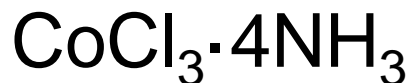
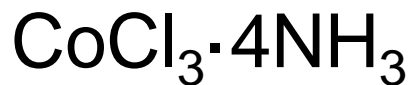
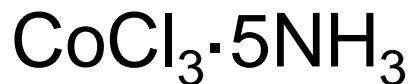
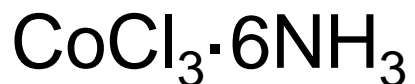




Alfred Werner 1866 – 1919  
Premio Nobel per la chimica 1913

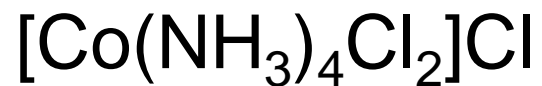
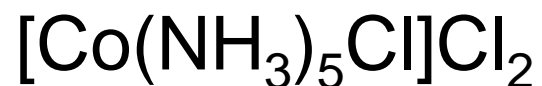
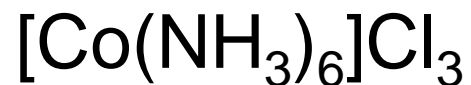


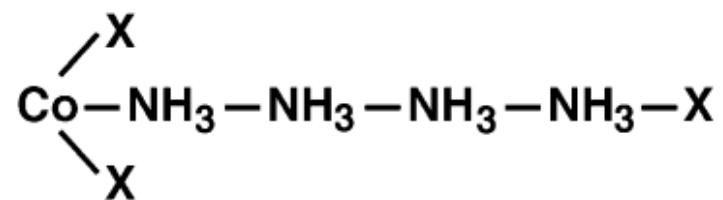
Giallo

Rosso-viola

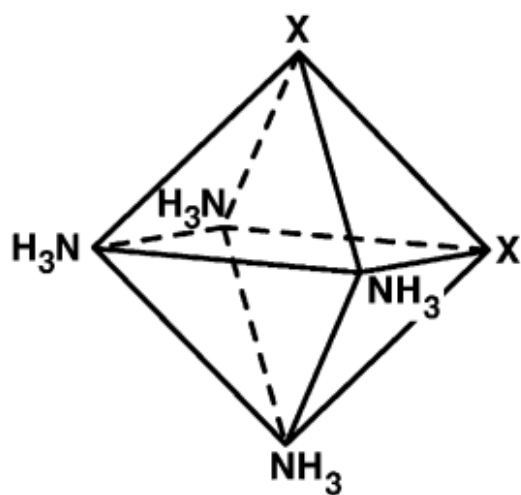
Verde

Violetto

