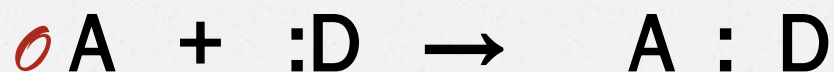


# Donador aceptor

Jesús Gracia Mora

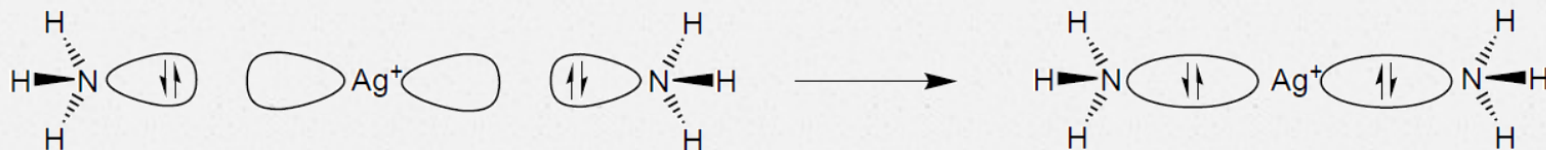
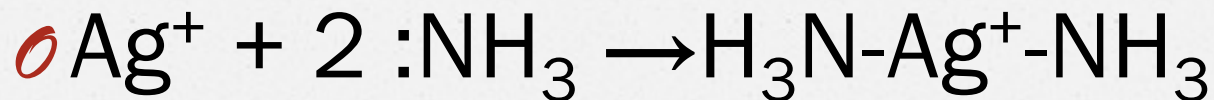
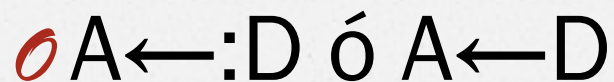
# La clave está en.....



o Base de Lewis más ácido de Lewis

o Es decir donador de pares  
electrónicos más aceptor de pares  
electrónicos

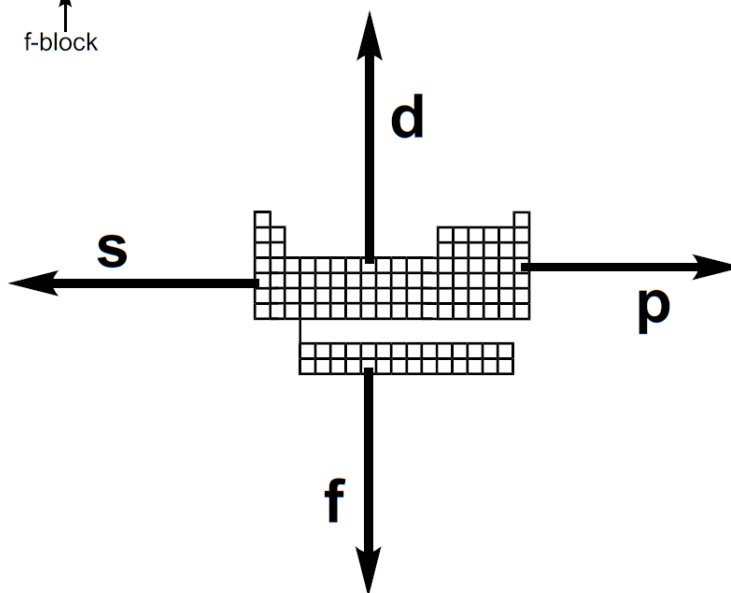
También la podemos escribir.



