**CHEMISTRY PAPER 3 (PRACTICAL)**

**DECEMBER 2021**

**Time 2Hours 15mins**

**END OF TERM TWO EXAMINATION**

**Instructions to candidates**

1. *Answer all the questions in the spaces provided*
2. *Mathematical tables and Electronic calculators may be used*
3. *All working must be clearly shown where necessary*
4. *Students 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**

|  |  |  |
| --- | --- | --- |
| **Questions** | **Max. score** | **Student’s score** |
| **1** | **20** |  |
| **2** | **10** |  |
| **3** | **10** |  |
| **Total score** | **40** |  |

**THIS PAPER HAS PRINTED PAGES**

1. You are provided with:

* 2.5g of anhydrous Sodium Carbonate labelled Solid A
* Aqueous hydrochloric acid Solution B
* Methyl Orange indicator.

You are required to determine the following;

1. Enthalpy change of solution for Sodium Carbonate
2. Concentration of Hydrochloric Acid Solution B in moles per litre.

**PROCEDURE 1**

Using 100cm3 measuring cylinder, add 50cm3 of distilled water into 100cm3 beaker. Note the temperature and record it in Table 1. below. Measure the temperature of the water after every half minute and record the values in table 1. At exactly 1½ minute, add Solid A to the water. Stir the mixture gently with the thermometer and note the temperature of the mixture after every 1½ minute up to the 6th minute. Record the values in the table.

(Preserve the contents in the beaker for use in procedure II)

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Time (minutes) | 0 | ½ | 1 | 1½ | 2 | 2½ | 3 | 3½ | 4 | 4½ | 5 | 5½ | 6 |
| Temperature (0c) |  |  |  | X |  |  |  |  |  |  |  |  |  |

1. TABLE 1 (5 mks)
2. Plot a graph of temperature (y-axis) against time. (3 mks)
3. From the graph, determine the highest change in temperature. (1 mk)

(Attach graph page)

…………………………………………………………………………………………………………………………………………………………………….

1. Calculate the molar enthalpy of solution of sodium carbonate Solid A.

(Assume that specific heat capacity of the mixture is 4.2 KJkg-1 k-1 and density of the mixture is 1g/cm3, Na = 23, C = 12, O = 16) (2 mks)

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**PROCEDURE II**

Transfer the contents in the beaker into a 100ml measuring cylinder. Add about 20cm3 of distilled water and shake well. Add more distilled water to make up to the 100cm3 mark. Label this Solution A. Fill the burette with Solution B. Using a clean pipette and a pipette filler, place 25cm3 of Solution A into a 250 ml conical flask. Add 2-3 drops of Methyl Orange indicator and titrate with Solution B up to the end point. Repeat the titrations 2 times and complete Table II.

1. TABLE 2 (3 mks)

|  |  |  |  |
| --- | --- | --- | --- |
|  | 1 | 2 | 3 |
| Final Burette reading (cm3) |  |  |  |
| Initial Burette reading (cm3) |  |  |  |
| Volume Solution B used (cm3) |  |  |  |

1. Determine the average solution B used. (1 mk)

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1. Calculate the molarity of solution A in moles per litre (Na = 23, O = 16, C = 12)

(2 mks)

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1. Calculate the number of moles of Sodium Carbonate Solution A in 25.0 cm3.(1 mk)

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1. Calculate the number of moles of Hydrochloric Acid Solution B in the volume used. ( 1 mk)

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1. Calculate the concentration of hydrochloric acid solution B in moles per litre.

(1 mk)

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1. You are provided with solid 2. Carry out the tests below and record your observations and inferences in the spaces provided
2. Place a spatula endful of Solid R into a clean dry test tube and heat it strongly on a Bunsen burner flame. Test it for any gas present. (2 mks)

|  |  |
| --- | --- |
| Observation | Inferences |
|  |  |

1. Put the remaining Solid R into a boiling tube. Add 10cm3 of distilled water and shake. Label it R. (2 mks)

|  |  |
| --- | --- |
| Observation | Inferences |
|  |  |

1. To about 1cm3 of solution R, add aqueous Sodium Hydroxide solution dropwise until in excess. (2 mks)

|  |  |
| --- | --- |
| Observation | Inferences |
|  |  |

1. To about 1 cm3 of solution R add 5 drops of 20 volume Hydrogen Peroxide and shake. (1½mks)

|  |  |
| --- | --- |
| Observation | Inferences |
|  |  |

1. To solution obtained in (iii) above add ammonia solution dropwise till in excess.(1½mks)

|  |  |
| --- | --- |
| Observation | Inferences |
|  |  |

1. To about 1 cm3 of solutionR, add Barium Chloride solution followed by 2M HNO3 (AQ) (2 mks)

|  |  |
| --- | --- |
| Observation | Inferences |
|  |  |

1. You are provided with slid T. carry out the following tests and record your observations and inferences in the spaces provided
2. Scoop half of Solid T with a metallic spatula and ignite it on a non-luminous flame of a Bunsen burner. Test for the gas produced using moist blue and red litmus papers.

(2 mks)

|  |  |
| --- | --- |
| Observation | Inferences |
|  |  |

1. Place the remaining half of solid T in a test tube. Add all the absolute ethanol provided to solid T in a test tube. Shake it well and divide it into 3 portions. (2 mks)

|  |  |
| --- | --- |
| Observation | Inferences |
|  |  |

1. Determine the pH of the first portion using universal indicator solution and pH chart. (1mks)

|  |  |
| --- | --- |
| Observation | Inferences |
|  |  |

1. To the second portion add one and a half of the solid Sodium Hydrogen Carbonate. (2mks)

|  |  |
| --- | --- |
| Observation | Inferences |
|  |  |

1. To the third portion, add about 2cm3 of acidified Potassium Manganate (VII) solution. (2 mks)

|  |  |
| --- | --- |
| Observation | Inferences |
|  |  |