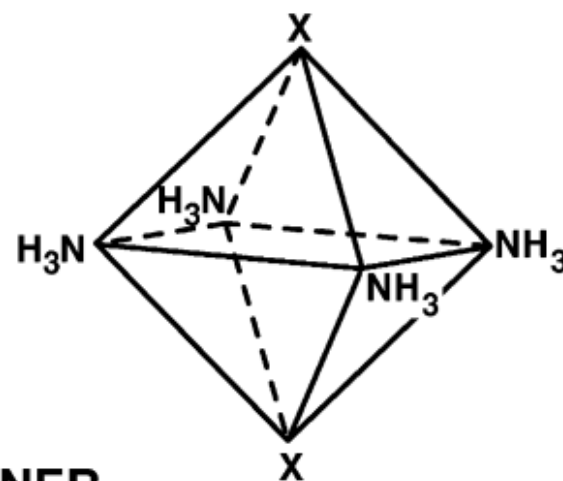


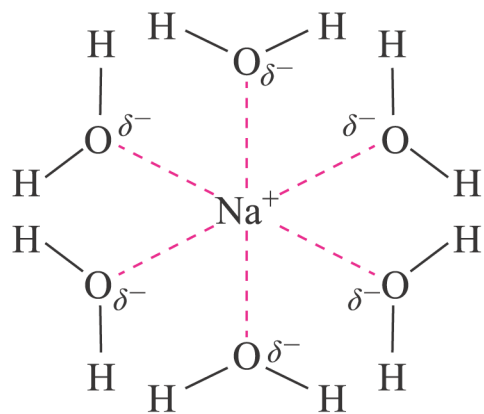


**JØRGENSEN**

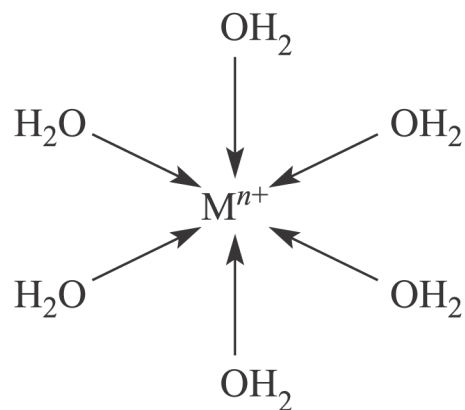
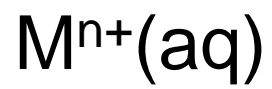


**WERNER**

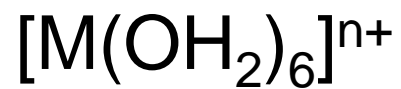




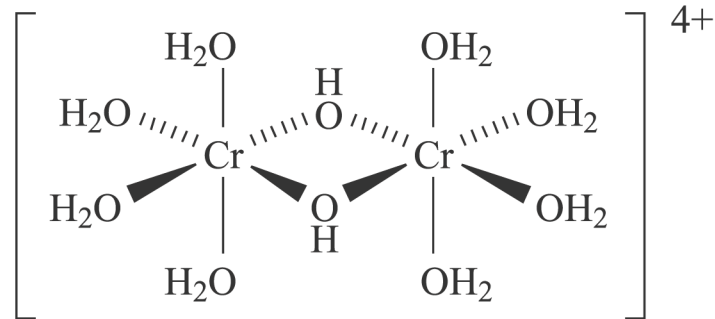
(a)



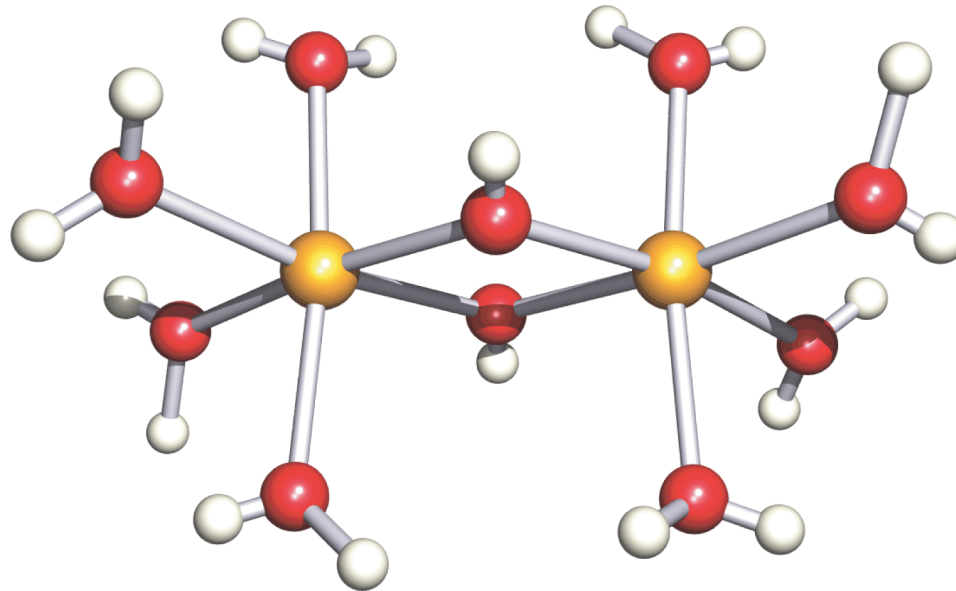
(b)



$$\text{p}K_a [\text{Fe}(\text{OH}_2)_6]^{3+}(\text{aq}) = 2.0$$
$$\text{p}K_a [\text{Fe}(\text{OH}_2)_5(\text{OH})]^{2+}(\text{aq}) = 3.3$$

