



INDIAN SCHOOL MUSCAT
SENIOR SECTION
DEPARTMENT OF CHEMISTRY
CLASS XII
CHEMISTRY PRACTICAL
PERMANGANOMETRY- (REDOX TITRATION)

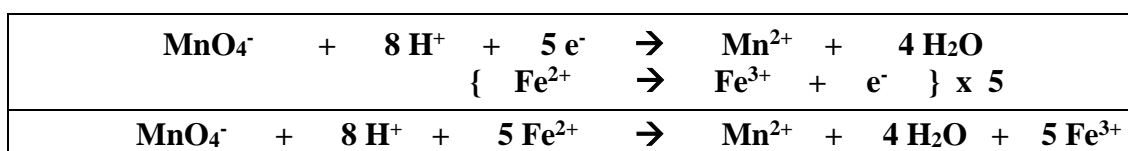
Experiment Number: _____

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ESTIMATION OF KMnO₄ USING STANDARD MOHR'S SALT SOLUTION

Aim: - To determine the mass of potassium permanganate in one litre of the given solution using the given pure Ferrous ammonium sulphate [Mohr's salt, (NH₄)₂SO₄.FeSO₄.6 H₂O] crystals of Analytical Reagent (A.R.) quality.

Principle: - The estimation is based on the reaction between KMnO₄ and Mohr's salt.



REQUIREMENTS: - Burette, Pipette, Conical flask, Weighing bottle, Ferrous ammonium sulphate (Mohr's salt) crystals (A.R. Grade), Balance, etc.

PROCEDURE: - First of all wash all the apparatus thoroughly with tap water and rinse with distilled water.

• **Preparation of Mohr's salt solution (standard 0.0500 M)**

Weigh **1.960 g** of Mohr's salt crystals (A.R. grade), accurately in a weighing bottle transfer and wash into a clean funnel placed over a **100 ml.** standard volumetric measuring flask. Add about 15ml (1 test tube) of 10% H₂SO₄ solution and then wash down the crystals carefully into the flask by a jet of distilled water. Wash the funnel also down into the flask. Dissolve the crystals completely and then make up the solution to 100 ml. mark. Shake well to make a homogeneous solution.

(Note: - Weigh **4.900 g** of Mohr's salt for a **250 ml.** flask)

Mass of Mohr's salt crystals = ----- gms.

Volume to which the solution is diluted = V_s ml. = 100 ml.

Molarity of the Mohr's salt solution = M_F = $\frac{a \times 1000}{392 \times V_s}$ =x1000 =M

• **Estimation of Potassium permanganate solution**

Pipette out 20 ml. of Mohr's salt solution into a conical flask and add about 20 ml. (1 ½ test tubes) of Dil. Sulphuric acid to it. The solution is then titrated with KMnO₄ solution taken in the burette. The end point is indicated by the appearance of **pale pink colour** in the solution. The titration is repeated till concordant titre values are obtained.

Sl. No	Volume of F A S (ml)	Burette reading		Titre value (Volume of KMnO ₄ consumed) (X - Y) ml
		Initial reading Y ml	Final reading X ml	
1	20 ml			
2	20 ml			

Calculation: -

Molarity of the Mohr's salt solution = M_F = ----- M

Volume of FAS used = V_F = 20 ml

Volume of $KMnO_4$ used up = V_K ml. = ----- ml.

By law of equivalence: - $5 M_K V_K = M_F V_F$		
M_K = Molarity of $KMnO_4$	V_K = Volume of $KMnO_4$ used up (Burette reading).	5 = Number of electrons consumed
M_F = Molarity of Mohr's salt used.	V_F = Volume of Mohr's salt (Volume of the pipette).	Only one electron is released

Molarity of the $KMnO_4$ solution = $M_K = \frac{M_F V_F}{5 V_K} = \frac{\dots\dots\dots \times 20}{5 \times \dots\dots\dots} = \dots\dots\dots M$

Result: -

Molarity of the given $KMnO_4$ solution = ----- M.

