Name \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Index No.

**Kenya Certificate of Secondary Education**



 [**SERIES**](https://teacher.co.ke/notes/) **4**

**CHEMISTRY**

**PAPER 3**

**2 ¼ HOURS**

**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 | 15 |  |
| 2 | 12 |  |
| 3 | 13 |  |
| **TOTAL SCORE** | **40** |  |

***This paper consists of 8 printed page***

1. You are provided with”

 - Solution C1 which is a solution of a dibasic acid, H2C2O4. XH2O containing 5.04g in 500cm3

 of solution.

- Solution C2 which is a 0.2M solution of sodium hydroxide.

 You are required to:-

* Determine the value of X in the formula H2C2O4.XH2O ( H =1, C = 12, O = 16 )

**Procedure**

Fill the burette with solution C1. Pipette 25cm3 of solution C2 into a clean dry conical flask. Add 2 drops of phenolphthalein indicator and titrate against C1 until the indicator just turns colourless.

Repeat the procedure two more times and complete the table below.

 ( 4 marks)

|  |  |  |  |
| --- | --- | --- | --- |
| Titration | I | II | III |
| Final burette reading (cm3) |  |  |  |
| Initial burette reading (cm3) |  |  |  |
| Volume of solution C1 used (cm3) |  |  |  |

 (a) Calculate the average volume of C1 used. (1 mark )

 (b) Calculate the moles of the acid, C1 reacting. (3 marks )

 (c ) Calculate the concentration of the acid, C1 in moles / liters. (2 marks )

 (d) Calculate the relative formula mass of the acid. (3 marks )

 (e) Hence determine the value of X in H2C2O4.XH2O . ( 2 marks )

2. You are provided with:

 - 5g of solid K

 - Distilled water

You are required to determine solubility of solid K at different temperatures.

**Procedure**

Transfer solid K into a boiling tube. Using a 10ml measuring cylinder, measure 10cm3 of water into the boiling tube. Heat the mixture while stirring with the thermometer to about 900C. When all the solid has dissolved, allow the solution to cool while stirring with the thermometer. (Cooling of the solution can be speeded up by dipping the boiling tube in cold water in a glass beaker for a few seconds.)

Record the temperature at which the crystals of solid K first appear. In the table below.

Retain the boiling tube and its contents for further experiments.

Measure 5cm3 of distilled water and add to the mixture in the boiling tube. Heat until the crystals dissolve, then cool while stirring with a thermometer.

Record the temperature at which the crystals again start to reappear.

Repeat this procedure, each time adding more 5cm3 of distilled water, heating, cooling and recording the crystallization temperature until the table is completely filled.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Total volume of water added to 5g of solid K (cm3) | 10 | 15 | 20 | 25 | 30 | 35 |
| Temperature at which crystals appear (0C) |  |  |  |  |  |  |
| Solubility of K in g/100g of water |  |  |  |  |  |  |

 (a) Complete the table and calculate the solubility of solid K in g/100g of water at

different temperatures. ( 6 marks )

 (b) On the grid provided, plot a graph of solubility of solid K against temperature. (3 marks)

 (c ) From the graph determine:-

 (i) The solubility of K at 250C. (1 mark)

 (ii) The temperature when the solution will contain 22g of K. (1 mark)

 (d) From your results calculate the mass of K that will crystallize out when a hot

 solution at 520C is cooled to 370C. (1 mark)

3. You are provided with solid F and P. Carry out the tests below. Write your observations and

inferences in the spaces provided.

 (a) Using a clean spatula heat the solid F in a Bunsen burner flame.

|  |  |
| --- | --- |
| Observations  | Inferences |
| ( ½ mark ) | ( ½ mark ) |

 (b) Place the remaining portion of the solid F in a boiling tube. Add about 10cm3 of distilled

water. Stir and filter. Keep the residue for further tests. Divide the filtrate into four

portions.

 (i) To the first portion, add sodium hydroxide solution till in excess.

|  |  |
| --- | --- |
| Observations  | Inferences |
| ( 1mark ) | ( 1 mark ) |

 (ii) To the second portion, add ammonium hydroxide solution till in excess.

|  |  |
| --- | --- |
| Observations  | Inferences |
| ( 1 mark ) | ( ½ mark ) |

 (iii) To the third portion, add lead (II) nitrate solution then warm.

|  |  |
| --- | --- |
| Observations  | Inferences |
| ( 1 mark ) | ( ½ mark ) |

 (iv) To the fourth portion, add barium chloride solution followed by hydrochloric acid.

|  |  |
| --- | --- |
| Observations  | Inferences |
| ( ½ mark ) | ( ½ mark ) |

(c ) Dissolve the residue into about 5cm3 of 2M hydrochloric acid and record your observation

and make inferences.

|  |  |
| --- | --- |
| Observations  | Inferences |
| ( ½ mark ) | ( ½ mark ) |

(d) Carry out the following tests on P.

 (i) Using a clean metallic spatula heat solid P in a Bunsen burner flame.

|  |  |
| --- | --- |
| Observations  | Inferences |
| ( ½ mark ) | ( ½ mark ) |

(ii) Put two spatulafuls of P in a boiling tube. Add 10cm3 of distilled water. Warm the

mixture to dissolve and divide the solution into three portions.

 I) To the first portion, add sodium hydrogen carbonate.

|  |  |
| --- | --- |
| Observations  | Inferences |
| ( ½ mark ) | ( ½ mark ) |

 II) To the second portion add 3 drops of conc. H2SO4. Shake well and add 1cm3 of

ethanol and warm the mixture.

|  |  |
| --- | --- |
| Observations  | Inferences |
| ( ½ mark ) | ( ½ mark ) |

 III) To the third portion, add 1-2 drops of acidified potassium manganate (VII) solution.

|  |  |
| --- | --- |
| Observations  | Inferences |
| ( 1 mark ) | ( 1 mark ) |