# ¿Quién es el aceptor?

21 Sc scandium	22 Ti titanium	23 V vanadium	24 Cr chromium	25 Mn manganese	26 Fe iron	27 Co cobalt	28 Ni nickel	29 Cu copper	30 Zn zinc
39 Y ytterbium	40 Zr zirconium	41 Nb niobium	42 Mo molybdenum	43 Tc technetium	44 Ru ruthenium	45 Rh rhodium	46 Pd palladium	47 Ag silver	48 Cd cadmium
57 La lanthanum	72 Hf hafnium	73 Ta tantalum	74 W tungsten	75 Re rhenium	76 Os osmium	77 Ir iridium	78 Pt platinum	79 Au gold	80 Hg mercury
89 Ac actinium	104 Rf rutherfordium	105 Db dubnium	106 Sg seaborgium	107 Bh bohrium	108 Hs hassium	109 Mt meitnerium	110 Ds darmstadtium	111 Rg roentgenium	112 Uub ununbium

1 H hydrogen	
3 Li lithium	4 Be beryllium
11 Na sodium	12 Mg magnesium
19 K potassium	20 Ca calcium
37 Rb rubidium	38 Sr strontium
55 Cs caesium	56 Ba barium
87 Fr francium	88 Ra radium



					2 He helium
5 B boron	6 C carbon	7 N nitrogen	8 O oxygen	9 F fluorine	10 Ne neon
13 Al aluminium	14 Si silicon	15 P phosphorus	16 S sulphur	17 Cl chlorine	18 Ar argon
31 Ga gallium	32 Ge germanium	33 As arsenic	34 Se selenium	35 Br bromine	36 Kr krypton
49 In indium	50 Sn tin	51 Sb antimony	52 Te tellurium	53 I iodine	54 Xe xenon
81 Tl thallium	82 Pb lead	83 Bi bismuth	84 Po polonium	85 At astatine	86 Rn radon
113 -- --	114 -- --	115 -- --	116 -- --	117 -- --	118 -- --

58 Ce cerium	59 Pr praseodymium	60 Nd neodymium	61 Pm promethium	62 Sm samarium	63 Eu europium	64 Gd gadolinium	65 Tb terbium	66 Dy dysprosium	67 Ho holmium	68 Er erbium	69 Tm thulium	70 Yb ytterbium	71 Lu lutetium
90 Th thorium	91 Pa protactinium	92 U uranium	93 Np neptunium	94 Pu plutonium	95 Am americium	96 Cm curium	97 Bk berkellium	98 Cf californium	99 Es einsteinium	100 Fm fermium	101 Md mendelevium	102 No nobellium	103 Lr lawrencium

# El átomo central

Sc	Ti	V	Cr	Mn	Fe	Co	Ni	Cu	Zn
scandium	titanium	vanadium	chromium	manganese	iron	cobalt	nickel	copper	zinc
		<b>0</b> d <sup>5</sup>	<b>0</b> d <sup>6</sup>	<b>0</b> d <sup>7</sup>	<b>0</b> d <sup>8</sup>	<b>0</b> d <sup>9</sup>	<b>0</b> d <sup>10</sup>		
		<b>1</b> d <sup>4</sup>	<b>1</b> d <sup>5</sup>	<b>1</b> d <sup>6</sup>	<b>1</b> d <sup>7</sup>	<b>1</b> d <sup>8</sup>	<b>1</b> d <sup>9</sup>	<b>1</b> d <sup>10</sup>	
	<b>2</b> d <sup>2</sup>	<b>2</b> d <sup>3</sup>	<b>2</b> d <sup>4</sup>	<b>2</b> d <sup>5</sup>	<b>2</b> d <sup>6</sup>	<b>2</b> d <sup>7</sup>	<b>2</b> d <sup>8</sup>	<b>2</b> d <sup>9</sup>	<b>2</b> d <sup>10</sup>
<b>3</b> d <sup>0</sup>	<b>3</b> d <sup>1</sup>	<b>3</b> d <sup>2</sup>	<b>3</b> d <sup>3</sup>	<b>3</b> d <sup>4</sup>	<b>3</b> d <sup>5</sup>	<b>3</b> d <sup>6</sup>	<b>3</b> d <sup>7</sup>	<b>3</b> d <sup>8</sup>	
	<b>4</b> d <sup>0</sup>	<b>4</b> d <sup>1</sup>	<b>4</b> d <sup>2</sup>	<b>4</b> d <sup>3</sup>	<b>4</b> d <sup>4</sup>	<b>4</b> d <sup>5</sup>	<b>4</b> d <sup>6</sup>		
		<b>5</b> d <sup>0</sup>	<b>5</b> d <sup>1</sup>	<b>5</b> d <sup>2</sup>	<b>5</b> d <sup>3</sup>	<b>5</b> d <sup>4</sup>			
			<b>6</b> d <sup>0</sup>	<b>6</b> d <sup>1</sup>	<b>6</b> d <sup>2</sup>				
				<b>7</b> d <sup>0</sup>					

