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Commentary

An Overview on Coordination Complex

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COMMENTARY

A coordination complex is composed of a central atom or ion (usually a metal) called a coordination center and a sequence around the bound molecule or ion. These are called ligands or complexing agents. Compounds containing many metal-containing compounds, especially transition metals (elements such as titanium belonging to the d block of the periodic table), are coordination complexes. Coordination complexes are so ubiquitous that their structures and reactions are described in many, and sometimes confusing ways. The atom in the ligand attached to the central metal atom or ion is called the donor atom. In a typical complex, a metal ion binds to multiple donor atoms, which can be the same or different. A multidentate (multiple bond) ligand is a molecule or ion that binds to a central atom through multiple atoms of the ligand. Ligands with 2, 3, 4, or 6 bonds to the central atom are common. These complexes are called chelate complexes. The formation of such complexes is called chelation, complex formation, and coordination.

The atom or ion at the center of forms a coordination sphere with all ligands. The central atom or ion and donor atom form the first coordination sphere. Coordination refers to the "coordination covalent bond" (bipolar bond) between the ligand and the central atom. Originally, a complex meant a reversible bond of a molecule, atom, or ion via such a weak chemical bond. The number of donor atoms attached to a central atom or ion is called the coordination number. The most common coordination numbers are 2, 4, especially 6. A hydrated ion is a kind of complex ion (or simply a complex) in which a central metal ion and one or more surrounding ligands, molecules, or at least one isolated one contain a pair of electrons increase. If all ligands are monodentate, the number of donor atoms is equal to the number of ligands. For example, cobalt (II) hexahydrate ion or hex aqua cobalt (II) ion $[Co(H_2O)_6]^{2+}$ is a hydrated complex ion consisting of six water molecules bound to the metal ion Co.

The oxidation state and coordination number reflect the number of bonds formed between the metal ion and the complex ion ligand. However, the coordination number of Pt (en) is 2^+, 2 is 4 (not 2) because it has 2 bidentate ligands containing a total of 4 donor atoms. Each donor atom provides a pair of electrons. There are several donor atoms or groups that can provide multiple electron pairs. This is called bidentate (providing two pairs of electrons) or polydentate (providing two or more pairs of electrons). In some cases, an atom or group provides an electron pair (by sharing an electron pair) to two similar or different central metal atoms or acceptors, forming a three-center two-electron bond. These are called cross-linking ligands.

The ions or molecules that surround the central atom are called ligands. Ligands are classified as L or X (or a combination thereof), depending on the number of electrons provided in the bond between the ligand and the central atom. The L ligand donates two electrons from a lone pair of electrons, resulting in a coordinate covalent bond. The X ligand donates one electron and the central atom donates the other electron, forming a regular covalent bond. The ligand is said to be coordinated to the atom. In alkenes, pi bonds can be coordinated to metal atoms. Geometry In coordination chemistry, the structure is first described by its coordination number, the number of ligands attached to the metal (more precisely, the number of donor atoms). You can usually count the bound ligands, but even counting can be ambiguous. Coordination numbers usually range from 2 to 9, but many ligands are not uncommon in lanthanides and actinides.

The number of bonds depends on the size, charge, and electron configuration of the metal ion and ligand. Metal ions can have multiple coordination numbers. Normally, the chemical properties of transition metal complexes are governed by the interaction between the s and p molecular orbitals of the donor atom of the ligand and the d orbital of the metal ion. Metal s, p, and d orbitals can hold 18 electrons Therefore, the maximum coordination number of a given metal depends on the electronic composition of the metal ion (more specifically, the number of empty orbitals) and the ratio of the size of the ligand to the metal ion. Larger metals and smaller ligands lead to higher coordination numbers. $[Mo(CN)_8]^{4-}$. Pt $[P(CMe_3)]_2$. Due to their size, lanthanides, actinides, and early transition metals tend to have high coordination numbers.

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