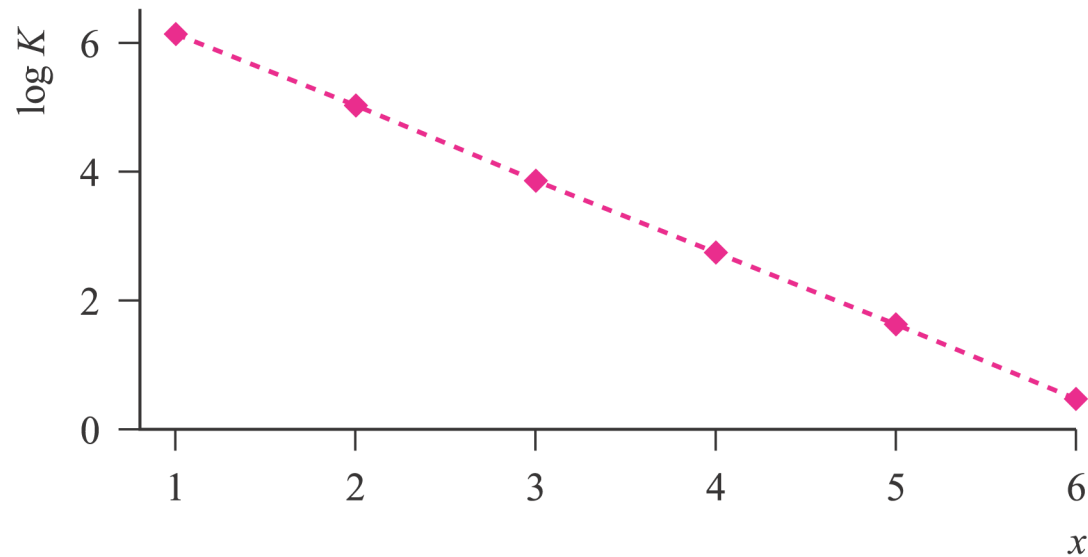


(a)

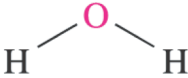
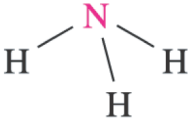

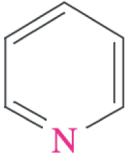



(b)

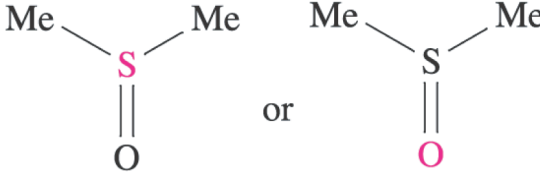

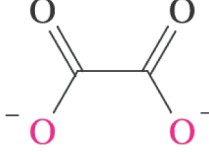
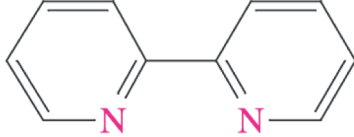
# Costanti di stabilità parziali per la formazione di $[M(OH_2)_{6-x}L_x]^{n+}$

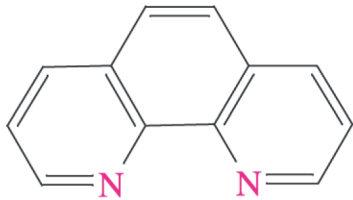




$$\beta = K_1 \times K_2 \times K_3 \times K_4 \times K_5 \times K_6$$

Name of ligand	Abbreviation (if any)	Denticity	Structure with donor atoms marked in red
Water		Monodentate	
Ammonia		Monodentate	
Tetrahydrofuran	THF	Monodentate	
Pyridine	py	Monodentate	
1,2-Ethanediamine <sup>†</sup>	en	Bidentate	

<sup>†</sup> The older names (still in use) for 1,2-ethanediamine, 1,4,7-triazaheptane and 1,4,7,10-tetraazadecane are ethylenediamine, diethylenetriamine and triethylenetetramine.

