**CHEMISTRY PAPER 3 FORM THREE END OF YEAR EXAM – 2019**

**TIME: 1 ¾ HOURS**

1. **You are provided with:**

- Dilute hydrochloric acid labeled A

- Solution B containing 3.15g of dibasic acid H2C2O4.2H2O dissolved to form 500cm3 of

solution.

- Sodium hydroxide solution labeled as solution C.

**You are required to:**

* Standardize the sodium hydroxide solution C.

– Use the standardized solution C to determine the concentration of solution A.

**Procedure:**

(i) Place solution B in a clean burette.

(ii) Using a pipette and a pipette filler, place 25cm3 of solution C into a conical flask and add two drops of phenolphthalein indicator. Titrate with solution B and record your results in table 1.

**Table 1**

Volume of pipette used = **25.0cm3** (1 mk)

|  |  |  |  |
| --- | --- | --- | --- |
|  | **I** | **II** | **III** |
| Final burette reading (cm3) | **25.0** | **25.0** | **25.3** |
| Initial burette reading (cm3) | **0.0** | **0.0** | **0.0** |
| Volume of solution B used (cm3) | **25.0** | **25.0** | **25.3** |

(4 mks)=5

(a) Calculate the:

(i) Average volume of solution B used. (1 mk)=6

**Average volume = 25.0 + 25.0 = 25.0cm3**

**2**

(ii) Concentration of the dibasic solution B in moles per litre. (H = 1, O = 16, C =12) (4 mks)=10

**RFM of H2C2O4.2H2O = (1x2) + (12 x 2) + (16 x4) + (2 x 18)**

**3.15g – 500cm3**

**? - 1000cm3**

**1000 x 3.15 = 6.3g**

**500**

**Molarity = 6.3**

**126**

**= 0.05M**

(iii) Concentration of the sodium hydroxide solution C in moles. (4 mks)=14

**2NaOH(aq) + H2X(aq)  Na2X(aq) + 2H2O**

**where H2X is the dibasic acid.**

**Number of moles of solution B = 25 x 0.05**

**1000**

**Moles of NaOH = 2 x 0.00125 = 0.0025 moles = 0.00125moles**

**0.0025 moles 25cm3**

**? moles 1000cm3 1000 x 0.0025 = 0.1M**

**25**

**Procedure II:**

(i) Using a clean measuring cylinder, measure 25cm3 of solution A and transfer into 250ml volumetric

flask.

(ii) Use distilled water to top up the solution in the volumetric flask to the mark.

(iii) Mix the solution well and label it a solution K.

(v) Clean the burette and place solution K.

(v) Using a pipette and pipette filler, place 25cm3 of solution C into a conical flask and add two drops of

phenolphthalein indicator.

(vi) Titrate the concentration in the conical flask with solution K. Record the results in table 2. Repeat

the titration two more times and record your results.

**TABLE 2**

Volume of pipette used = **25cm3** (1 mk)=15

|  |  |  |  |
| --- | --- | --- | --- |
|  | **I** | **II** | **III** |
| Final burette reading (cm3) | **25.1** | **25.0** | **24.9** |
| Initial burette reading | **0.0** | **0.0** | **0.0** |
| Volume of solution K used (cm3) | **25.1** | **25.0** | **24.9** |

(4 mks)

(a) What is the average volume of solution K used? (1 mk)=16

**Average volume = 25.1 + 25.0 + 24.9 = 25.0cm3**

**3**

(b) Calculate the concentration of solution K in moles per litre. (4 mks) =20

**HCl(aq) + NaOH(aq) NaCl(aq) + H2O(l)**

**Moles of NaOH used = 25 x 0.1 = 0.0025 moles**

**1000**

**Moles of HCl (solution K) 0.0025 (mole ratio = 1:1)**

**Molarity of solution K = 1000 x 0.0025 = 0.1M**

**25**

(c) Determine the concentration of solution A in moles per litre. (3 mks)=23

**M1V1 = M2V2**

**X x 25 = 250 x 0.1**

**X = 250 x 0.1 = 1.0M**

**25**

2. You are provided with solid D. Carry out the tests below and record your observations and inferences

in the spaces provided.

(a) Place solid D in a boiling tube. Add about 8cm3 of distilled water to dissolve the solid. Divide the

solution into four portions. (3 mks)=26

|  |  |
| --- | --- |
| Observations | Inferences |
| **A colourless solution is formed** | **CU2+, Fe2+, Fe3+ absent (Polar substance** |

(b) To the first portion, add aqeous sodium hydroxide dropwise until in excess. (3 mks)=29

|  |  |
| --- | --- |
| Observations | Inferences |
| **White precipitate soluble in excess** | **Zn2+, Al3+, Pb2+ present** |

(c) To the second portion, add aqeous ammonia dropwise until in excess. (2 mks)=31

|  |  |
| --- | --- |
| Observations | Inferences |
| **White precipitate soluble in excess** | **Zn2+ present (confirmed present** |

(d) To the third portion, add barium chloride solution (3 mks)=34

|  |  |
| --- | --- |
| Observations | Inferences |
| **A white precipitate is formed** | **SO42-, SO32-, CO32- present** |

(e) To the fourth portion, add acidified lead (II) nitrate solution. (2 mks)=36

|  |  |
| --- | --- |
| Observations | Inferences |
| **A white precipitate is formed.** | **SO42- (confirmed present).** |

Solid B is Zinc Sulphate.