Name _____ Index No.

Candidate's Signature_____

Date _____

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SERIES 5 EXAMS

233/3

CHEMISTRY

PAPER 3

PRACTICAL

2 ¼ HOURS

INSTRUCTIONS TO CANDIDATES

(a) Write your name and Index number in the space provide above.
(b) Answer ALL the questions in the spaces provided.
(c) This paper has 2 questions. You have 2 ¼ hours for the paper. The first ¼ hours will be used to check the apparatus.
(d) Mathematical tables and silent calculators may be used.
(e) All working MUST be clearly shown where necessary.

FOR EXAMINER'SUSE ONLY

QUESTION	MAXIMUM SCORE	CANDIDATE'S SCORE
1	22	
2	18	
TOTAL SCORE	**40**	

1. You are provided with:

- Solid A, 2.0g of dibasic acid, H_2X

- Solution B, 0.5M solution of the dibasic acid, H_2X.

- Solution C, sodium hydroxide solution.

- Solution D, 0.02M acidified potassium manganate (VII) solution.

You required to determine:

(a) The heat of reaction of solid A H_2X with sodium hydroxide solution.
(b) The number of moles of solution E that reacts with 2 moles of acidified potassium manganate (VII) solution.

Procedure 1 (a)

Place 40cm^3 of distilled water into 100ml beaker. Measure the initial temperature of water and record in table **1 below**. Add all the solid A provided at once. Stir the mixture carefully with the thermometer until **all** the solid dissolves. Measure the final temperature and record in table 1.

Table 1

Temperature (^{0}C)	
Initial temperature (^{0}C)	

(1½ marks)

(a) Determine the change in temperature, ΔT. (1 mark)

(b) Calculate the:

(i) heat change when H_2X dissolves in water. (Assume the heat capacity of the solution

is 4.2 J/g/^{0}C and density of the solution is 1g/cm^3) (1mark)

(ii) the molar heat of solution, ΔH1 solution of the acid H_2X.

(Molar mass of the acid H_2X is 126g. (2marks)

Procedure 1 (b):

Place 40cm^3 of solution B into 100ml beaker. Measure the initial temperature and record in **table II** below. Measure 40cm^3 of sodium hydroxide, solution C. Add all the 40cm^3 of solution C at once to solution. Stir the mixture carefully with the thermometer. Measure the final temperature reached and record in table II. (Keep remaining solution B for use in procedure II). Table II

Temperature (^{0}C)	
Initial temperature (^{0}C)	

(1 ½ marks)

(a) Determine the change in temperature, ΔT. (1mark)

(b) Calculate the:

(i) heat change for the reaction. (Assume the heat capacity of the solution is 4.2 J/g/^{0}C and density of the solution is 1gcm^3) (mark)

(ii) heat for the reaction of one mole of the acid H_2X with sodium hydroxide, ΔH_2. (2marks)

(c) Given that the $H_2X_{(s)} + 2OH^-_{(aq)} \longrightarrow 2H_2O_{(l)} + X^{2-}_{(aq)}$

Determine ΔH_3 using an energy cycle diagram. (2marks)

Procedure II

Measure exactly 15cm^3 of solution B and put in a 250ml volumetric flask. Add water as you shake up to the mark. Labelled as solution E. Using a pipette filler, pipette 25cm^3 of solution E and place in a conical flask. Warm solution E to boiling. Fill the burette with solution D and titrate with hot solution E. Stop just when a permanent change in colour. Record your results in the **table III** below. Repeat the procedure to complete the table **III below**.

TABLE III

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

(4 marks)

(a) Calculate the average volume of solution D used. (1 mark)

(b) Calculate the number of moles of solution D reacting. (1 mark)

(c) Calculate the number of moles of solution E used. (1 ½ marks)

(d) Calculate the number of moles of E which react with 2 moles of potassium manganate (VII) (2 marks)

2. (a) You are provided with a solution F in a conical flask.

Carry out the following tests and record your observations and inferences in the spaces provided.

(i) Add 20cm^3 of 2M sodium hydroxide solution to solution F in the flask; shake well, filter the mixture into a clean boiling tube. Retain the filtrate and the residue.

Observation	Inferences
(½ mark)	(½ mark)

(ii) i) Place about 2cm^3 of the filtrate in a test tube. Add 2M nitric acid drop wise until in excess. Retain the mixture.

Observation	Inferences

(½ mark)	(½ mark)

(iii) Divide the mixture in (ii), I above into two portions. To one portion add 2M sodium hydroxide solution drop wise until in excess.

Observation	Inferences
(1 mark)	(1 mark)

iv) To portion two, add 2M ammonia solution drop wise until in excess.

Observation	Inferences

(1 mark)	(1 mark)

(v) Place about $2cm^3$ of the filtrate in a test tube. Add 3 drops of acidified barium chloride.

Observation	Inferences
(1 mark)	(1 mark)

(vi) To the residue add about $5cm^3$ of 2M nitric (V) acid and allow it to filter into a test tube. Place

About $2cm^3$ of this filtrate in a test tube. Add 2M ammonia solution drop wise until in excess.

Observation	Inferences
(1 mark)	(1 mark)

(c) You are provided with solid G. Carry out the test below and record your observations and inferences in the spaces provided.

(i) Using a metallic spatula heat half spatula endful of solid G in a non-luminous flame. Remove it when it ignites.

Observation	Inferences
(1 mark)	(1 mark)

(ii) Put the remaining solid G in a boiling tube. Add about $5cm^3$ of distilled water and shake vigorously. (Keep the content for the next test)

Observation	Inferences
(½ mark)	(½ mark)

(ii) Divide the resulting solution into two portions. To the first portion add two drops of acidified potassium manganate (VII) solution and shake vigorously.

Observation	Inferences
(½ mark)	(½ mark)

(iv) Test pH of the second portion using pH indicator paper.

Observation	Inferences
(1 mark)	(1 mark)