Department of biology

Department of biology

2025-2026

((Analytical Chemistry))

Stage (First Year)

LEC- ((-7-))

Types of Titrations and Volumetric Analysis

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Introduction

Volumetric analysis is one of the most important quantitative analytical methods. It is based on measuring the volume of a standard solution of known concentration that reacts chemically with an unknown solution. This process is called titration, and the concentration of the unknown is determined at the equivalence point.

Definition of Titration

Titration is an analytical method used to determine the concentration of an unknown solution by reacting it with a standard solution of known concentration based on a balanced chemical reaction.

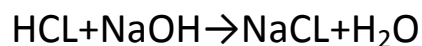## Components of Titration

Standard solution

Unknown solution

Indicator

Glassware: burette, pipette, conical flask

Types of Titrations

1-Acid–Base Titrations

They are based on neutralization reactions between an acid and a base to form salt and water.

$HCL+NaOH \rightarrow NaCL+H_2O$

25 mL of HCl was titrated with 0.10 M NaOH.

The volume of NaOH used was 30 mL.

Calculate the concentration of HCl.

Solution:

$M_{HCL}XV = M_{NaOH} XV$
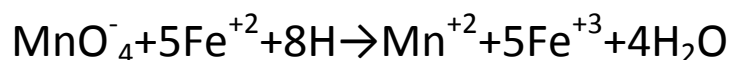
$M_{HCLX25=0.1X30}$

$M_{HCl} = 0.12$ M

2- Redox Titrations

They are based on electron transfer between an oxidizing agent and a reducing agent.

$MnO^-_4+5Fe^{+2}+8H \rightarrow Mn^{+2}+5Fe^{+3}+4H_2O$

20 mL of Fe^{2+} solution was titrated with 0.02 M $KMnO_4$.

The volume used was 10 mL.

Calculate the concentration of Fe^{2+}.

Solution:

$M_{Fe^{2+}} XV = M XV$

$M_{Fe^{2+}} x20=0.02x10x5$

$M_{Fe^{2+}} = 0.05$ M

3-Precipitation Titrations

They are based on the formation of a sparingly soluble precipitate.

$AgNO_3 + NaCl \rightarrow AgCl\downarrow + NaNO_3$ ✓

50 mL of NaCl was titrated with 0.10 M $AgNO_3$.

The volume used was 25 mL.
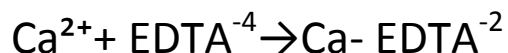
Calculate the concentration of NaCl.

Solution:

$M_{NaCl} = 0.05$ M

4-Complexometric Titrations

They are based on the formation of a stable complex between metal ions and a complexing agent such as EDTA.

$Ca^{2+} + EDTA^{-4} \rightarrow Ca\text{-} EDTA^{-2}$

25 mL of Ca^{2+} was titrated with 0.01 M EDTA.

The volume used was 20 mL.

Calculate the concentration of Ca^{2+}.

Solution:

$M_{Ca^{2+}} =$