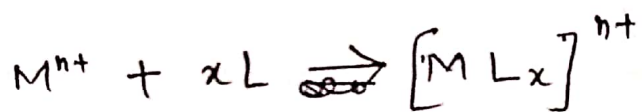


# Co-ordination Chemistry

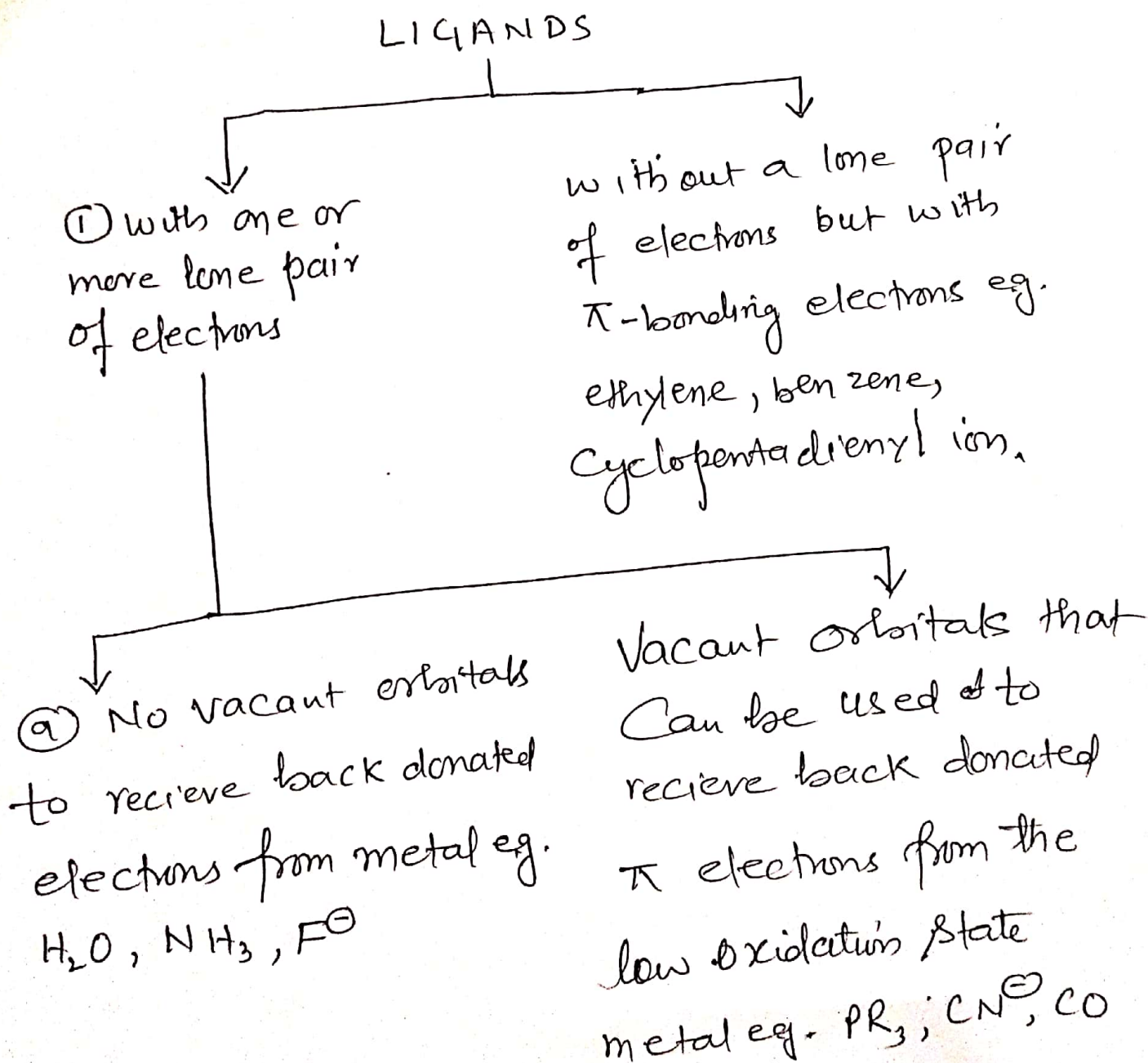
Definitions : Complex, Ligand and Co-ordination