# La abundancia

Metal	Earth's crust	Oceans	Plants (ryegrass)	Animals (human blood)
Na	23 000	10 500	1 000	2 000
K	21 000	1 620	28 000	1 600
Mg	23 000	1 200	2 500	40
Ca	41 000	390	12 500	60
Al	82 000	0.000 5	50	0.3
Sc	16	0.000 000 6	>0.01	0.008
Ti	5 600	0.000 48	2.0	0.055
V	160	0.001	0.07	<0.000 2
Cr	100	0.000 18	0.8	0.008
Mn	950	0.000 11	130	0.005
Fe	41 000	0.000 1	240	450
Co	20	0.000 001	0.6	0.01
Ni	80	0.000 1	6.5	0.03
Cu	50	0.000 08	9.0	1.0
Zn	75	0.000 05	31	7.0
Mo	1.5	0.01	1.1	0.001
Cd	0.11	0.000 001 1	0.07	0.0052
Pb	14	0.000 02	2.0	0.21
Sn	2.2	0.000 002 3	<0.01	0.38
Ce	68	0.000 002	<0.01	<0.001

# Recapitulando algunos conceptos

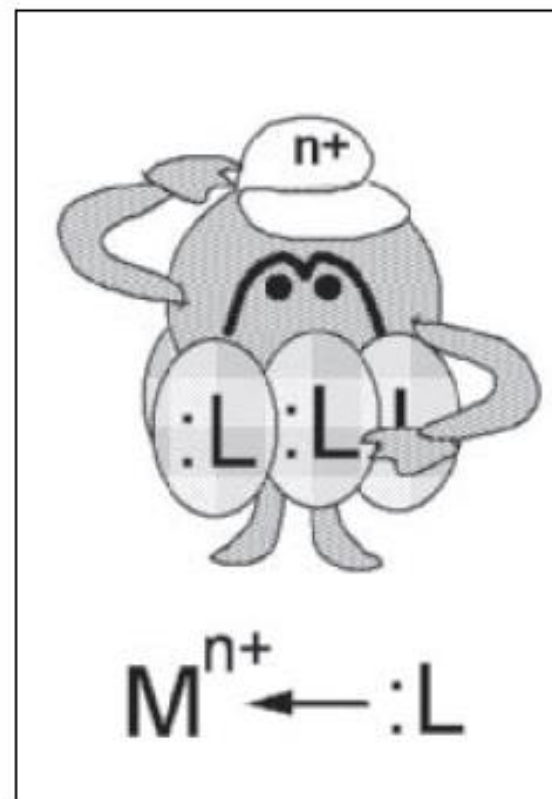
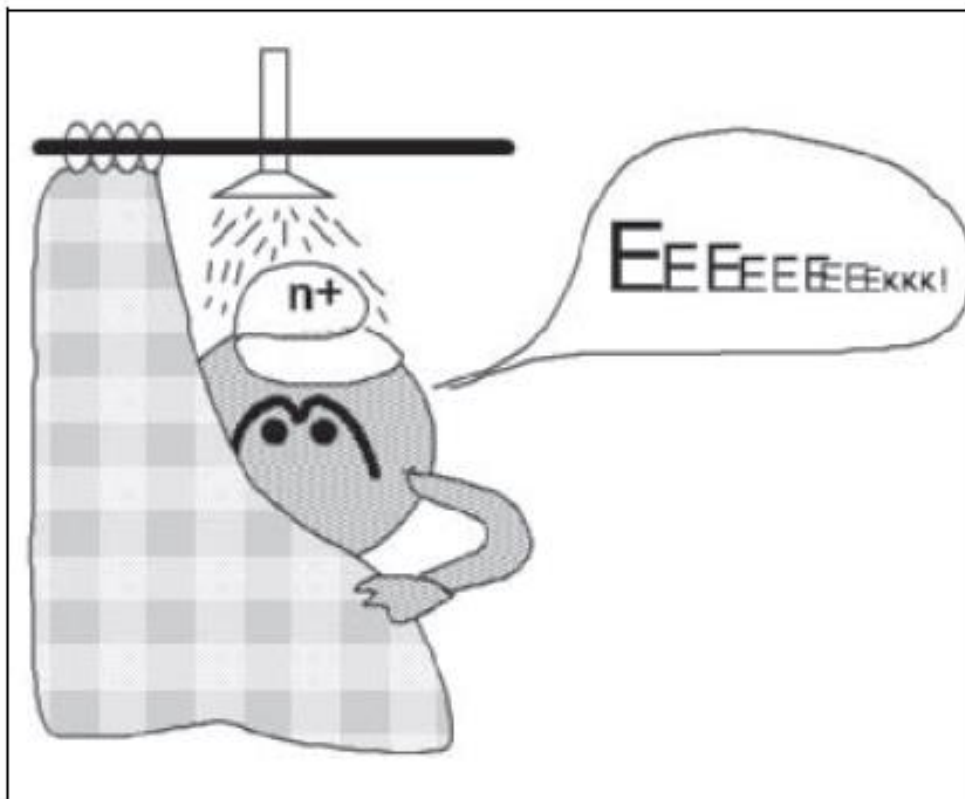
- o Un compuesto de coordinación consiste de un átomo central, usualmente un ion metálico enlazado a un grupo de ligantes a través de enlaces de coordinación
- o Un enlace covalente coordinado se caracteriza porque un ligante con un átomo que dona un par de electrones (par libre) a un orbital vacío de un átomo central, ácido de Lewis (aceptor de pares electrónicos)

# Recapitulando algunos conceptos

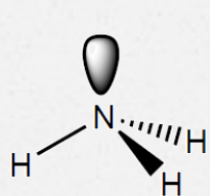
- o Los iones metálicos pueden existir y formar complejos con diferentes estados de oxidación; esto es usual principalmente en los elementos del bloque «d».
- o Los metales de la primera serie de transición de bloque «d» muestran estados de oxidación II y III de forma más común. Los estados de oxidación mayores suelen ser más comunes en elementos más pesados.



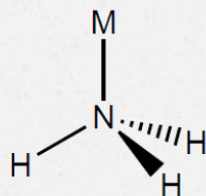
Es muy difícil encontrar a un ion metálico «desnudo»