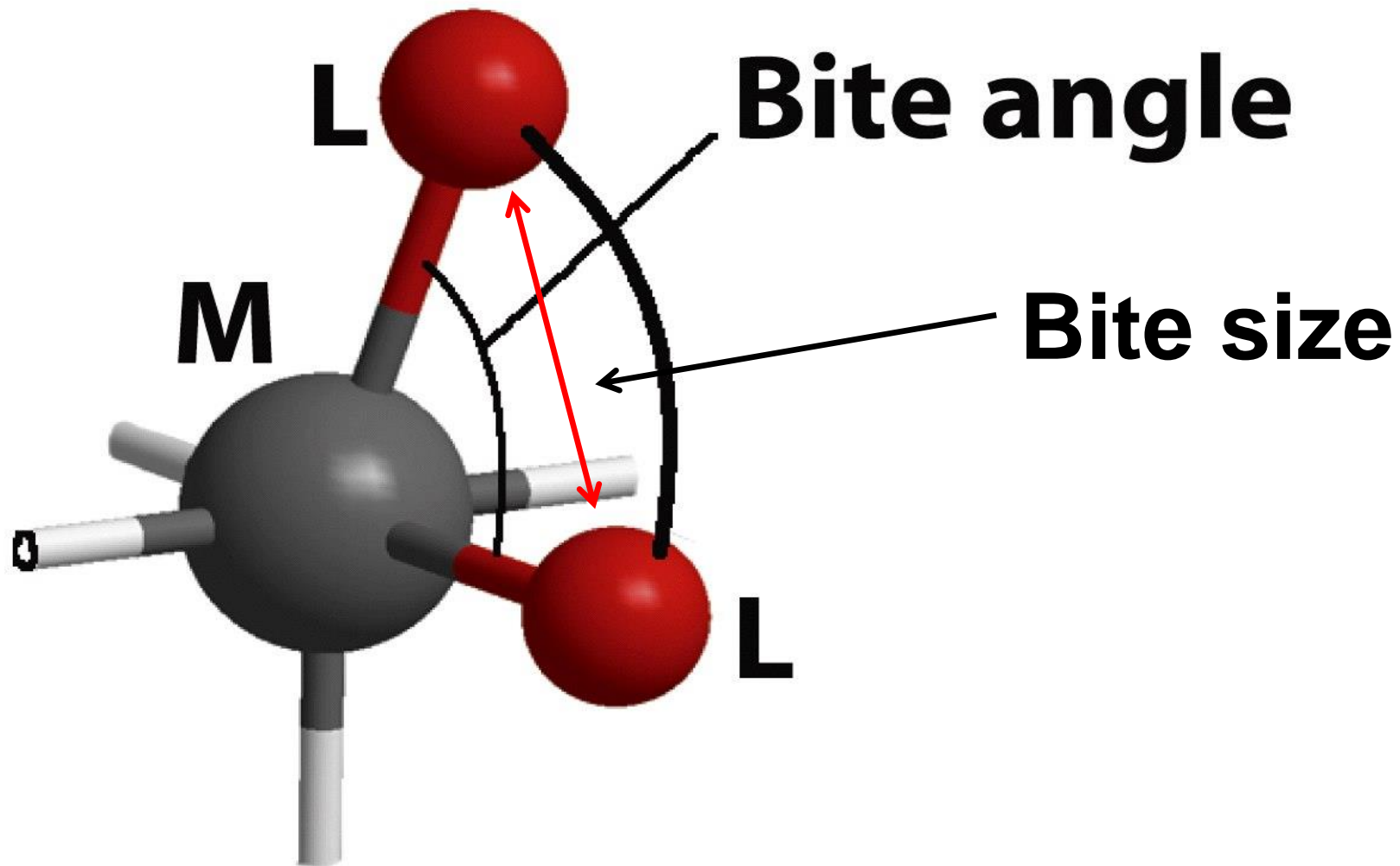
Name of ligand	Abbreviation (if any)	Denticity	Structure with donor atoms marked in red
Dimethylsulfoxide	DMSO	Monodentate	
Acetylacetonate ion	[acac] <sup>-</sup>	Bidentate	
Oxalate or ethanedioate ion	[ox] <sup>2-</sup>	Bidentate	
2,2'-Bipyridine	bpy or bipy	Bidentate	

