**NAME………………………………………………………….ADM NO………………CLASS……......**

**SCHOOL ……………………………………………………...SIGN ………………….DATE …………...**

 **233/3**

 **CHEMISTRY**

 **Paper 3**

 **(PRACTICAL)**

 **September 2022**

 **2¼ hours**

**SUNRISE 2 examination - 2022**

***Kenya Certificate of secondary Education***

***(K.C.S.E)***

## *Instructions to candidates*

1. *Write your* ***name, adm no, class,*** *and* ***school*** *in the spaces provided above.*
2. *Sign and write the date of examination in the spaces provided above.*
3. *Answer* ***all*** *the questions in the spaces provided.*
4. *You are not allowed to start working with the apparatus for the first 15 minutes of the 2¼ 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 that you may require.*
5. *All working* ***MUST*** *be clearly shown where necessary.*
6. *Mathematical tables and electronic calculators may be used.*

***For Examiner’s Use Only***

|  |  |  |
| --- | --- | --- |
| **Questions** | **Maximum** **Score** | **Candidate’s** **score** |
| **1** | 22 |  |
| **2** | 10 |  |
| **3** | 08 |  |

**40**

**Total Score**

**4**

***This paper consists of 7 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;

* + **4.0g** of solid **P.** Hydrated dibasic acid **H2C2O4.nH2O**
	+ **0.2M** sodium hydroxide Solution **X**

 You are required to determine the;

1. Solubility of solid **P**
2. Value of n in the formula **H2C2O4.nH2O**

***Procedure***

1. Fill the burette with distilled water
2. Place all solid **P** in a boiling tube
3. Transfer **4cm3** of distilled water from the burette into the boiling tube containing solid **P**
4. Heat the mixture while stirring with the thermometer to a temperature of about 800C.
5. Allow the mixture to cool while stirring with a thermometer. You may use cold water in a beaker to enhance cooling.
6. Record the temperature at which the crystals start to form in table **1** below.
7. Add a further **2cm3** of distilled water from the burette to the mixture in the boiling tube.

Repeat procedure (iv) and (v) above and record the crystallization temperature. Complete the table below by adding the volumes of distilled water as indicated. (***Preserve the contents of the boiling tube to be used in procedure II)***

1. Calculate the solubility of solid P in g/100g of water and complete **table 1.**

***Table 1***

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

 (7 marks)

1. On the grid provided, plot a graph of solubility of solid $P(y-axis$) against crystallization temperature. **(3 marks)**
2. From the graph determine;
3. The solubility of solid **P** at **600C.** (1 mark)

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1. The temperature at which **40g** of **P** dissolves in **50g** of water. (1 mark)

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1. The mass of **P** that crystallizes out when the mixture is cooled from **550C** to **450C**. (1 mark)

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***Procedure II***

1. Transfer all the contents of the boiling tube in procedure 1 to a clean 250ml volumetric flask.
2. Add distilled water to the mark, shake thoroughly.
3. Label the resulting solution as **Q**.
4. Fill the burette with solution **Q.**
5. Pipette **25cm3** of solution **X** into a clean conical flask. Add three drops of phenolphthalein indicator.
6. Titrate **Q** against **X** to an accurate end point.

Record your results in table II below.

**Table II**

**Final burette reading (cm3)**

 **I II III**

**Initial burette reading (cm3)**

**Volume of solution Q used in (cm3)**

(4 marks)

Calculate;

1. Average volume of Q used. (1 mark)

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

1. i) Moles of solution **X** used. (1 mark)

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ii) Moles of solution **Q** used. (1 mark)

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iii) Concentration of solution **Q** in moles per litre. (1 mark)

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1. Determine the value of **n** in the formula **H2C2O4. nH2O** (2 marks)

**(H=1.0, C=12.0, O=16.0)**

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**2**. You are provided with solid **R**. Carry out the following tests and record the observations and inferences in the spaces provided.

(a) Place about one-third of solid **R** in dry test-tube. Heat the solid strongly and test any gas

 with both blue and red litmus papers.

|  |  |
| --- | --- |
|  ***Observations*** | ***Inferences*** |
|  |  |

(1½ marks) (1 mark)

(b) Place the remaining amount of solid **R** in a boiling tube. Add about **15cm3** of distilled

 water and shake. Divide the mixture into four test tubes each containing about **2cm3.**

1. To the first portion, add four drops of dilute hydrochloric acid.

|  |  |
| --- | --- |
|  ***Observations*** | ***Inferences*** |
|  |  |

(1 mark) (2 marks)

1. To the second portion, add two or three drops of aqueous barium nitrate.

|  |  |
| --- | --- |
|  ***Observations*** | ***Inferences*** |
|  |  |

(½ mark) (½ mark)

1. To the third portion, add aqueous sodium hydroxide dropwise until in excess.

|  |  |
| --- | --- |
|  ***Observations*** | ***Inferences*** |
|  |  |

(1 mark) (1 mark)

1. To the fourth portion, add aqueous ammonia dropwise until in excess.

|  |  |
| --- | --- |
|  ***Observations*** | ***Inferences*** |
|  |  |

(1 mark) (½ mark)

**3.** You are provided with **solid S**. carry out the following tests and record the observations and

inferences in the spaces provided.

(a) Place about one-third of solid **S** on a clean metallic spatula and burn it in a Bunsen burner flame.

|  |  |
| --- | --- |
|  ***Observations*** | ***Inferences*** |
|  |  |

(1 mark) (1 mark)

(b) Place the remaining amount of solid **S** in a boiling tube. Add about **10cm3** of distilled water and shake. Use the mixture for tests (i) and (iii) below.

|  |  |
| --- | --- |
|  ***Observations*** | ***Inferences*** |
|  |  |

(½ mark) (½ mark)

(i) Using about **2cm3** of the mixture in a test-tube, determine the PH using universal indicator paper and chart.

|  |  |
| --- | --- |
|  ***Observations*** | ***Inferences*** |
|  |  |

(½ mark) (½ mark)

(ii) To about **2cm3** of the mixture in a test-tube, add two or three drops of acidified potassium manganate (VII).

|  |  |
| --- | --- |
|  ***Observations*** | ***Inferences*** |
|  |  |

(1 mark) (1 mark)

(iii) To about **2cm3**of the mixture in a test-tube add **two** drops of acidified potassium dichromate (VI).

|  |  |
| --- | --- |
|  ***Observations*** | ***Inferences*** |
|  |  |

(1 mark) (1 mark)

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