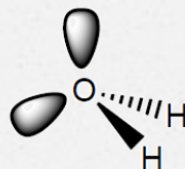
# Algunos ligantes comunes y simples



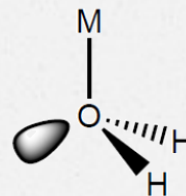
free



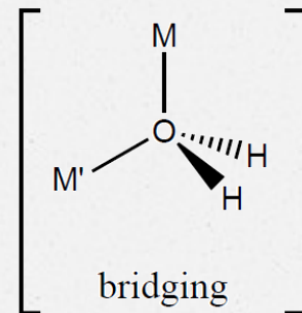
coordinated



free



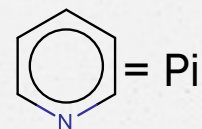
coordinated



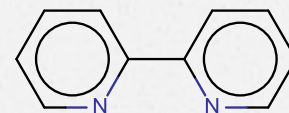
bridging

# Algunos ligantes comunes y simples

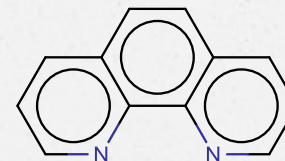
Ligando	Nombre	Tipo
$F^-$	fluoro	Aniónico
$Cl^-$	cloro	Aniónico
$Br^-$	bromo	Aniónico
$I^-$	yodo	Aniónico
$O_2^-$	oxo	Aniónico
$OH^-$	hidroxo	Aniónico
$O_2^{2-}$	peroxo	Aniónico
$HS^-$	mercapto	Aniónico
$S_2^-$	tio	Aniónico
$H_2O$	Aqua	Neutro
$NH_3$	Ammina	Neutro
$NO$	Nitrosilo	Neutro
$CO$	Cabonilo	Neutro



Piridina



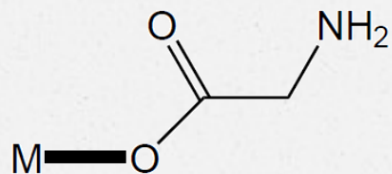
2, 2' bipyridina= bipi



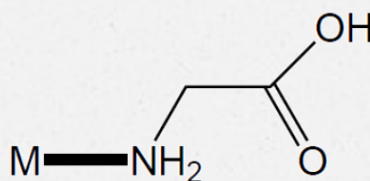
1, 10-fenantrolina

# Los ligantes

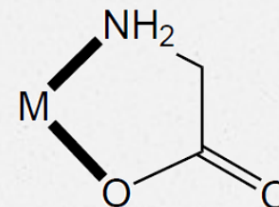
$R_3N$	$R_2O$	$F^-$
$R_3P$	$R_2S$	$Cl^-$
$R_3As$	$R_2Se$	$Br^-$
$R_3Sb$	$R_2Te$	$I^-$