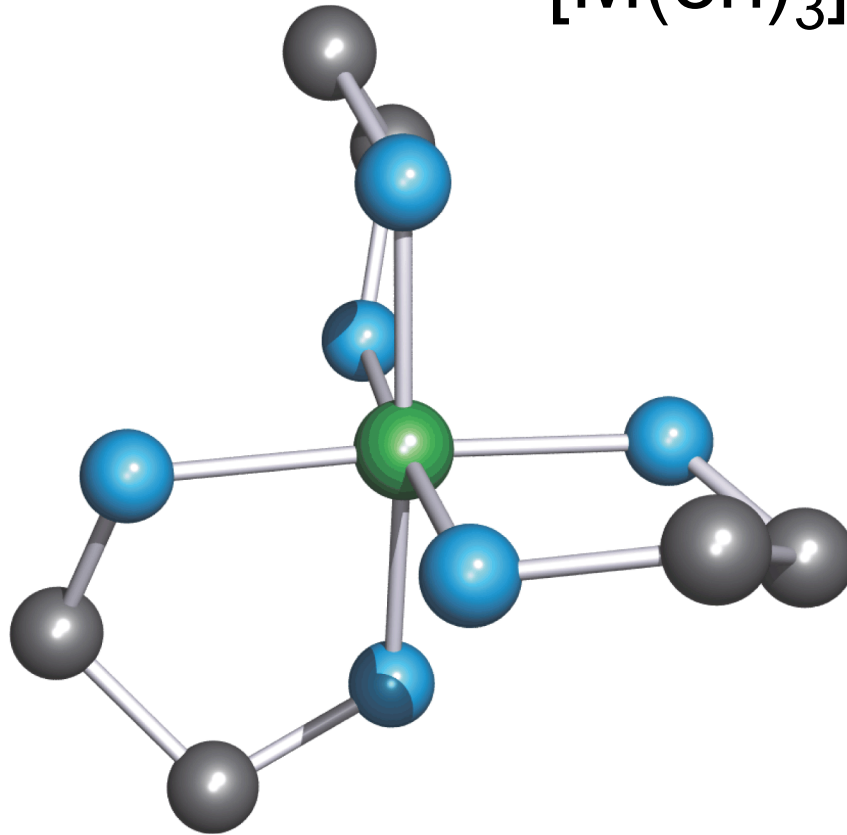
Name of ligand	Abbreviation (if any)	Denticity	Structure with donor atoms marked in red
1,10-Phenanthroline	phen	Bidentate	
1,4,7-Triazaheptane <sup>†</sup>	dien	Tridentate	
1,4,7,10-Tetraazadecane <sup>†</sup>	trien	Tetradentate	
<i>N,N,N',N'</i> -Ethylenediaminetetraacetate ion <sup>‡</sup>	[EDTA] <sup>4-</sup>	Hexadentate	See equation 7.75

<sup>†</sup> The older names (still in use) for 1,2-ethanediamine, 1,4,7-triazaheptane and 1,4,7,10-tetraazadecane are ethylenediamine, diethylenetriamine and triethylenetetramine.

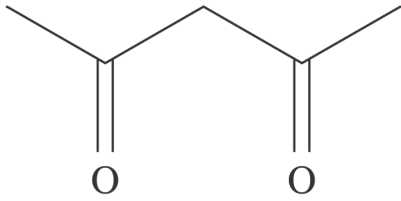
<sup>‡</sup> Although not systematic by the IUPAC rules, this is the commonly accepted name for this anion.