N.B: - (Do not enter in your journal)

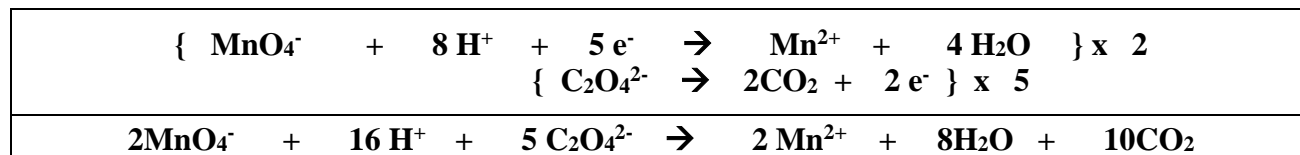
- 1. If during the reaction a brown precipitate of hydrated manganese dioxide is observed, insufficient sulphuric acid is indicated. More acid should then be added to the solution.*
- 2. Since the lower meniscus cannot be seen clearly through the purple colour of the $KMnO_4$ solution, the burette readings are taken at the highest level of the liquid surface (upper meniscus).*
- 3. A burette, which has been used for $KMnO_4$ solution, should be emptied and cleaned, immediately after use. Any brown stain due to MnO_2 should be removed by oxalic acid solution or Mohr's salt solution.*

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ESTIMATION OF KMnO₄ USING STANDARD OXALIC ACID SOLUTION.

Aim: - To determine the mass of potassium permanganate in one litre of the given solution using the given pure oxalic acid crystals of Analytical Reagent (A.R.) quality.

Principle: - The estimation is based on the reaction between KMnO₄ and Oxalic acid.



REQUIREMENTS: - Burette, Pipette, Conical flask, Weighing bottle, Oxalic acid crystals (AR grade), Balance, etc.

PROCEDURE: - First of all wash all the apparatus thoroughly with tap water and rinse with distilled water

• **Preparation of oxalic acid solution (standard 0.0500 M)**

Weigh **0.6300 g** of Oxalic acid crystals (A.R. grade), accurately in a weighing bottle wash and transfer into a clean funnel placed over a **100 ml.** standard volumetric measuring flask. Wash the funnel also down into the flask. Dissolve the crystals completely and then make up the solution to 100ml. mark. Shake well to make a homogeneous solution.

(Note: - Weigh **1.575 g** of oxalic acid for a **250ml.** flask)

Mass of oxalic acid crystals = X g
 Volume of solution prepared = V_s ml = 100 ml.

Molarity of the Oxalic acid solution (M_o) = $\frac{X \times 1000}{126 \times V_s} = \frac{\dots \times 1000}{126 \times 100} = \dots\text{M}$

• **Estimation of Potassium permanganate solution**

Pipette out 20 ml. of oxalic acid into a conical flask, about 20 ml. (1 ½ test tubes) of Dil. Sulphuric acid is added and the mixture is **heated to 60° to 70° C** (bearable warmth). The solution is then titrated with KMnO₄ solution taken in the burette. The end point is indicated by the appearance of **pale pink colour** in the solution. The titration is repeated till concordant titre values are obtained.

Sl No	Volume of Oxalic acid used (ml)	Burette reading		Titre value (Volume of KMnO ₄ consumed) (Z – Y) ml
		Initial reading Y ml	Final reading Z ml	
1	20 ml			
2	20 ml			

Calculation: -

Molarity of the Oxalic acid solution = M_o =M

Volume of oxalic acid used = V_o = 20 ml

Volume of $KMnO_4$ used up = V_K ml. = ml.

By law of equivalence: - $5 M_K V_K = 2 M_o V_o$		
M_K = Molarity of $KMnO_4$	V_K = Volume of $KMnO_4$ used up (Burette reading).	5 = Number of electrons consumed
M_o = Molarity of Oxalic acid used.	V_o = Volume of Oxalic acid (Volume of the pipette)	2 = Number of electrons released.

Molarity of the $KMnO_4$ solution = $M_K = \frac{2 M_o V_o}{5 V_K} = \frac{2 \times \dots \times 20}{5 \times \dots} = \dots M$

Mass of $KMnO_4$ in one litre of the given solution = $M_K \times 158 = \dots \times 158 = \dots g$.

Result: -

Molarity of the given $KMnO_4$ solution = M.

Mass of $KMnO_4$ in one litre of the given solution = g.

N.B: - (Do not enter in your journal)

- 1. If during the reaction a brown precipitate of hydrated manganese dioxide is observed, insufficient sulphuric acid is indicated. More acid should then be added to the solution.*
- 2. Since the lower meniscus cannot be seen clearly through the purple colour of the $KMnO_4$ solution, the burette readings are taken at the highest level of the liquid surface (upper meniscus).*
- 3. A burette, which has been used for $KMnO_4$ solution, should be emptied and cleaned, immediately after use. Any brown stain due to MnO_2 should be removed by oxalic acid solution or Mohr's salt solution.*

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