**Name: ………………………………………………………………….Adm. No…………………..**

**School………………………………………………………**

**233/3**

**CHEMISTRY**

**PAPER 3**

**2 1/4 HOURS**

**FORM 2 JANUARY 2023 TERM 1 OPENER EXAM**

**Instructions to Candidates**

1. Write your name and admission number in the spaces provided.
2. Answer all the questions in the spaces provided.
3. Mathematical table and electronic calculator may be used.
4. All working must be clearly shown where necessary.
5. Students should check the question paper to ascertain that all the pages are printed as indicated and that no questions are missing.

|  |  |  |
| --- | --- | --- |
| QUESTION | MARKS | STUDENT SCORE |
| 1 | 26 |  |
| 2 | 6 |  |
| 3 | 8 |  |
| TOTAL | 40 |  |

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **1.** | **You are provided with:**   * 1.0g of solid **V** - impure calcium carbonate. * Solution **T,** dilute hydrochloric acid. * Solution **R,** 0.2M sodium hydroxide solution.   **You are required to determine:**   * Concentration of dilute hydrochloric acid. * The percentage of calcium carbonate in the mixture solid **V.**   **Procedure I**  Fill the burette with dilute hydrochloric acid, solution T .Pipette 25.0 cm3 of **solution R** into a conical flask. Add 3 drops of methyl orange indicator. Titrate with dilute hydrochloric acid, **solution T** from the burette until the indicator just turns pink. Record the results in the table I below. Repeat the titration two more times to complete the table.  **Table 1** | | | | | |
|  |  | | **I** | **II** | **III** |  |
|  | | Final burette readings |  |  |  |  |
|  | | Initial burette readings |  |  |  |  |
|  | | Volume of solution **T** used (cm3) |  |  |  |  |
|  | [4 marks] | | | | | |
|  | (a) Calculate the:  (i) Average volume of solution **T** used. [1 mark]  (ii) the number of moles of sodium hydroxide, solution **R** contained in 25.0 cm3 of  0.2M sodium hydroxide. [2 marks]  (iii) Write the equation of reaction between sodium hydroxide and the hydrochloric  acid. [1 mark]  (iv) Calculate the number of moles of hydrochloric acid, solution **T** contained in the  volume used. [1 mark] | | | | | |
|  |  | | | | | |

**- 2 -**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | (iv) Calculate the molarity of hydrochloric acid solution **T**. [1 mark]  **Procedure II**  Put all the mixture **V** provided into a clean conical flask. Using a 100 cm3 measuring cylinder , measure 100 cm3 of the dilute hydrochloric acid, solution **T** and add it to mixture V in the conical flask. Swirl the contents of the flask until effervescence stops. Label this solution as **M**.  Rinse the burette with distilled water and fill it with sodium hydroxide solution R. Using a clean pipette, transfer 25.0 cm3 of solution **M** into a clean conical flask. Add 3 drops of methyl orange indicator and titrate with the 0.2M sodium hydroxide, solution **R** from the burette until the indicator just turns from pink to yellow. Repeat the titration two more times to complete the table II below.  **Table 2** | | | | | |
|  |  | | **I** | **II** | **III** |  |
|  | | Final burette readings |  |  |  |  |
|  | | Initial burette readings |  |  |  |  |
|  | | Volume of solution **R** used (cm3) |  |  |  |  |
|  | [4 marks] | | | | | |
|  | (b) Calculate the:  (i) Average volume of sodium hydroxide used. [1 mark]  (ii) number of moles of sodium hydroxide present in the average volume of the  Solution. [2 marks]  (iii) Number of moles of hydrochloric acid in the 25.0cm3 of solution **M** used. [1 mk]  (iv) number of moles of hydrochloric acid contained in 100 cm3 of solution **M**. [1 mk]  (v) number of moles of hydrochloric acid contained in 100 cm3 of solution **T**. [1 mk] | | | | | |

**- 3 -**

|  |  |  |  |
| --- | --- | --- | --- |
|  | (vi) number of moles of hydrochloric acid that reacts with calcium carbonate present in  solid V**.**  [1 mark]  (vii) Write an equation for the reaction between calcium carbonate and hydrochloric acid  [1 mark]  (viii) Number of moles of calcium carbonate that reacted with the acid. [2 mark]  (ix) Mass of calcium carbonate present in 1.0g of the mixture (Ca = 40; O = 16, C= 12). [1 marks]  (x) Determine the percentage of Calcium Carbonate present in the mixture. [1 mark] | | |
| **2.** | You are provided with solid **F**. Carry out the tests below and record your observations and inferences in the spaces provided. | | |
|  | (a) | Place about a **third** of the solid **F** in a test tube and heat. Test any gases produced using moist blue and red litmus papers. | |
|  |  | **Observations** | **Inferences** |
|  |  | [1 mark] | [1 mark] |
|  |  |  | |
|  | (b) | Put the entire remaining solid **F** into a boiling tube and add about 5.0 cm3 of distilled water and shake well to dissolve. Divide the solution into two equal portions. | |
|  |  | (i) To the first portion, add ammonia solution drop-wise until in excess. | |
|  |  | **Observations** | **Inferences** |
|  |  | [1 mark] | [1 mark] |

|  |  |  |  |
| --- | --- | --- | --- |
|  | (ii) | To the second portion add 5 drops of hydrogen peroxide and warm. Then add ammonia solution drop-wise until in excess. | |
|  |  | **Observations** | **Inferences** |
|  |  | [1 mark] | [1 mark] |
|  |  |  | |
| **3.** | You are provided with solid **H**. Carry out the tests below and record your observations and inferences in the spaces provided. | | |
|  | (a) | Put **a third** of the solid **H** on a spatula and ignite it in a non-luminous flame. | |
|  |  | **Observations** | **Inferences** |
|  |  | [1 mark] | [1 mark] |
|  |  |  | |
|  |  |  | |
|  | (b) | Put all the remaining solid **H** into a boiling tube and add about 10cm3 of distilled water and shake well to dissolve. Divide the solution into three equal portions.  (i) Put the rest of the solid in a boiling tube. Add about 6cm3 of distilled water and shake. Note down the observations and inferences in the spaces provided. Divide the resulting solution into three portions   |  |  | | --- | --- | | **Observations** | **Inferences** | | (1mk) | (1mk) |   (ii) To the first portion, add 3 drops of acidified potassium manganate (VII) and warm. | |
|  |  | **Observations** | **Inferences** |
|  |  | [1 mark] | [1 mark] |
|  |  |  | |
|  |  | (iii) To the 2nd portion, add all the sodium hydrogen carbonate provided. | |
|  |  | **Observations** | **Inferences** |
|  |  | [1/2 mark] | [1/2 mark] |
|  |  |  | |
|  |  | (iv) Test the pH of the 4th portion using universal indicator solution provided | |
|  |  | **Observations** | **Inferences** |
|  |  | [1/2 mark] | [1/2 mark] |