**Name: …………………………………………………………… Index No. ………………**

**School: …………………………………………………. Candidate’s Sign. …………...........**

**Date: ………………………………....................................**

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**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 B2X.10H2O.

You are required to determine the relative atomic mass of metal B in the formula B2X.10H2O

Procedure

* Fill the burette with solution A upto the zero mark.
* Using a pipette and a pipette filler, place 25cm3 of solution B into a 250cm3 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 (cm3) |  |  |  |
| Initial burette reading (cm3) |  |  |  |
| Volume of solution A used (cm3) |  |  |  |

( 5 marks )

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

(b) Given that one mole of B2X.10H2O reacts with 2 moles of hydrochloric acid, calculate the:

(i) Moles of B2X.10H2O 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 B2X.10H2O . ( 2 marks )

(iv) Relative atomic mass of metal B in B2X.10H2O (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 ( H2C2O4.2H2O)

- 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 30cm3 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 (0C) |  |
| Initial temperature (0C) |  |

(ii) Determine the change in temperature, DT1. ( 1 mark )

(b) Calculate the:

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

(ii) Moles of solid C oxalic acid (H2C2O4.2H2O) used (H = 1.0, C = 12.0, O = 16.0) ( 2 marks )

(iii) Molar heat of solution, DH1 of solid C (oxalic acid ). ( 1 mark )

Procedure II:

* Place 30cm3 of solution D into a clean 100ml plastic beaker.
* Measure its temperature and record it in table III below.
* Measure 30cm3 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(0C) |  |
| Temperature of solution E, T2(0C) |  |
| Initial temperature T1 + T2 (0C)  2 |  |
| Final temperature of mixture (0C) |  |

( 2 marks )

(ii) Determine the change in temperature, DT2. ( 1 mark )

(d) Determine the:

(i) Heat change for the reaction (Assume heat capacity of solution = 4.2kJkg-1k-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, DH2, 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:

DM1 is the molar heat of solution of solid oxalic acid; reaction:

H2C2O4(s)  Water 2H+(aq) + C2O42-(aq)

DM2 is the heat of reaction of one mole of oxalic acid with sodium hydroxide; reaction

2M+(aq) + 2OH -(aq)  2H2O(l)

Calculate DH3, for the reaction:

H2C2O4(s) + 2OH-(aq) 2H2O(l) + C2O42-(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 10cm3 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