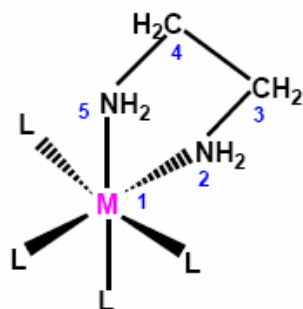


3.1.2 Chelating Ligands

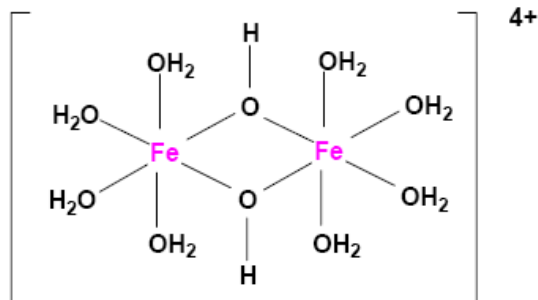
A **chelating ligand** has several donor atoms arranged in such a way that they can interact with one metal center. In the following example, the two nitrogen atoms of 1,2-diaminoethane (= ethylenediamine, abbreviation "n") are bound to the metal. Together with the metal the ligand forms a five membered chelate ring.



Complexes with chelating ligands are always more stable than those with an equivalent number of comparable monodentate ligands.

3.1.3 Bridging Ligands

A **bridging ligand** acts as a bridge between two or more metal centers. In di- μ -hydroxo-bis(tetraaquairon(III)), (it may also be called octoaqua-di- μ -hydroxo-diiron(III)) (see chemical formula below), two hydroxyls bridge the two irons. Bridging ligands are preceded by “ μ ” .



Important bridging ligands are: OH⁻, S²⁻, CO₃²⁻, PO₄³⁻, NH₂⁻.

3.1.4 Ambidentate Ligands

An ambidentate ligand has two donor atoms but their geometrical arrangement does not allow them to bind to the same metal, i.e. they cannot form a chelate ring. (*see Chap. 4*).

Examples: CN⁻, CO, SCN⁻, (CH₃)₂SO (dimethylsulfoxide = DMSO), HCON(CH₃)₂ (dimethylformamide = DMF)

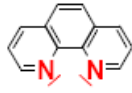
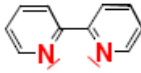
3.2 List of Ligands

Ligand atoms and non bonding electron pairs are printed in red.

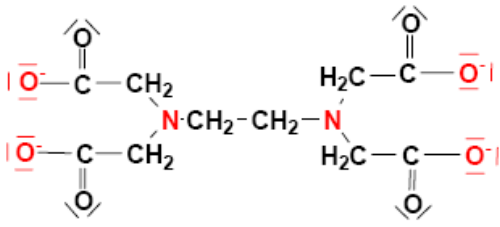
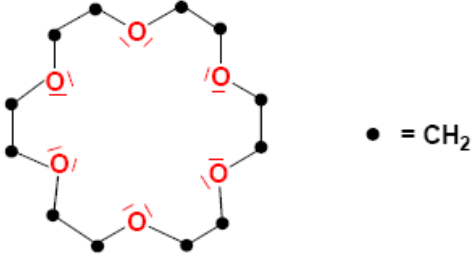
3.2.1 Examples of Monodentate Ligands

Anions	halogenides	$\overset{\cdot\cdot}{\text{I}}\text{E}^-$ $\overset{\cdot\cdot}{\text{I}}\text{Cl}^-$ $\overset{\cdot\cdot}{\text{I}}\text{Br}^-$ $\overset{\cdot\cdot}{\text{I}}\text{I}^-$
	cyanide	$\overset{\cdot\cdot}{\text{I}}\text{C}\equiv\text{N}^-$ $\overset{\cdot\cdot}{\text{I}}\text{C}\equiv\text{N}^-$
	rhodanide or thiocyanate	$\overset{\cdot\cdot}{\text{I}}\text{S}-\text{C}\equiv\text{N}^-$ $\overset{\cdot\cdot}{\text{I}}\text{S}-\text{C}\equiv\text{N}^-$
	hydroxide	$\text{H}-\overset{\cdot\cdot}{\text{O}}\text{I}^-$

3.2.2 Examples of Bidentate Ligands

forming a four-membered chelate ring	carboxylate	$\text{R-COO}^- = \left[\text{R-C} \begin{array}{l} \text{O}^- \\ \text{O}^- \end{array} \right]$
	carbonate	$\left[\begin{array}{c} \text{O}^- \\ \text{C} \\ \text{O}^- \end{array} \right]^{2-}$
	sulfate	$\left[\begin{array}{c} \text{O}^- \\ \text{S} \\ \text{O}^- \end{array} \right]^{2-}$
forming a five-membered chelate ring	glycinate	$\left[\text{H}_2\text{N}^-\text{CH}_2\text{C} \begin{array}{l} \text{O}^- \\ \text{O}^- \end{array} \right]^-$
	oxalate	$\left[\begin{array}{cc} \text{O}^- & \text{O}^- \\ \text{C} & - & \text{C} \\ \text{O}^- & \text{O}^- \end{array} \right]^{2-}$
	ethylenediamine ("en")	$\text{H}_2\text{N}^-\text{CH}_2\text{CH}_2\text{N}^-\text{H}_2$
	1,10-phenanthroline or o-phen or phen	
	2,2'-bipyridyl or bipy or bpy	

3.2.5 Examples of hexadentate Ligands

<p>ethylenediaminetetraacetate (= EDTA⁴⁻)</p>	
<p>18-crown-6</p>	 <p>● = CH₂</p>