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# **COMPLEXOMETRIC TITRATION PRINCIPLE, CLASSIFICATION**

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## COMPLEXOMETRIC TITRATION

**(chelation)** is a form of volumetric analysis in which the formation of a colored complex is used to indicate the end point of a titration. Complexometric titrations are particularly useful for the determination of a mixture of different metal ions in solution.

- In theory, any complexation reaction can be used as a volumetric technique provided that:
- The reaction reaches equilibrium rapidly after each portion of titrant is added.



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- **Interfering situations do not arise. For instance, the stepwise formation of several different complexes of the metal ion with the titrant, resulting in the presence of more than one complex in solution during the titration process.**
- **A complexometric indicator capable of locating equivalence point with fair accuracy is available.**



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# THEORY AND PRINCIPLE

**1. COMPLEX** is a compound that is formed by the combination of a metal ion with a molecule that is capable of donating electrons, for example :  $[\text{Cu}(\text{NH}_3)_4]^{2-}$  and  $\text{Co}[(\text{NH}_3)_6]^{3+}$  Cupric ammonium ion Cobalt ammine In the above two examples both  $\text{Cu}^{2+}$  and  $\text{Co}^{2+}$  form complexes with lone pair of electrons present in the neutral molecule ammonia .

**2. CHELATE** is a complex that is formed by the combination of a polyvalent metal ion with a molecule which essentially contains two or more groups that can donate electrons. disodium ethylenediaminetetraacetate (EDTA) reacts with polyvalent metal ions to result in the formation of a fairly stable water-soluble complex, or a chelate compound.



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**3.LIGAND is a molecule that affords groups for attachment to metal ions such as EDTA.**

**Some examples of polyvalent metal ions are given below :**

**Bivalent Metal ions :  $\text{Ca}^{2+}$ ,  $\text{Mg}^{2+}$ ,  $\text{Zn}^{2+}$ , Trivalent Metal ions :  $\text{Fe}^{3+}$ ,  $\text{Al}^{3+}$ ,  $\text{Cr}^{3+}$ .**



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## **TYPES OF COMPLEXOMETRIC TITRATION**

### **1. DIRECT TITRATION**

**in this case, the metal ion is titrated with a standard solution of EDTA.. the solution containing the metal ion is buffered to an appropriate ph at which the stability constant of the metal-edta complex is large. the free indicator has a different colour from that of the metal-indicator complex.**



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## 2. BACK TITRATION

- **in certain circumstances a particular metal ion cannot be titrated directly. this includes situations where: the metal ion precipitates in the absence of EDTA.**
- **The metal ion reacts too slowly with EDTA**
- **The metal ion forms an inert complex.**
- **in these cases a back titration is required. this involves addition of a known excess of EDTA to the metal ion then, the excess EDTA is titrated with a standard solution of a different metal ion.**



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