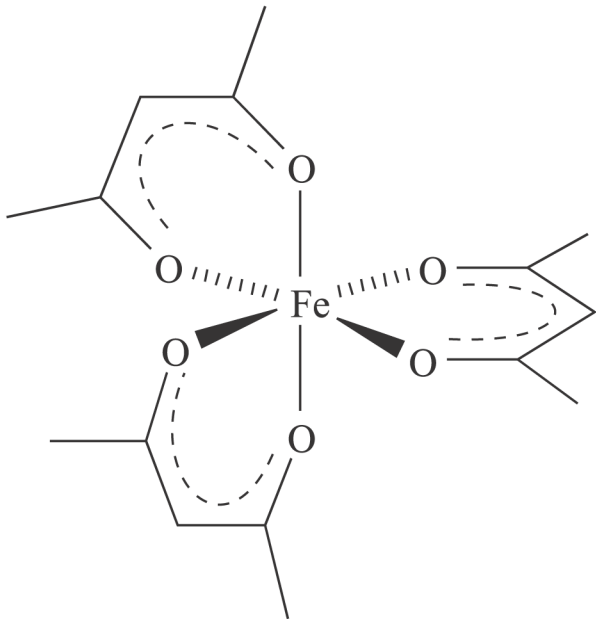




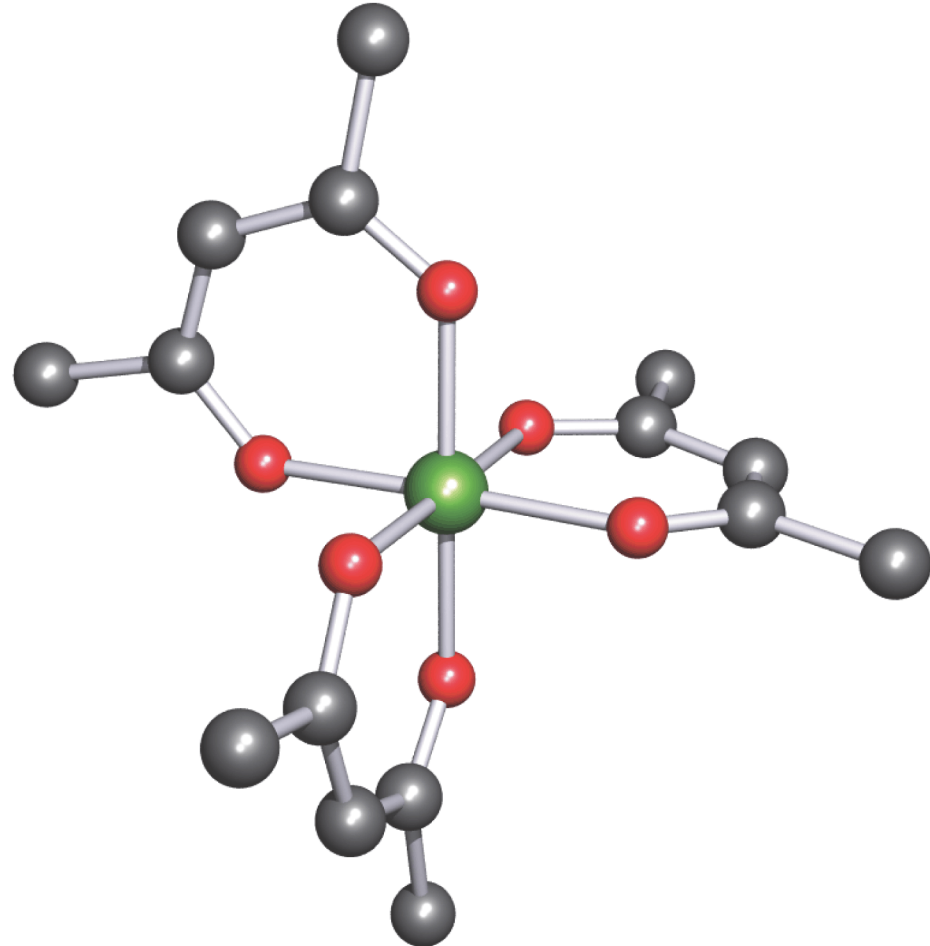
Anelli chelati a 5 termini



(a)



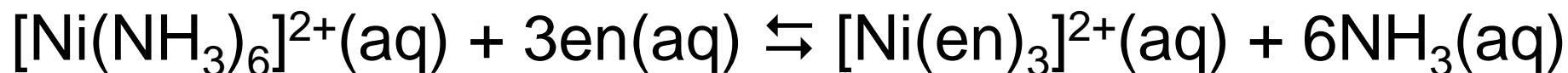
(b)



(c)

Anelli chelati a 6 termini

# Effetto chelante



$$\log K = 9.27$$

$$\Delta G^\circ = -52.9 \text{ kJ mol}^{-1}$$

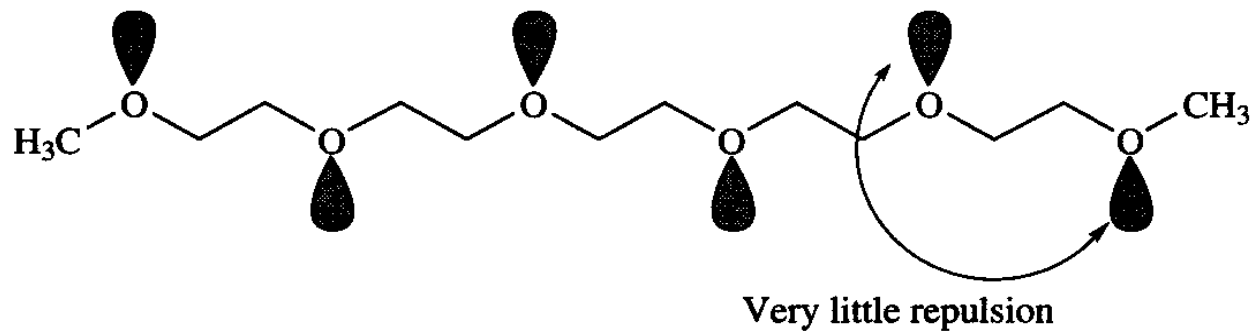
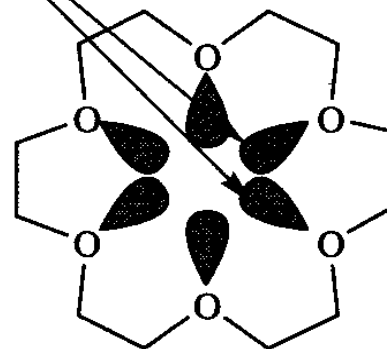
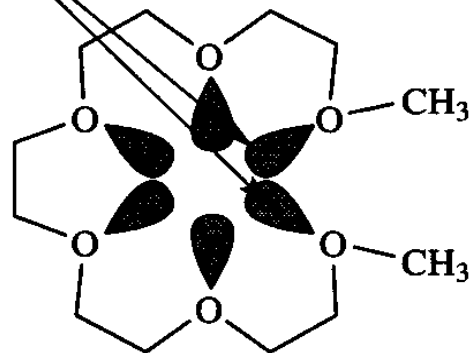
$$\Delta H^\circ = -16.8 \text{ kJ mol}^{-1}$$

