**NAME……………………………………………………….…… INDEX NO.:………………………...**

**STREAM: .…..…………………………………………………… ADM NO: …………………………**

 **DATE: …………………….………**

**233/3**

**CHEMISTRY**

**PAPER 3**

**AUGUST-2022**

**TIME: 2 ¼ HOURS**

**MINCKS GROUP OF SCHOOLS**

**FORM FOUR EXAM**

***Kenya Certificate of Secondary education (K.C.S.E)***

233/3

Chemistry

Paper 3

2 ¼ hours

**INSTRUCTIONS TO CANDIDATES**

* *Write your* ***name*** *and* ***index number*** *in the spaces provided.*
* ***Sign*** *and write the* ***date*** *of examination in the spaces provided.*
* *Answer* ***all*** *the questions in the spaces provided in the question paper.*
* *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 question paper and make sure you have all the chemicals and apparatus you need.*
* *All working* ***must*** *be clearly shown where necessary.*
* *Mathematical tables and electronic calculators may be used.*

**For examiner’s use only**

|  |  |  |
| --- | --- | --- |
| **Questions** | **Maximum Score** | **Candidate’s Score** |
| **1** | **20** |  |
| **2** | **11 ½**  |  |
| **3** | **8 ½**  |  |
| **Total Score** | **40** |  |

***This paper consists of 8 printed pages. Candidates should check the question paper to ensure that all the pages are printed as indicated and no questions are missing.***

1. You are provided with:

5.0g of solid R which is a hydrated acid with formula H2C2O4.nH2O

Solution Q which is 0.25M NaOH

 You are required to determine the

1. Solubility of R
2. The value of n in the formula H2C2O4.nH2O

**Procedure I**

Fill the burette with distilled water

Place solid R in a clean boing tube

Transfer 4cm3 of distilled water from the burette into the boiling tube containing solid R. Heat the mixture while stirring carefully with thermometer to a temperature of 80oC. Allow the solution to cool while stirring with thermometer. Record the temperature at which crystals start to form in the table 1 below.

Add a further 2cm3 of distilled water from the burette to the mixture. Repeat the procedure above by adding 2cm3 of distilled water and record the crystallization temperature after every experiment. Complete table 1 below by adding volumes of distilled water as indicated from table 1. PRESERVE THE CONTENTS OF THE BOILING TUBE TO BE USED IN PROCEDURE II

**Table 1**

|  |  |  |
| --- | --- | --- |
| **Volume of distilled water** | **Crystallization temperature (oC)** | **Solubility of solid R in g/100g water** |
| 4 |  |  |
| 6 |  |  |
| 8 |  |  |
| 10 |  |  |
| 12 |  |  |

 (6mks)

1. On the grid provided, plot a graph of solubility of solid R (vertical axis against temperature. (3mks)



1. From the graph determine
2. The solubility of solid R at 55oC. (1mk)

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1. The temperature at which 40g of R dissolves in 50g of water. (1mk)

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**Procedure II**

Transfer the contents of the boiling tube in procedure I to clean 250ml volumetric flask.

Add distilled water to the mark.

Label this as solution P.

Fill the burette with solution P

Pipette 25cm3 of solution Q into a clean conical flask. Add two drops of phenolphthalein indicator. Titrate solution P against solution Q until pink colour just changes to colourless. Record your results to the table II below. Repeat the procedure, two more times to complete that table II.

**Table II**

|  |  |  |  |
| --- | --- | --- | --- |
|  | **I** | **II** | **III** |
| Final burette reading (cm3) |  |  |  |
| Initial burette reading (cm3) |  |  |  |
| Volume of P used (cm3)  |  |  |  |

 (4mks)

Calculate:

1. Average volume of solution P used. (1mk)

………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………

1. Moles of solution Q used. (1mk)

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1. Moles of P used given that 2 moles of solution Q reacts with 1 mole of solution P. (1mk)

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1. Concentration of solution P in moles per litre. (1mk)

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1. The value of n in the formula C2H2O4.nH2O (C = 12, O = 16, H = 1) (1mk)

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2(a) You are provided with solid T. Put all solid T in a clean boiling tube. Add about 10cm3 of distilled water and shake. Filter the resultant mixture in a clean boiling tube. PRESERVE THE CONTENTS OF FILTER PAPER FOR USE IN PROCEDURE 2 (B) BELOW. Divide the filtrate into 3 portions of about 2cm3.

|  |  |
| --- | --- |
| **Observations** | **Inferences** |
|  (1mk) |  (1mk) |

1. To the first portion add two drops of Lead (II) nitrate solution.

|  |  |
| --- | --- |
| **Observations** | **Inferences** |
|  (1mk) |  (1mk) |

1. To the second portion add three drops of acidified Barium nitrate solution.

|  |  |
| --- | --- |
| **Observations** | **Inferences** |
|  (½ mk) |  (½ mk) |

(iii) To the third portion add aqueous ammonia dropwise until in excess

|  |  |
| --- | --- |
| **Observations** | **Inferences** |
|  (1mk) |  (½ mk) |

(b) Using spatula scoop the contents of the filter paper and transfer it in a clean boiling tube. Add about 6cm3 of 2M HNO3 provided. Divide the resultant mixture into two portions of about 2cm3.

|  |  |
| --- | --- |
| **Observations** | **Inferences** |
|  (1mk) |  (1mk) |

1. To about 2cm3 portion add sodium hydroxide dropwise until in excess.

|  |  |
| --- | --- |
| **Observations** | **Inferences** |
|  (1mk) |  (1mk) |

1. To the second portion add two drops of potassium iodide solution

|  |  |
| --- | --- |
| Observations | Inferences |
|  (½ mk) |  (½ mk) |

1. You are provided with solid S. Use it to answer the questions that follow.
2. Describe the appearance of solid S. (1mk)

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1. Place all solid S into a clean boiling tube and add about 8cm3 of distilled water and shake. Divide the resulting mixture into three portions of about 2cm3.

|  |  |
| --- | --- |
| **Observations** | **Inferences** |
|  (1mk) |  (½mk) |

1. To the first portion add 2 drops of acidified potassium manganate (VII) and warm.

|  |  |
| --- | --- |
| **Observations** | **Inferences** |
|  (1mk) |  (1mk) |

1. To the second portion, add magnesium ribbon provided

|  |  |
| --- | --- |
| **Observations** | **Inferences** |
|  (1mk) |  (1mk) |

(c(i) Describe how the PH of the third portion can be determined. (1mk)

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ii) Carry out the actual test in (c(i) above and record the observation and inference.

|  |  |
| --- | --- |
| **Observations** | **Inferences** |
|  (½mk) |  (½mk) |

**THIS IS THE LAST PRINTED PAGE!**