P525/2

UNNASE

***🕮***

***🖎***

**Community**

**Chemistry**

**Paper 3**

**2024**

**3 hours**

**UNNASE MOCK EXAMINATION**

**UGANDA ADVANCED CERTIFICATE OF EDUCATION**

**CHEMISTRY PRACTICAL**

**PAPER 3**

**3 HOURS 15 MINUTES**

**INSTRCUTIONS TO CANDIDATES**

* Answer all the questions
* Answers to be written in the spaces provided
* Candidates are not allowed to work with apparatus for the first 15 minutes. This time is to ensure that they read through the paper and all have the chemicals and apparatus they need.

|  |  |  |  |
| --- | --- | --- | --- |
| **FOR EXAMINER’S USE ONLY** | | | |
| Q.1 | Q.2 | Q.3 | TOTAL |
|  |  |  |  |
|  |  |  |  |

1. You are provided with the following:-

**FA1**, which is a solution containing thiosulphate ions, **S2O32-**

**Solid Q** which is potassium manganate **(VII),** **KMnO4**

**FA3,** which is a solution containing 8 gl-1 of a mixture of potassium

dichromate **(VI), K2Cr2O7** and potassiumiodide**, KI.**

**2M** sulphuric acid

**10%** potassium iodide solution.

You are required to determine the:-

1. Molar concentration of thiosulphate ions in **FA1**
2. Percentage mass composition of potassium dichromate,

**K2Cr2O7 in FA3 (K = 39, Cr = 52, Mn = 55, O = 16)**

**Theory:-**

Acidified manganate **(VII)** ions, **MnO4** and dichromate **(VI)** ions,

**Cr2O72-** in solution react quantitatively with iodide ions to liberate iodine according to the following equations.

**2MnO-4(aq) + 16H+(aq)+ 10I-(aq) 2Mn2+(aq) + 8H2O(l) + 5I2(aq)**

**Cr2O72-(aq) + 14H+(aq) + 6I-(aq) 2Cr3+ + 7H2O(l) + 3I2(aq)**

The liberated iodine in each case reacts with thiosulphate ions as follows:-

**I2(aq) + 2S2O32-(aq) S4O62-(aq) + 2I-(aq)**

**PROCEDURE**

**PART A**

1. Weigh accurately about **0.8g** of **Q** and dissolve it in about **100cm3** of **2M** sulphuric acid in a beaker. Transfer the solution into a **250cm3** volumetric flask and make up to the mark with distilled water. Label the resultant solution **FA2.**
2. Pipette **25cm3 or (2cm3)** of **FA2** into a conical flask, then add about **15cm3** of potassium iodide solution and titrate the mixture with solution **FA1** from the burette until the solution turns pale yellow. Add **5 drops** of starch indicator and complete the titration until the blue-black complex is discharged.
3. Repeat the titration **2 – 3 times** until you get consistent readings. Enter your results in table I below.

Mass of weighing bottle + Q = ………………………. ɡ (mark)

Mass of weighing bottle alone = ……………………... ɡ (mark)

Mass of Q alone = …………………….. ɡ (mark)

Volume of pipette used = ………………………… cm3 (mark)

**TABLE 1:**

|  |  |  |  |
| --- | --- | --- | --- |
|  | 1 | 2 | 3 |
| Final burette reading (cm3) |  |  |  |
| Initial burette reading (cm3) |  |  |  |
| Volume of FA1 used (cm3) |  |  |  |

Titre values used to calculate average volume of **FA1** used

……………………………………………………………………………

Calculate average volume FA1 used

…………………………………………………………………………(cm3)

**Question:**

1. Calculate the molar concentration of thiosulphate ions, S2O32- in **FA1**

**…………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………..**

**…………………………………………………………………………….**

**PART B**

1. Pipette **25cm3** or **(20cm3)** of FA3 into a conical flask, as an equal volume of **2M** sulphuric acid and titrate with solution **FA1** until you obtain a pale yellow solution. Add 5 drops of starch indicator and complete the titration until you obtain a pale green solution.
2. Repeat the titration 2 – 3 times until you obtain consistent readings. Enter your results in table II below.

