REDOX TITRATION

Oxidation-Reduction Titration

Oxidation-Reduction Titration, also known as redox titration, involves titrations based on oxidation-reduction reactions. In the case of Permanganate Titration, potassium permanganate serves as the oxidizing agent in an acidic medium.

The indicator used in this titration is $KMnO_4$, which acts as a self-indicator. The reaction during the titration is represented as follows:

$$MnO_4^- + 8H^+ + 5e^- \rightarrow Mn^{2+} + 4H_2O$$

Prior to reaching the end point, the solution maintains a colorless appearance. However, after the equivalence point, the addition of a single drop of $KMnO_4$ imparts color to the solution.

This titration finds application in the estimation of $FeSO_4$, where $KMnO_4$ is employed for its oxidizing properties.

Dichromate Titration

Dichromate Titration involves the utilization of $K_2Cr_2O_7$ as an oxidizing agent in an acidic medium. The chemical reaction associated with this titration is represented as follows:

$$Cr_2O_7^{2-} + 14H^+ + 6e^- \longrightarrow 2Cr^{3+} + 7H_2O$$

For the purpose of indicating the endpoint, $K_3[Fe(CN)_6]$ can be used as an external indicator, or diphenylamine can serve as an internal indicator. The reaction between $K_3[Fe(CN)_6]$ and Fe^{3+} is expressed as:

$$K_3[Fe(CN)_6] + Fe^{3+} \rightarrow \underset{\text{brown color.}}{Fe[Fe(CN)_6]}$$

Dichromate titration finds application in the estimation of F_2^+ salts and I^-.

Iodimetric Titration

Iodimetric Titration involves the use of free iodine and is particularly employed in titrations. Due to the challenges associated with preparing a solution of iodine, given its volatility and low solubility in water, it is instead dissolved in a potassium iodide (KI) solution, resulting in the formation of KI_3:

$$KI + I2 \rightarrow KI_3$$

This iodine-containing solution needs to undergo standardization before being utilized in titrations. Its application extends to the estimation of ions such as:

$$SO_3^{2-}, S_2O_3^{2-}, \text{ and } AsO_3^{3-}.$$

To indicate the endpoint of the titration, starch is commonly employed as the indicator, facilitating the detection of the presence of free iodine in the solution.

Iodometric Titration

$$I_2 + Na_2S_2O_3 \rightarrow 2NaI + Na_2 + Na_2S_4O_6$$

$$2CuSO_4 + 4KI \rightarrow Cu_2I_2 + 2K_2SO_4 + I_2$$

$$K_2Cr_2O_7 + 6KI + 7H_2SO_4 \rightarrow Cr_2(SO_4)_3 + 4H_2SO_4 + 7H_2O + 3I_2$$

Starch is employed as the indicator in this context.