$$\Delta S^\circ = +121 \text{ J K}^{-1} \text{ mol}^{-1}$$

$$T\Delta S^\circ = +31.6 \text{ kJ mol}^{-1}$$

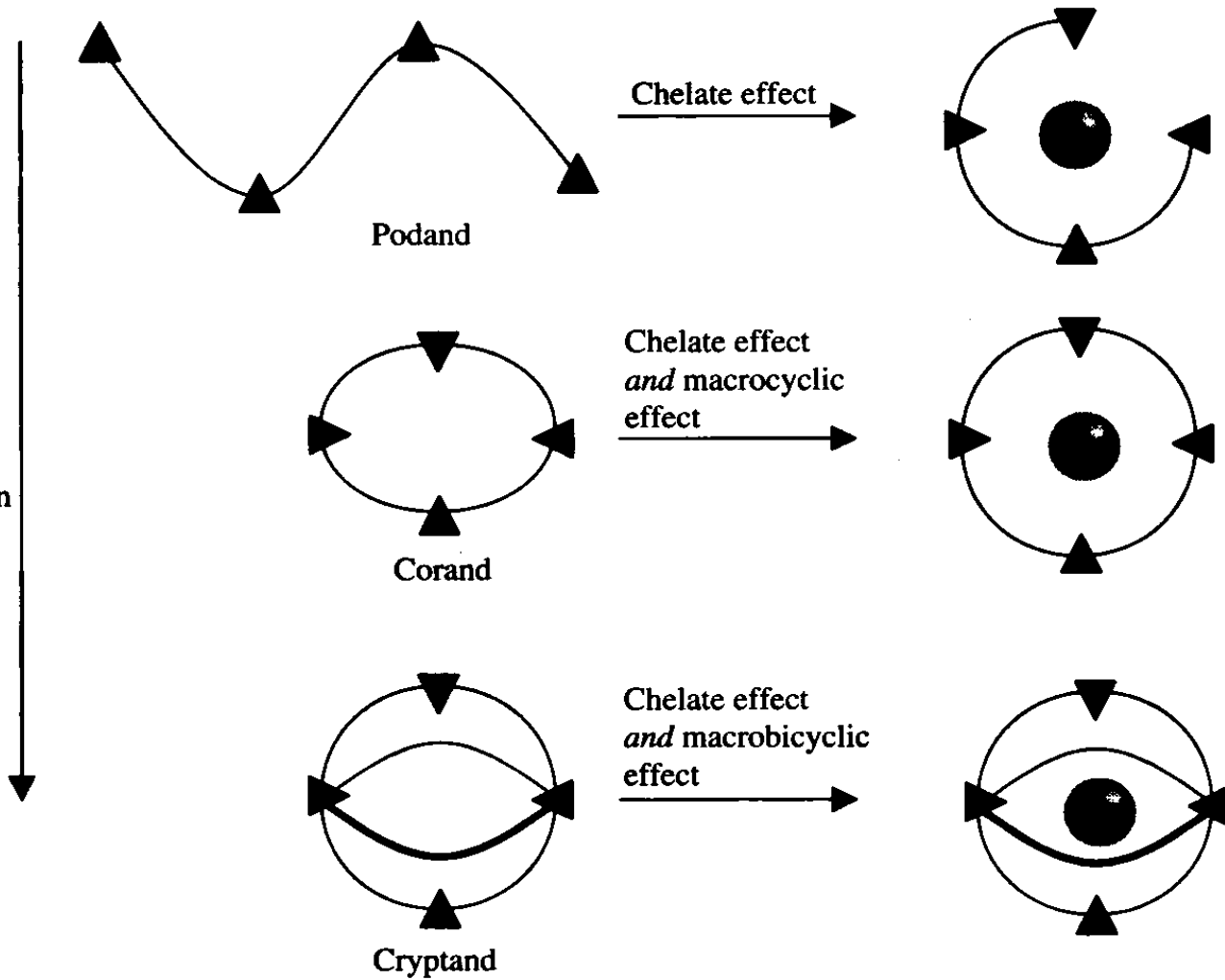
# Effetto macrociclo

Lone pair–lone pair repulsive interaction



podando

Increasing  
degree  
of host  
organisation



	Metal ion	log $K_1$			
		X = F	X = Cl	X = Br	X = I
<b>a</b>	Fe <sup>3+</sup> (aq)	6.0	1.4	0.5	–
<b>b</b>	Hg <sup>2+</sup> (aq)	1.0	6.7	8.9	12.9

F > O > N > Cl > Br > C ≈ I ≈ S > Se > P > As > Sb

*elettronegatività*



*Hard*

*Soft*

F > Cl > Br > I

O » S > Se > Te

N » P > As > Sb

HSAB principle  
(Pearson)

F < Cl < Br < I

O « S > Se ≈ Te

N « P > As > Sb

# HSAB Principle

## Metal centres (Lewis acids)

Hard; class (a)	$\text{Li}^+$ , $\text{Na}^+$ , $\text{K}^+$ , $\text{Rb}^+$ , $\text{Be}^{2+}$ , $\text{Mg}^{2+}$ , $\text{Ca}^{2+}$ , $\text{Sr}^{2+}$ , $\text{Sn}^{2+}$ , $\text{Mn}^{2+}$ , $\text{Zn}^{2+}$ , $\text{Al}^{3+}$ , $\text{Ga}^{3+}$ , $\text{In}^{3+}$ , $\text{Sc}^{3+}$ , $\text{Cr}^{3+}$ , $\text{Fe}^{3+}$ , $\text{Co}^{3+}$ , $\text{Y}^{3+}$ , $\text{Th}^{4+}$ , $\text{Pu}^{4+}$ , $\text{Ti}^{4+}$ , $\text{Zr}^{4+}$ , $[\text{VO}]^{2+}$ , $[\text{VO}_2]^+$
