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

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

**233/3**

**CHEMISTRY**

**PAPER 3**

**PRACTICAL**

**DECEMBER 2020**

**TIME: 2 ¼ HOURS**

**INSTRUCTIONS TO CANDIDATES**

1. Write your name, class, admission number in the spaces provided above.
2. Answer ALL the questions in the spaces provided.
3. Mathematical tables and silent electronic calculators may be used for calculations.
4. All workings MUST be clearly shown where necessary.
5. You are not allowed to start working with the apparatus for the first 15 minutes of the 2 ¼ hours allowed. This time is to enable you read the question paper and make sure you have the chemicals and apparatus that you may need.
6. This paper consist of **6** printed pages candidates must check to ensure that all pages are printed and that no question is missing.

**For Examiner’s use only**

|  |  |  |
| --- | --- | --- |
| Question | Maximum score | Candidate’s score |
| 1 | 20 |  |
| 2 | 15 |  |
| 3 | 05 |  |
| Total score | 40 |  |

1. **You are provided with:**
* 6.5g of solid A.
* Solution B containing 20g per litre of sodium hydroxide
* Phenolphthalein indicator.

You are required to determine;

* The solubility of solid A at different temperatures.
* The number of moles of water of crystallization in solid A.

**Procedure I**

1. Place all solid A in a boiling tube

Using a burette add 4cm3 of distilled water into the boiling tube. Heat the mixture while stirring with the thermometer to about 700c. When all the solid has dissolved allow the solution to cool while stirring with the thermometer. Note the temperature at which crystals of solid A first appear; Record this temperature in table I.

1. Using the burette, add 2cm3 of distilled water to the contents of the boiling tube. Warm the mixture while stirring with the thermometer until all the solid A dissolves. Allow the mixture to cool while stirring. Note and record the temperature at which crystals of solid A just appear.
2. Repeat procedure (b) two more times and record the temperature in the table 1. Retain the content of the boiling tube for use in procedure 2.
3. i) Complete table I by calculating the solubility of solid A at different temperatures.

**Table I**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Volume of water in the boiling tube (cm3) | 4.0 | 6.0 | 8.0 | 10.0 |
| Temperature at which crystals of solid A first appear( 0c) |  |  |  |  |
| Solubility of solid A (g/100g of water |  |  |  |  |

 (6marks)

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

1. From your graph, at what temperature will 100g of solid A dissolves in 100cm3 of water. (1mk)

**Procedure 2**

a) Transfer the content of the boiling tube into a 250ml volumetric flask. Rinse the boiling tube and the thermometer with distilled water and add to volumetric flask. Add more distilled water to make up to the mark, label this solution A

Place solution B in a clean burette. Using a pipette and pipette filler, place 25.0cm3of solution A into a 250ml conical flask. Add 3 drops of phenolphthalein indicator. Titrate solution A with solution B. Record your results in table II.

 b) Repeat the titration two or more times and complete the table.

**Table II**

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

 (4mks)

Determine the;

1. Average volume of solution **B** used. (1mk)
2. Number of moles sodium hydroxide solution. (1mk)
3. The number of moles of solution **A** given that 2 moles of solution B react completely with 1 mole of solution **A**. (1mk)
4. Relative formula mass of **A.** (2mks)
5. Given that A has the formula L.nH2O. Determine the value of n. Given that the relative formula mass of L is 90.0 (O = 16.0, H= 1.0) (1mk)
6. You are provided with solid **V**. Carry out the tests below and write your observations and inferences in the spaces provided.

a) i) Place all solid V provided into a clean boiling tube, add about 5cm3 distilled water.

 Shake the contents thoroughly and filter. Retain both the filtrate and the residue.

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

ii) Divide the filtrate into 4 portions.

 To the first portion add sodium hydroxide dropwise solution until in excess.

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

iii) To the second portion, add Ammonia solution dropwise until in excess.

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

iv) To third portion, add about 1cm3 2M hydrochloric acid.

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

v) To the fourth portion add a few drops of Barium chloride solution followed by Nitric (V) acid.

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

b) i) Transfer all the residue into a clean boiling tube, then add about 6cm3 of 2M Nitric acid. Divide the mixture into 3 portions.

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

ii) To the 1st portion add sodium hydroxide solution dropwise until in excess.

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

iii) To the 2nd portion, add Ammonia solution dropwise until in excess.

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

iv) To the 3rd portion, add 3drops of sodium sulphate solution.

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

1. You are provided with substance F. Carry out the following tests and record your observations and inferences in the spaces provided.

a) Place a half of solid F in a clean metallic spatula and ignite it on a non- luminous flame.

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

b) Put the remaining solid F in a boiling tube and add about 10cm3 of distilled water shake well and **warm.** Use about 2cm3 portions of the solution obtained in a test – tube for each of the tests b (i), b (ii) and b (iii).

b (i) To the first portion add **2 to 3** drops of acidified potassium manganate (VII) solution and shake well.

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

b) ii) To the second portion dip a universal indicator paper and determine the pH of the solution.

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

b) iii) To the third portion add the solid sodium hydrogen carbonate provided.

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