Name :……..……..…… **Index No……..……..**

Candidate's sign….....

Date ……

233/3

CHEMISTRY

Paper 3 (Practical)

Time: 2 ¼ Hours

INSTRUCTIONS TO CANDIDATES

- *Write **your name** and **index number** in the spaces provided above*
- ***Sign** and **write** the date of examination in the spaces provided.*
- *Answer **all** questions in the spaces provided .*
- *You are not allowed to start working with the apparatus for the first **15 minutes** of the 2 ¼ hours allowed for this paper. This time is to enable you to **read** the questions paper and **make sure** you have all the chemicals and apparatus that you may need.*
- *All working **must** be clearly shown where necessary.*

FOR EXAMINER'S USE ONLY

Question	Maximum Score	Candidate's Score
1.	14	
2.	10	
3.	16	
TOTAL	**40**	

This paper consists of 6 printed pages . Candidates should check the question paper to ascertain that all the pages are printed as indicated and that no questions are missing

1. You are provided with sodium hydroxide solution **L** 1.8g of solid **T**, Solid **T** is a dibasic acid 0.36M Solution of the dibasic acid **H_2X** labelled solution **Q.**

You are required to determine

i) The molar heat of solution of solid **T**

ii) The heat of reaction of one mole of dibasic acid with sodium hydroxide.

II. Calculate the heat of reaction of solid H_2X with aqueous sodium hydroxide.

Procedure I

Place 40cm^3 of distilled water into a 100cm^3 beaker. Measure the initial temperature of the water and record it in table **I** below. Add all the Solid **T** at once. Stir the mixture carefully with the thermometer until all the solid dissolves. Measure the final temperature reached, record it in table I and complete table I. (2mks)

Table I

Final temperature (^oC)	
Initial temperature (^0C)	
Temperature change ΔTI	

(b) Calculate the;

(i) Heat change when H_2X dissolve in water (Assume the specific heat capacity of the solution is 4.2J g^{-1} $^oC^{-1}$ and density is 1g / cm^3) (2mks)

(ii)The number of moles of the acid that dissolved.
(Relative formula mass of H_2X is 126) (1mk)

iii) Molar heat of solution, Δ**H_1,** solution of the acid **H_2X** (1mk)

Procedure II

Place 40cm^3 of solution **Q** into a 100cm^3 beaker. Measure the initial temperature and record it in table II below. Measure 40cm^3 of sodium hygroxide, solution **L**. Add all the 40cm^3 of solution **L** at once to solution **Q** in the beaker. Stir the mixture with the thermometer. Measure the final temperature reached, record it in table II and complete the table (2mks)

a) Table II

Final temperature	
Initial temperature	
Temperature ΔT	

(b) (i) Calculate the heat change for the reaction (Assume the specific heat capacity of the solution is 4.2J $g^{-1}\ ^oC^{-1}$ density is 1g / cm^3) (2mks)

(ii) Calculate the number of moles of H_2X used (1mk)

(iii)Calculate the heat of reaction ΔH_2 of one mole of the acid H_2X with sodium hydroxide (1mk)

(c) Given that :

$\Delta H1$ is the heat for the reaction. $H_2X_{(s)} \longrightarrow H_2X_{(aq)}$

$\Delta H2$ is the heat for reaction $H_2X_{(aq)} + 2NaOH_{(aq)} \longrightarrow Na_2X_{(aq)} + 2H_2O_{(l)}$

Calculate $\Delta H3$ for the reaction $H_2X_{(s)} + 2NaOH_{(aq)} \longrightarrow 2H_2O_{(l)} + Na_2X_{(aq)}$ (2mks)

2. You are provided with:

- 2.3g of solid **N** in a boiling tube.
- Solution, 0.03M acidified potassium manganate (VII).

You are required to determine the number of moles of water of Crystallization in solid **N**.

Procedure (III)

(a) Add 10cm^3 of distilled water into the boiling tube containing solid **N** shake it to dissolve the solid. Transfer the contents of the boiling tube into a 250cm^3 volumetric flask. Rinse the boiling tube with the distilled water and add it to the volumetric flask. Add more distilled water to make it to the mark label this **solution N**.

Fill the burette with **solution R**. using a pipette and a pipette filler place. 25.0cm^3 of **solution N** into a conical flask. Warm the mixture to about 60^{o}C. Titrate the hot **solution N** with **solution R** until a permanent pink colour persists. Record your readings in table III below . Repeat the titration two more times and complete table III. (Retain solution **R** for use in question 3 II f (i) (4mks)

Table III

	I	**II**	**III**
Final burette readings (cm^3)			
Initial burette reading (cm^3)			
Volume of solution R (cm^3)			

b) Calculate the :

i) Average volume of solution **R** used (1mk)

ii) Number of moles of potassium manganate (VII) that reacted (1mk)

iii) Number of moles of **N** in 25cm^3 of solution **N**, given that 5moles of **N** reacts completely with 2 moles of potassium manganate (VII) Solution **R** (1mk)

iv) Relative formula mass of **N** (1mk)

b) The formula of **N** has the form P**.** X H_2O. Determine the value of **x** in the formula given that the relative formula mass of **P** is 90.0 and atomic masses of hydrogen and oxygen are 1.0 and 16.0 respectively.

(2mks)

2. You are provided with Solid **M** carry out the tests below. Write your observations and inferences in the spaces provided.

Place all the solid **M** in a boiling tube. Add about $10cm^3$ of distilled water. Shake until all the solid dissolves. Divide the solutions into five portions.

i) To the first portion add 2M sodium hydroxide drop wise till in excess.

OBSERVATIONS	**INFERENCE**
(1mk)	(1½mk)

(b) To the second portion add ammonia solution drop wise until in excess.

OBSERVATIONS	**INFERENCE**
(1mk)	(½mk)

(c) To the third portion add four drops of hydrochloric acid.

OBSERVATIONS	**INFERENCE**
(½mk)	(½mk)

d) To the forth portion add 3 drops of lead (ii) Nitrate solution

OBSERVATIONS	**INFERENCE**
(½mk)	(2mk)

e) Warm the mixture obtained in (d) above

OBSERVATIONS	**INFERENCE**
(½mk)	(½mk)

II. You are provided with solid **W**. Carry out the tests. Write your observations and inferences in the spaces provided.

(f) Place ¾ of the solid **W** provided in a boiling tube. Add about $10cm^3$ of distilled water and shake until all the solid dissolves. Divide the solution into portion.

(i) To portion one add 3 drops of solution **R**

OBSERVATIONS	**INFERENCE**
(½mk)	(1mk)

(ii) To the portion two, add 5 drops of acidified potassium dichromate (vi)

OBSERVATIONS	**INFERENCE**
(1mk)	(2mks)

(iii) To portion 3, add all the sodium hydrogen carbonate

OBSERVATIONS	**INFERENCE**
(½mk)	(½mk)

(iv) To portion 4 add 3 drops of universal indicator and determine the pH

OBSERVATIONS	**INFERENCE**
(½mk)	(½mk)

v) Scoop the remaining Solid **W** using a metallic spatula. Ignite it in a bunsen burner flame.

OBSERVATIONS	**INFERENCE**
(½ mk)	(½ mk)