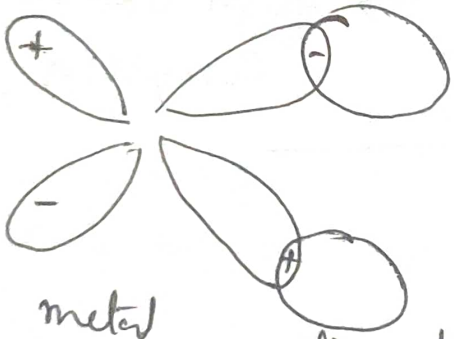
Molecular orbital theory of octahedral complex with Pi bonding

Metal and ligand orbitals participating in π bonds will lie perpendicular to the internuclear axes. There are four potential metal - ligand π interactions

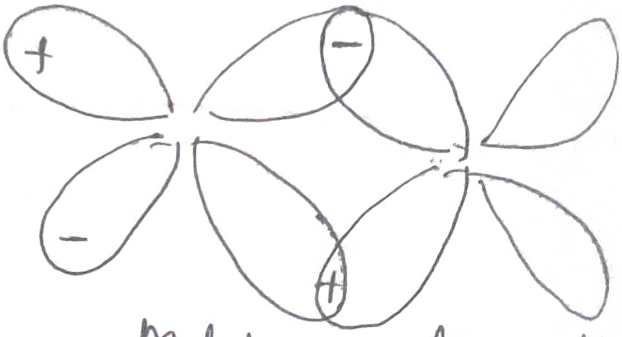
(1) $d_\pi - p_\pi$ (2) $d_\pi - d_\pi$ (3) $d_\pi - \pi^*$

(4) $d_\pi - \sigma^*$

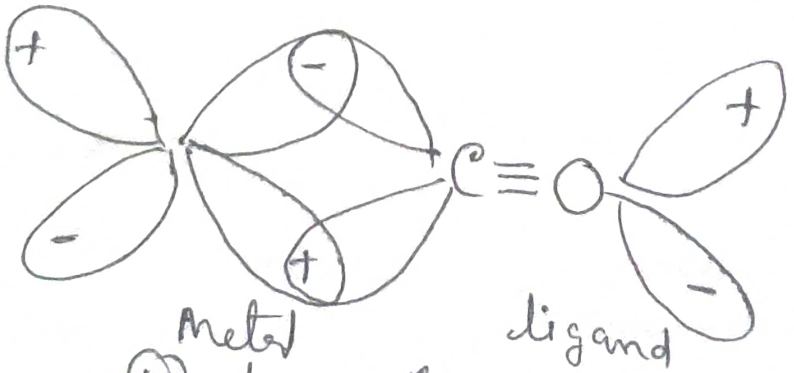
The ligand group orbitals capable of π interactions in an octahedral complex fall into four symmetry categories : t_{2g}, t_{1u}, t_{2u}, t_{1g}. of these, a transition metal will possess orbitals of only two of the types : t_{2g} (d_{xy}, d_{xz}, d_{yz}) and t_{1u} (p_x, p_y, p_z)



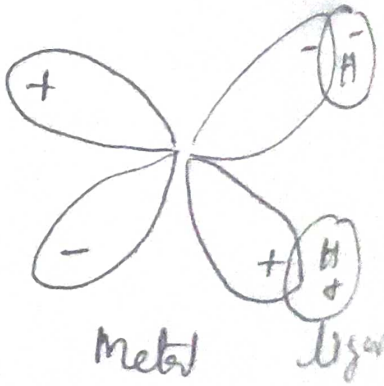
(1) $d\pi - p\pi$



(4) $d_\pi - d_\pi$



(3) $d_\pi - \pi^*$



(4) $d\pi - \sigma^*$

Pi bonding in Coordination Compounds

Type	description	Ligands
$p\pi - d\pi$	Donation of electrons from filled p orbitals of ligand to empty d orbitals of metal	RO^-, RS^-, O^{2-}, F^-, Cl^- Br^-, I^-, R_2N^-
$d\pi - d\pi$	Donation of electrons from filled d orbitals of metal to empty d orbitals of ligand	R_3P, R_3As, R_2S
$d\pi - \pi^*$	Donation of electrons from filled d orbitals of metal to empty π antibonding orbitals of ligand	CO, RNC, pyridine, CN^- N_2, NO_2, ethylene
$d\pi - \sigma^*$	Donation of electrons from filled d orbitals of metal to empty σ^* orbital of ligand	H_2, R_3P, Alkanes