09/2018 EXPERIMENT NUMBER: 13

STANDARDISATION OF $KMnO_4$ USING 0.025 M OXALIC ACID.

→ **AIM:**

To standardise the given $KMnO_4$ using $\frac{M}{40}$ oxalic acid solution.

→ **APPARATUS REQUIRED:**

Burette, pipette, standard flask, conical flask, funnel, glass rod.

→ **CHEMICALS REQUIRED:**

Oxalic acid, $KMnO_4$ solution, 4N H_2SO_4.

→ **PRINCIPLE:**

1. This is an example of a redox reaction.
2. Acidified $KMnO_4$ is the oxidising agent.
3. Oxalic acid is the reducing agent.
4. $KMnO_4$ is the self-indicator.
5. End point is the colour change from colourless to permanent pink.
6. During the reaction, the oxidation state of Mn changes from +7 to +2. T
   oxidation state of C changes from +3 to +4.
7. $KMnO_4$ is in the burette and oxalic acid is in the conical flask. It
   by the pipette.

→ **EQUATION:**

Ionic Equation:

$$2MnO_4^- + 16H^+ + 5C_2O_4^{2-} \longrightarrow 2Mn^{2+} + 8H_2O + 10CO_2$$

Overall Equation: $2KMnO_4 + 5H_2C_2O_4 + 3H_2SO_4 \rightarrow K_2SO_4 + 2MnSO_4 + 10CO_2$

→ PROCEDURE:

1. Prepare a standard solution of 0.025 M oxalic acid by accurately weighing 0.7875 g of oxalic acid using a chemical balance.
2. Fill the burette with $KMnO_4$ after rinsing well.
3. Pipette out 20 mL of oxalic acid from the standard flask to the conical fla
4. Add 1 test tube full of 4N H_2SO_4 into the oxalic acid solution of the conical flask.
5. Heat the solution in the conical flask to 60–70°C
6. Titrate the hot solution of oxalic acid against the $KMnO_4$ till end point is reached [colourless to permanent pink].

→ RESULT:

1. Molarity of $KMnO_4$ = 0.0102 mol L^{-1}.
2. Strength of $KMnO_4$ = 1.611 g L^{-1}.

→ PRECAUTIONS:

1. The burette and pipette must be washed well.
2. For colourless solution, lower meniscus must be considered while for coloured solutions, upper meniscus must be considered while measuring the level of liquid.

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→ OBSERVATION AND CALCULATION:

SR. No.	Initial Burette Reading	Final Burette Reading	Volume of KMnO4 (mL)	Volume of Oxalic acid sol
1.	0	19.5	19.5	20
2.	0	19.5	19.5	20.

$KMnO_4$ × Oxalic Acid

$$\frac{M_1V_1}{N_1} = \frac{M_2V_2}{N_2}$$

M_1 = Molarity of $KMnO_4$ = ?
V_1 = Volume of $KMnO_4$ = 19.5mL
N_1 = No. of moles of $KMnO_4$ = 2.

M_2 = Molarity of Oxalic Acid = $\frac{M}{40}$ = 0.025
V_2 = Volume of oxalic acid = 20mL
N_2 = No. of moles of oxalic acid = 5.

$$M_1 = \frac{M_2V_2N_1}{N_2V_1}$$

$$M_1 = \frac{0.025 \times 20 \times 2}{5 \times 19.5}$$

$$M_1 = 0.0102$$

Strength or wt/Litre of $KMnO_4$:

$$M = \frac{Wt}{M_r \times V} \Longrightarrow \frac{Wt}{V} = M \times M_r.$$

Strength = $0.0102\ mol\ L^{-1} \times 158\ g\ L^{-1}$
= $1.611\ g\ L^{-1}$