**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 **H2X** labelled solution **Q.**

 ***You are required to determine***

1. The molar heat of solution of solid **T**
2. The heat of reaction of one mole of dibasic acid with sodium hydroxide.

 II. Calculate the heat of reaction of solid H2X with aqueous sodium hydroxide.

 ***Procedure I***

Place 40cm3 of distilled water into a 100cm3 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)

|  |  |
| --- | --- |
| Final temperature (oC) |  |
| Initial temperature (0C) |  |
| Temperature change ∆TI |  |

 **Table I**

(b) Calculate the;

 (i) Heat change when H2X dissolve in water (Assume the specific heat capacity of the solution is 4.2J g -1 o C -1 and density is 1g / cm3 ) (2mks)

 (ii)The number of moles of the acid that dissolved.

 (Relative formula mass of H2X is 126) (1mk)

 iii) Molar heat of solution, **∆H1,** solution of the acid **H2X**  (1mk)

**Procedure II**

Place 40cm3 of solution **Q** into a 100cm3 beaker. Measure the initial temperature and record it in table II below. Measure 40cm3 of sodium hygroxide, solution **L**. Add all the 40cm3 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)

1. **Table II**

|  |  |
| --- | --- |
| Final temperature |  |
| Initial temperature |  |
| Temperature ∆T |  |

 (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 / cm3) (2mks)

 (ii) Calculate the number of moles of H2X used (1mk)

 (iii)Calculate the heat of reaction ∆H2 of one mole of the acid H2X with sodium hydroxide (1mk)

 (c) Given that :

 ∆H1 is the heat for the reaction. H2X (s) H2X (aq)

 ∆H2 is the heat for reaction H2X (aq) + 2NaOH (aq) Na2X (aq) + 2H2O (l)

 Calculate ∆H3 for the reaction H2X (s) + 2NaOH (aq) 2H2O (l) + Na2X (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)**

1. Add 10cm3 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 250cm3 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. 25.0cm3 of **solution N** into a conical flask. Warm the mixture to about 60oC. 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)

|  |  |  |  |
| --- | --- | --- | --- |
|  | **I** | **II** | **III** |
| Final burette readings (cm3) |  |  |  |
| Initial burette reading (cm3) |  |  |  |
| Volume of solution R (cm3) |  |  |  |

 **Table III**

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 25cm3 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 H2O. 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 10cm3 of distilled water. Shake until all the solid dissolves. Divide the solutions into five portions.

1. 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) |

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

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

1. 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 10cm3 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)  |

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

|  |  |
| --- | --- |
| **OBSERVATIONS**  | **INFERENCE** |
|   ( ½ mk) |   (½ mk)  |