Contd.

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Limitations of C.F.T. AND Thermodynamic Stability Constant

Limitations of CFT :- The main points are

(1) CFT ignores the attractive forces between the d-orbitals of Metal ion and nuclear charge on the ligand atom. Therefore, all properties are dependent upon the ligand orbitals and their and their interaction with metal orbitals are not explained.

(2) In CFT model partial covalency of Metal-Ligand bonds are not taken into consideration. According to CFT metal-ligands bonding is purely electrostatic.

(3) In CFT only d-electrons of metal ions are considered. the other orbitals such as s, p_x, p_y, p_z are not considered.

(4) In CFT π orbitals of ligand are not considered.

(5) This theory can not explain the relative strength of ligands. i.e why H_2O is stronger ligand than OH^-

(VI) It fail to explain charge transfer spectra or the intensities of the UV absorption bands.

STABILITY OF COMPLEX COMPOUND

The term stability of complex compound can be used in number of different ways. Generally, it means the existance of complex ion under given conditions. This term may also be refferd to the action of heat or light on compound. There are following two types of stability of complex

(I) Thermodynamic stability → This is measurment of extent to which the complex will form or will be transformed into another species under given set of conditions at equilibrium state.
When we consider this type of stability we deal with Metal-Ligand bond energies, stability constant etc.

(II) Kinetic stability :- This types of stability refers to the speed with which speed equilibrium is attained. This deals

with rati of mechanism of chemical reaction. example - substitution, isomerisation, racimisation and electron or group transformation.

DETERMINATION OF STABILITY CONSTANT

If we consider the complexes of Cu^{II} and Cd^{II} with NH_3

$[Cu(NH_3)_4]^{++}$ and $[Cd(NH_3)_4]^{++}$

Treated with H_2S — treated with H_2S

CdS (yellow ppt)

We get

No black ppt of CuS is found. That means $[Cu(NH_3)_4]^{++}$ complex is more stable than $[Cd(NH_3)_4]^{++}$.

Thermodynamic stability deals with → Bond energy, Stability const. and redox potential.

Thermodynamic stability

Let metal ion (M^{+n}) combine with ligand (L) to form MLn (charge on ion is ignored for simplicity)

Then

$$M + nL \rightleftharpoons ML_n$$

$$K = \frac{[ML_n]}{[M][L]^n}$$

K = Stability const. and if we know the value of [M], [L] and [MLn] value of K stability const. can be calculated.

These data are widely used in analytical chem., biochem, stereo-chemistry, solvent extraction etc