Name: …… Index No. ……

School: ……. Candidate's Sign. …….....

Date: …….....

233/3
CHEMISTRY
PAPER 3
PRACTICAL
2 ¼ HOURS

INSTRUCTIONS

(a) Write your name, and index number in the space provided above.
(b) Sign and write the date of examination in the spaces provided above.
(c) Answer ALL the questions in the spaces provided.
(d) Mathematical tables and electronic calculators may be used.
(e) All working MUST clearly be shown where necessary
(f) 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	MAX SCORE	CANDIDATES SCORE
1	14	
2	17	
3	09	
TOTAL SCORE	40	

This paper consists of 7 printed pages

Turn Over

1. You are provided with:
- Solution A – 0.1M hydrochloric acid
- Solution B – Containing 19.1g 1L of a basic compound $B_2X.10H_2O$.

You are required to determine the relative atomic mass of metal B in the formula $B_2X.10H_2O$

Procedure
- Fill the burette with solution A upto the zero mark.
- Using a pipette and a pipette filler, place $25cm^3$ of solution B into a $250cm^3$ conical flask.
- Add three drops of methyl orange indicator and titrate.
- Record your results in the table below.
- Repeat the procedure two more times and complete table I.

(a) (i) TABLE I

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

(5 marks)

(ii) Calculate the average volume of solution A used.
(1 mark)

(b) Given that one mole of $B_2X.10H_2O$ reacts with 2 moles of hydrochloric acid, calculate the:

(i) Moles of $B_2X.10H_2O$ in the volume of solution B used. (2 marks)

(ii) Concentration of solution B in moles per litre. (2 marks)

(iii) Relative formula mass of $B_2X.10H_2O$. (2 marks)

(iv) Relative atomic mass of metal B in $B_2X.10H_2O$ (Relative formula mass of X = 156, H = 1.0, O = 16.0) (2 marks)

2. You are provided with:
- 2g of solid C – Oxalic acid ($H_2C_2O_4.2H_2O$)
- Solution D – 0.5M solution of oxalic acid (dibasic acid)
- Solution E – Sodium hydroxide solution.

You are required to determine

(a) (i) The molar heat of solution of solid C.

(ii) The enthalpy of neutralization between oxalic acid solution D and sodium hydroxide solution E

(b) Calculate the heat of reaction of solid C with aqueous sodium hydroxide by applying Hess' law.

Procedure I:

- Place 30cm^3 of distilled water into a 100ml plastic beaker.
- Measure the initial temperature of the water and record it in table II below. Add all the solid C at once.
- Stir the mixture carefully with the thermometer until all the solid dissolves. Do not break the thermometer.
- Measure the final temperature reached and record it in table II below.

(a) (i) Table II

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

(ii) Determine the change in temperature, ΔT_1. (1 mark)

(b) Calculate the:

(i) Heat change when solid C dissolves in water. (Assume the heat capacity of the solution is $4.2kJkg^{-1}k^{-1}$ and density is $1gcm^{-3}$) (2 marks)

(ii) Moles of solid C oxalic acid ($H_2C_2O_4.2H_2O$) used (H = 1.0, C = 12.0, O = 16.0) (2 marks)

(iii) Molar heat of solution, ΔH_1 of solid C (oxalic acid). (1 mark)

Procedure II:

- Place $30cm^3$ of solution D into a clean 100ml plastic beaker.
- Measure its temperature and record it in table III below.
- Measure $30cm^3$ of solution E and measure its temperature; record it in table III below.
- Add all the solution E at once to solution D in the beaker.
- Stir the mixture gently with the thermometer.
- Measure the final temperature reached and record it in table III below.

Table III

(c) (i)

Temperature of solution D, T1(^{0}C)	
Temperature of solution E, T_2(^{0}C)	
Initial temperature $\frac{T_1 + T_2}{2}$ (^{0}C)	
Final temperature of mixture (^{0}C)	

(2 marks)

(ii) Determine the change in temperature, ΔT_2. (1 mark)

(d) Determine the:

(i) Heat change for the reaction (Assume heat capacity of solution = 4.2kJkg^{-1}k^{-1} and density of solution is 1gcm^{-3}) (2 marks)

(ii) Number of moles of oxalic acid, solution D used. (1 mark)

(iii) Heat of reaction, ΔH_2, of one mole of oxalic acid with sodium hydroxide. (1 mark)

(iv) Molar enthalpy of neutralization between oxalic acid and sodium hydroxide. (1 mark)

(e) Given that:

ΔM_1 is the molar heat of solution of solid oxalic acid; reaction:

$H_2C_2O_{4(s)}$ Water $2H^+_{(aq)} + C_2O_4^{2-}{}_{(aq)}$

ΔM_2 is the heat of reaction of one mole of oxalic acid with sodium hydroxide; reaction

$2M^+_{(aq)} + 2OH^-_{(aq)}$ $2H_2O_{(l)}$

Calculate ΔH_3, for the reaction:

$H_2C_2O_{4(s)} + 2OH^-_{(aq)}$ $2H_2O_{(l)} + C_2O_4^{2-}{}_{(aq)}$ (2 marks)

3. You are provided with solid F which is a mixture of two salts. Put all the solid F provided
in a boiling tube and add a about 10cm^3 of distilled water. Shake to dissolve.
Divide the resulting solution into four portions.

(a) To the first portion, add 5 drops of aqueous sodium hydroxide and heat. Test for any gases
produced using a blue and red litmus papers.

Observations Inferences

(b) To the second portion, dip a clean glass rod and vaporize a drop of the solution on a non-luminous flame.
Observations Inferences

(c) To the third portion, add 3 drops of acidified potassium manganate (VII) (KMnO4) solution.
Observations Inferences

(d) To the fourth portion, add about 5 drops of Barium chloride followed by dilute hydrochloric acid.
Observations Inferences