

Deg II Chem. Hons, Paper - III & Deg II sub

Topic :- Valence Bond Theory

Linus Pauling made a major contribution to the modern theory of Co-ordination complex by applying valence bond approach to the complex.

Pauling's valence bond theory contained three important new ideas :-

- ✓ (1) First was concerned with the geometry of the complexes with the different co-ordination number explained by the so called hybridisation of electronic orbitals
- ✓ (2) The second by the magnetic criterion of metal to ligand bond
- ✓ (3) The third by a type of double bonding between metal and ligand which by spreading the negative charge over the whole of the co-ordination sphere can result in a more stable structure.

According to Linus Pauling -

- (1) A central atom makes available a number of orbitals equal to its

Co-ordination number for the formation of dative bond with the ligand orbital

(2) A dative σ -bond arises from the overlap of the vacant metal orbital with the filled orbital on the ligands. The ligand must therefore be a chemical species which contains at least one lone pair of electrons.

(3) For the formation of a strong dative bond the charge clouds must overlap as much as possible. This is possible only when metal orbitals are hybridised from the available s, p and d orbitals to a set of equivalent bonding orbitals having definite directional characteristics. Octahedral, square planar and tetrahedral complexes are thus formed as a result of d^2sp^3 , dsp^2 and sp^3 hybridisation respectively.

The regrouping of electrons is achieved obeying Hund's rule i.e. with maximum possible unpaired spins.