**Results:-**

Volume of pipette used ……………………………………cm3 **(mark)**

**Table II**

|  |  |  |  |
| --- | --- | --- | --- |
|  | 1 | 2 | 3 |
| Final burette reading (cm3) |  |  |  |
| Initial burette reading (cm3) |  |  |  |
| Volume of FA1 used (cm3) |  |  |  |

Titre values used to calculate average volume of **FA1** used

……………………………………………………………………………

Calculate average volume of **FA1** used

…………………………………………………………………………….

**Questions:-**

1. Calculate the:-
2. Moles of potassium dichromate that are present in **25cm3** of **FA3**.

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

1. Percentage mass composition of potassium dichromate in **FA3**

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

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

1. You are provided with substance **R** which contains **two** cations and two anions. You are required to carry out the following tests on **R** to identify the cations and anions in it. Identify any gas(es) evolved. Record your observations and deductions in the table below.

|  |  |  |
| --- | --- | --- |
| **TESTS** | **OBSERVATIONS** | **DEDUCTION** |
| 1. Heat a spatula endful of **R** in a hard glass test tube first gently and then more strongly until there is no further change. |  |  |
| 1. To one spatula endful of **R** add 3-4 drops of concentrated sulphric acid and warm. |  |  |
| 1. To **two** spatula   endfuls of **R** in a test tube, add about 5cm3 of water and shake vigorously to dissolve. Divide the resulting solution into three portions. |  |  |
| 1. To the **first** portion of the solution from (c), add 2 – 3 drops of iron (iii) chloride solution and heat to boiling. |  |  |
| 1. To the **second** portion of the solution from (c) add a few pieces of copper turnings, then add 6 drops of concentrated sulphuric acid and heat. |  |  |
| 1. To the **third** portion of the solution from (c), add dilute sodium hydroxide solution drop-wise until in excess. Shake and filter. Keep both the filtrate and residue. |  |  |
| 1. To the filtrate, add dilute nitric acid drop wise until the solution just becomes acidic. Divide the resultant solution into **three** portions. |  |  |
| (i)To the **first** portion of the solution, add sodium hydroxide solution drop wise until in excess |  |  |
| (ii)To the **second** portion of the solution, add ammonia solution drop wise until in excess |  |  |
| (iii)Use the **third** portion of the solution to carry out a test of your own to confirm one of the cations in **R** |  |  |
| 1. Wash the residue, add dilute nitric acid until it dissolves. Divide the resultant solution into four portions |  |  |
| (i)To the **first** portion of the solution, add sodium hydroxide solution drop wise until in excess |  |  |
| (ii)To the **second** portion of the solution, add ammonia solution drop wise until in excess, leave to stand |  |  |
| (iii)To the **third** portion of the solution add 3-4 drops of sodium sulphate solution |  |  |
| (iv) Use the fourth portion of the solution, to carry out a test of your own to confirm the second cation in R.  **Test** |  |  |

1. Cations in **R** ……………………………… and……………………………..

(ii) Anions in **R** ………………………………..and…………………………….

1. You are provided with organic substances **S.** You are required to determine the nature of **S**. Carry out the following tests on **S** and record your observations and deductions in the table below.

|  |  |  |
| --- | --- | --- |
| **TESTS** | **OBSERVATIONS** | **DEDUCTIONS** |
| 1. Burn a spatula endful amount of **S** on a spatula end or in a porcelain dish |  |  |
| 1. Transfer **two** spatula endfuls of **S** in a test tube then add 4cm3 of sodium hydroxide solution and shake |  |  |
| 1. Transfer **two** spatula endfuls of **S** in a test tube containing 5cm3 of water, shake vigorously and test with litmus. Divide the mixture into four portions. |  |  |
| (i)To the **first** portion, add half a spatula end ful of solid sodium carbonate |  |  |
| (ii)To the **second** portion, add 3-4 drops of neutral iron (iii) chloride solution. |  |  |
| (iii)To the **third** portion, add 3-4 drops of acidified potassium dichromate (vi) solution and warm. |  |  |
| (iv) To the **fourth** portion, add 3-4 drops of Brandy’s reagent |  |  |
| (d) To a spatula endful of **S,** add about four drops of ethanol followed by 2 – 3 drops of concentrated sulphuric acid. Heat the mixture and pour it in a small beaker of cold water allow to stand. |  |  |
| (e) To a spatula endful of **S** in a test tube, add 2cm3 of water and shake. Then add 3-4 drops of acidified potassium manganite (vii) solution |  |  |

(f) Comment on the nature of **S**.

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