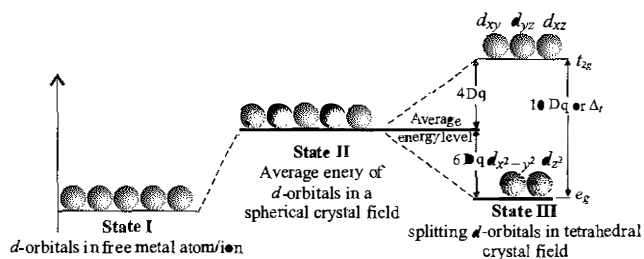


much more than the other two d -orbitals ($d_{x^2-y^2}$ and d_{z^2}). The d -orbitals thus split in two sets of orbitals: t_{2g} orbital of higher energy including d_{xy} , d_{yz} , d_{xz} and e_g orbital of lower energy including $d_{x^2-y^2}$, d_{z^2} .



Energy difference between two sets of orbitals is represented by Δ_t . However splitting is much smaller than that in octahedral complexes.

$$\Delta_t \approx \frac{4}{9} \Delta_o$$

Negative sign denotes that order of splitting in tetrahedral complexes is reverse of that in octahedral complexes.

Because of the small value of Δ_t , electrons generally do not pair and results in formation of high-spin complex.

APPLICATIONS OF COORDINATION COMPOUNDS

Analytical Chemistry

- Coordination compounds are important in both qualitative and quantitative analysis.
 - **Separation of Ag^+ from Hg_2^{2+} in first group :** It is based on the fact that AgCl is soluble in aq. NH_3 while Hg_2Cl_2 forms a black insoluble complex.
 - Separation of IIB group sulphides from IIA group sulphides.
 - Detection of Cu^{2+} due to the formation of blue tetrammine copper sulphate complex.
 - Detection of Fe^{3+} and Ni^{2+} , etc.

Biological Processes

- Coordination compounds play many important roles in animals and plants. They are essential in storage and

transport of oxygen, as electron transfer agents, as catalysts and in photosynthesis. Three important examples are given below:

- **Haemoglobin :** Haemoglobin is a protein which is present in blood. The main function of haemoglobin is to carry oxygen in the blood from the lungs to the tissues where it delivers the oxygen molecules to myoglobin.
- Haemoglobin molecule consists four heme groups embedded in a protein molecule. The iron in the heme group has the oxidation number +2.
- **Chlorophyll :** The chlorophyll molecule, which plays an essential role in photosynthesis also contains the porphyrin ring but the metal ion there is Mg^{2+} rather than Fe^{2+} . It is a green plant pigment and acts as a photosensitizer in the synthesis of carbohydrates in plants.
- **Vitamin B_{12} :** It is a complex of cobalt with a quadridentate ligand which is similar to porphyrin ligand of haemoglobin.

Other Uses

- **Metallurgical operations :** Silver and gold are extracted by the use of complex formation. Silver ore is treated with sodium cyanide solution with continuous passing of air through solution.
- **Photography :** In photography, the image on the negative is fixed by dissolving all the remaining silver halides with hypo solution in the form of a soluble complex.
- **In medicinal field :** The complex of calcium with EDTA is used for the treatment of a lead poisoning. Lead readily replaces calcium in the complex and lead-EDTA complex is finally eliminated from the body in urine.

The platinum complex $\text{cis} [\text{Pt}(\text{NH}_3)_2\text{Cl}_2]$ known as *cis*-platin is used as an antitumor agent in the treatment of cancer.