Number : A metal ion may combine with neutral molecules or anions to give a new reasonably identifiable entity called a complex. The groups that are bound to the metal ion in a complex are called ligands. The ligands are arranged around the metal



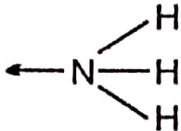
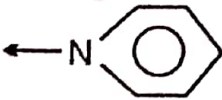
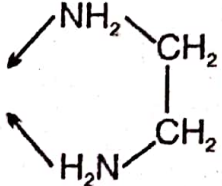
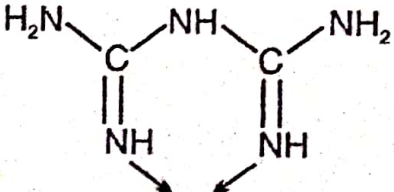
ion inside the first sphere of attraction in preferred geometry. The number of ligands bound around a metal ion by  $\sigma$  bonds is called the coordination number of the metal ion. In above reaction a metal ion  $M^{n+}$  reacts with  $x$  moles of a neutral ligand 'L' to form a complex  $[ML_x]^{n+}$ . Here  $x$  represents the Co-ordination number. In  $[Co(NH_3)_6]Cl_3$ ,  $Co^{+3}$  has a Co-ordination number six.

Ligands: Based on donor and acceptor properties ligands may be of following types.



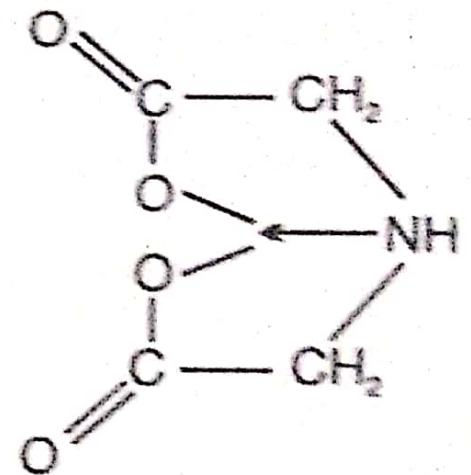
Ligands may also be classified *according as the number of coordination positions they occupy around the metal ion* (Table 10.1). A ligand having only one lone pair of electrons can only be bonded to a metal ion at just one stereochemical point, that is, it occupies one coordination position only. This is called a unidentate or a monodentate ligand. When the ligand can occupy two positions around the metal ion it is di(bi)dentate; with three, four, five or six such links the ligands are called tri (ter) dentate, tetra (quadri) dentate, pentadentate or hexa (sexa) dentate respectively. Some authors prefer to classify ligands *according to the number of donor atoms they can offer to metal ions*. Thus, when a ligand has two atoms which can *simultaneously* serve as donors it is called didentate and so on. It follows that a didentate ligand has to have two lone pairs, a tridentate three lone pairs and so on. The

**Table 10.1. : Some Monodentate and Polydentate Ligands**

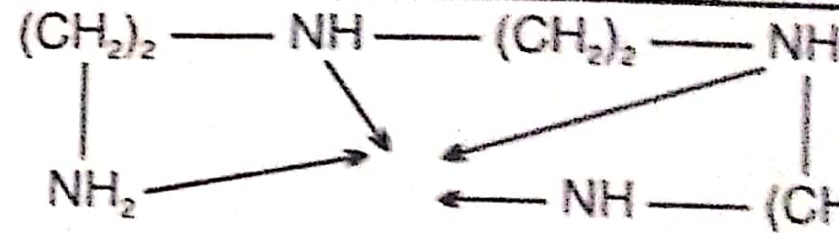
Ligand type	Name	Formula
Monodentate	Ammonia	
	Pyridine	
Didentate	Ethylenediamine (en)	
	Biguanide (Hbig)	

Tridentate

Iminodiacetate ion (ida)



Triethylenetetramine  
(trien)



Tetradentate

Pentadentate

ethylenediamine  
triacetic acid anion

