake to dissolve.

ii) To about $2cm^3$ of solution J in a test tube add 2 to 3 drops of bromine water.

Observation	Inferences
Yellow bromine water turns colourless ✓1	:C=C: ✓1 or −C≡C−
1mk	1mk

iii) To about $2cm^3$ of solution J in a test tube, add about $1cm^3$ of acidified potassium dichromate (vi). Warm gently and allow to stand for a minute.

Observation	Inferences
Orange acidified Potassium dichromate (VI) remains Orange ✓1	R − OH ½ Absent
1mk	½mk

iv) To about $2cm^3$ of solution in a test tube, add a small amount of solid Sodium hydrogen carbonate.

Observation	Inferences
Effervescence/fizzing/ Bubbles of colourless ✓1 is produced	R − COOH ½ or H^+ and H_3O^+
1mk	½mk