Soft; class (b)	Zero oxidation state metal centres, $\text{Tl}^+$ , $\text{Cu}^+$ , $\text{Ag}^+$ , $\text{Au}^+$ , $[\text{Hg}_2]^{2+}$ , $\text{Hg}^{2+}$ , $\text{Cd}^{2+}$ , $\text{Pd}^{2+}$ , $\text{Pt}^{2+}$ , $\text{Tl}^{3+}$
Intermediate	$\text{Pb}^{2+}$ , $\text{Fe}^{2+}$ , $\text{Co}^{2+}$ , $\text{Ni}^{2+}$ , $\text{Cu}^{2+}$ , $\text{Os}^{2+}$ , $\text{Ru}^{3+}$ , $\text{Rh}^{3+}$ , $\text{Ir}^{3+}$

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# HSAB Principle

## Ligands (Lewis bases)

Hard; class (a)	$F^-$ , $Cl^-$ , $H_2O$ , $ROH$ , $R_2O$ , $[OH]^-$ , $[RO]^-$ , $[RCO_2]^-$ , $[CO_3]^{2-}$ , $[NO_3]^-$ , $[PO_4]^{3-}$ , $[SO_4]^{2-}$ , $[ClO_4]^-$ , $[ox]^{2-}$ , $NH_3$ , $RNH_2$
Soft; class (b)	$I^-$ , $H^-$ , $R^-$ , $[CN]^-$ ( <i>C</i> -bound), $CO$ ( <i>C</i> -bound), $RNC$ , $RSH$ , $R_2S$ , $[RS]^-$ , $[SCN]^-$ ( <i>S</i> -bound), $R_3P$ , $R_3As$ , $R_3Sb$ , alkenes, arenes
Intermediate	$Br^-$ , $[N_3]^-$ , $py$ , $[SCN]^-$ ( <i>N</i> -bound), $ArNH_2$ , $[NO_2]^-$ , $[SO_3]^{2-}$

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