**NAME:……………………………………………..……INDEX NUMBER……….…………..**

 **CANDIDATE’S SIGN………………..**

 **DATE……………………………..…**

**233/3**

**CHEMISTRY**

**PAPER 3**

**TIME: 2 ¼ HOURS**

**FORM 4 END OF TERM 2 - 2019 EXAMINATION**

***Kenya Certificate of Secondary Education***

**INSTRUCTIONS TO CANDIDATES**

1. Write your name and index number in the spaces provided above.
2. Answer all the questions in the spaces provided.
3. Mathematical tables and silent electronic calculators many be used.
4. All working must be clearly shown where necessary.

**FOR EXAMINER’SUSE ONLY**

|  |  |  |
| --- | --- | --- |
| **QUESTION**  | **MAXIMUM SCORE**  | **CANDIDATE’S SCORE** |
| 1 | 22 |  |
| 2 | 12 |  |
| 3 | 6 |  |
| **TOTAL SCORE** | **40** |  |

***This paper consists of 7 printed pages***

*Candidates should check the question paper to ascertain that all pages are printed as indicated and that no questions are missing.*

1. **You are provided with**

* 4.5g of solid S in a boiling tube
* Solution Q, 0.06 M acidified potassium manganate (VII)

 **You are required to determine:**

1. The solubility of solid S at different temperatures
2. The number of moles of water of crystallisation in solid S

**PROCEDURE I**

1. Fill the burette with distilled water. Add 4.0cm3 of distilled water to solid S and

Heat the mixture in a water bath while stirring with a thermometer to about 800C until all the solid dissolves.

1. Allow the solution to cool while stirring with the thermometer and note the temperature at which crystals of solid S start to appear. Record this temperature in table **I**below.
2. Add 2.0cm3 of distilled water to the contents of the boiling tube. Heat the mixture in the water bath while stirring with the thermometer until all the solid dissolves.
3. Allow the mixture to cool while stirring and note the temperature at which crystals of solid S start to appear.
4. Repeat the procedure (c) and (d) three more times and record the temperatures in the table**I**

**(Retain the contents of the boiling tube for use in procedure II)**

Complete the table by calculating the solubility of solid S at the different temperatures.

**TABLE I**(6mks)

|  |  |  |
| --- | --- | --- |
| Volume of water in the boiling tube(cm3) | Temperature at which crystals of solid S first appear( 0 C) | Solubility of solid S (g/100g) of water |
| 4 |  |  |
| 6 |  |  |
| 8 |  |  |
| 10 |  |  |
| 12 |  |  |

On the grid provided plot a graph of the solubility of solid S against temperature. (3mks)



(ii) Using your graph determine the temperature at which 100g of solid S would dissolve in 100cm3 of water. (1mk)

 **PROCEDURE (II)**

1. Transfer the content of the boiling tube into 250ml volumetric flask. Rinse the boiling tube and the thermometer with distilled water to the volumetric flask. Add more distilled water to make up to the mark. Label this solution S. Fill the burette with solution Q

 Using a pipette and pipette filler, place 25.0cm3 of solution S into a conical flask. Warm the mixture to about 70oC. Titrate the hot solution S with solution Q until a permanent pink colour persists. Record your readings in table 2.

**Table II**

|  |  |  |  |
| --- | --- | --- | --- |
|  |  I |  II |  III |
| Final burette reading (cm3) |  |  |  |
| Initial burette reading (cm3) |  |  |  |
| Volume of solution Q used (cm3) |  |  |  |

 (4marks)

1. Calculate the :
2. Average volume of solution Q used. (1mark)
3. Number of moles of potassium manganate (VII) used. (1mark)
4. Number of moles of **S** in 25cm3 of solution **S**given that 2 moles of potassium manganate(VII) react completely with 5 moles of **S**(1mark)
5. Relativeformula mass of **S.** (3marks)
6. The formula of S has the form (CHO2)2. ***x***H2O. Determine the value of ***x***in the formula.

(C=12, O=16, H=1) (2 marks)

2. You are provided with solid M, which is a mixture of two compounds. You are required to:

 Carry out the tests below.Write your observations and inferences in the spaces provided.

**Procedure:**

1. Place all of solid M into a boiling tube. Add about 10cm3 of distilled water, Shake well and filter.

Keep both the filtrate and the residue.Divide the filtrate into 3 portions

* 1. To the first portion add acidified Barium Chloride solution

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

* 1. Add sodium hydroxide solution drop wise to the second portion till in excess.

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

* 1. Add NH3 solution drop wise to the third portion till in excess.

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

1. (i) Scrape the solid residue from the filter paper and transfer it into a boiling tube. Add about5cm3of nitric(v) acid and shake to dissolve.Divide the solution into 3 portions

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

1. To the first portion add sodium hydroxide solution drop wise till in excess.

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

1. To the second portion add ammonia solution drop wise until in excess.

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

1. Add 3 drops of hydrochloric acid to the third portion warm the mixture and allow it to cool.

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

3. (i) Place solid A into a boiling tube. Add 10cm3 of distilled water and shake well.Use the solution for the following tests.Divide the solution into 3 portions

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

(ii) Place 1cm3 of solution A in a test tube and determine its PH using a PH paper.

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

 (iii) To about 2cm3 of the solution obtained in (b) above, add 3drops of acidified KMnO4(aq)

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