IMPORTANCE AND APPLICATION OF COORDINATION COMPOUNDS

(i) Coordination compounds play a vital role in biological systems. Examples include chlorophyll, the green pigment in plants; hemoglobin, the red pigment in blood serving as an oxygen carrier, along with myoglobin, which stores oxygen and regulates respiration; and Vitamin B_{12} (cyanocobalamin), known as the anti-pernicious anemia factor. These compounds involve magnesium, iron, and cobalt, forming macrocyclic porphyrin and corrin ligands.

(ii) Coordination compounds find extensive use in qualitative and quantitative chemical analysis. The recognizable color reactions exhibited by metal ions with various ligands, especially chelating ligands, serve as the foundation for their detection and estimation through classical and instrumental analysis methods. Notable examples of such reagents include ethylenediaminetetraacetic acid (EDTA), dimethylglyoxime, α-nitroso β-naphthol, cupron, etc.

(iii) Several crucial metal extraction processes, such as those for silver and gold, involve complex formation.

For instance, gold combines with cyanide in the presence of oxygen and water to form the coordination entity $[Au(CN)_2]^-$ in aqueous solution. The precipitation of gold from this solution is achieved by the addition of zinc.

(iv) Purification of metals can be accomplished through the formation and subsequent decomposition of their coordination compounds.

For instance, impure nickel is converted into $[Ni(CO)_4]$, which is then decomposed to yield pure nickel.

(v) EDTA is utilized in the treatment of lead poisoning. Some platinum coordination compounds effectively inhibit tumor growth, with examples including cis-platin (cis-$[Pt(NH_3)_2Cl_2]$) and related compounds.

(vi) Organometallic compounds serve as catalysts, falling into either the homogeneous type (soluble in the reaction medium) or the heterogeneous type (insoluble in the reaction medium). The catalyzed polymerization of alkenes at atmospheric pressure and ambient temperature using the Ziegler-Natta catalyst (titanium tetrachloride plus triethylaluminium) is a significant achievement in organometallic chemistry. The first effective homogeneous catalyst, chloridoids (triphenylphosphine) rhodium(I), $[RhCl(PPh_3)_3]$ for hydrogenation, was developed by Wilkinson.

(vii) Tetraethyl lead (TEL) is employed as an antiknock compound in gasoline.