Coordination Compounds (

In coordination chemistry, the **oxidation number** of a central metal atom in a complex can be calculated using the charge of the ligands and the overall charge of the coordination complex. The oxidation number is important for determining the reactivity, stability, and naming of complexes.

General Rule for Oxidation Number Calculation:

The oxidation number of the central metal ion is found by balancing the charges:

$$\text{Oxidation Number of Metal} = \text{Total Charge of Complex} - (\text{Sum of Charges on Ligands} \times \text{Nun}$$

Example Calculations:

1. **In** $[Fe(CN)_6]^{4-}$:
   The cyanide ligand CN^- has a charge of -1. There are 6 cyanide ions.
   Let the oxidation number of iron (Fe) be x.

   $$x + 6(-1) = -4 \quad (\text{overall charge})$$

   Solving:

   $$x - 6 = -4 \implies x = +2$$

   Therefore, the oxidation state of iron is **+2**.
2. **In** $[Co(NH_3)_5Cl]^{2+}$:
   The ammine ligand NH_3 is neutral (charge = 0), and the chloride ligand Cl^- has a charge of -1.
   Let the oxidation number of cobalt (Co) be x.

   $$x + 5(0) + (-1) = +2 \quad (\text{overall charge})$$

   Solving:

   $$x - 1 = +2 \implies x = +3$$

   Therefore, the oxidation state of cobalt is **+3**.

Ligands and Their Typical Charges:

Here is a table of common ligands and their charges:

Ligand	Formula	Charge
Ammonia	NH_3	0
Cyanide	CN^-	-1
Hydroxide	OH^-	-1
Chloride	Cl^-	-1

Ligand	Formula	Charge
Water	H_2O	0
Ethylenediamine	en	0
Oxalate	$C_2O_4^{2-}$	-2
Carbonyl	CO	0

These examples show how ligand charges help determine the overall charge and oxidation state of the metal.