*O*-monodentate

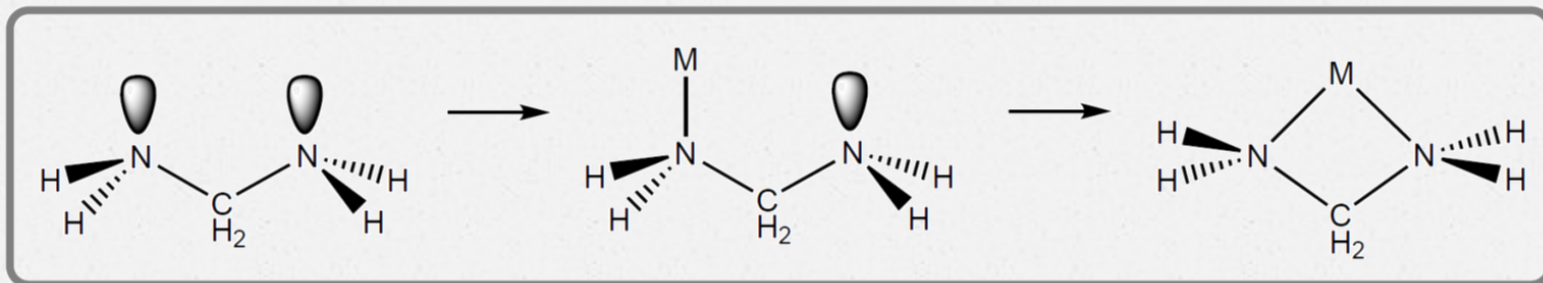


*N*-monodentate

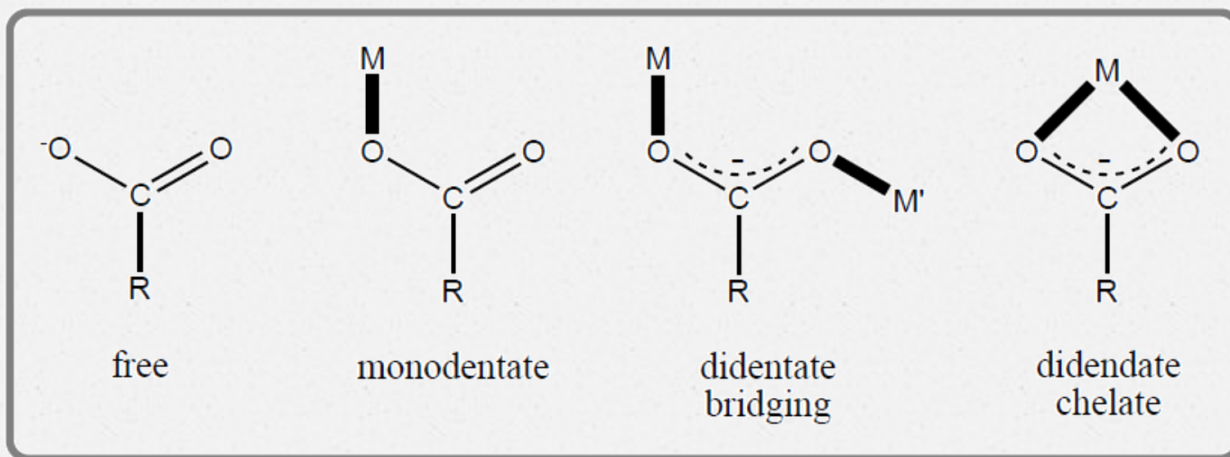


*N,O*-didentate

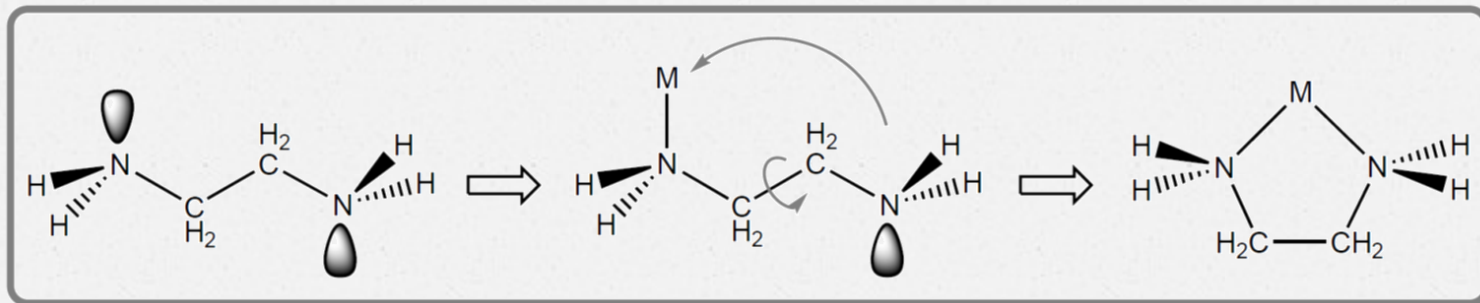
# Algunos ligandos comunes y simples



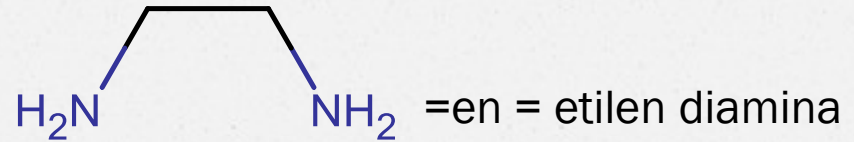
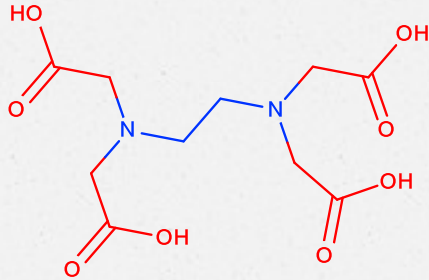
## Los carboxilatos



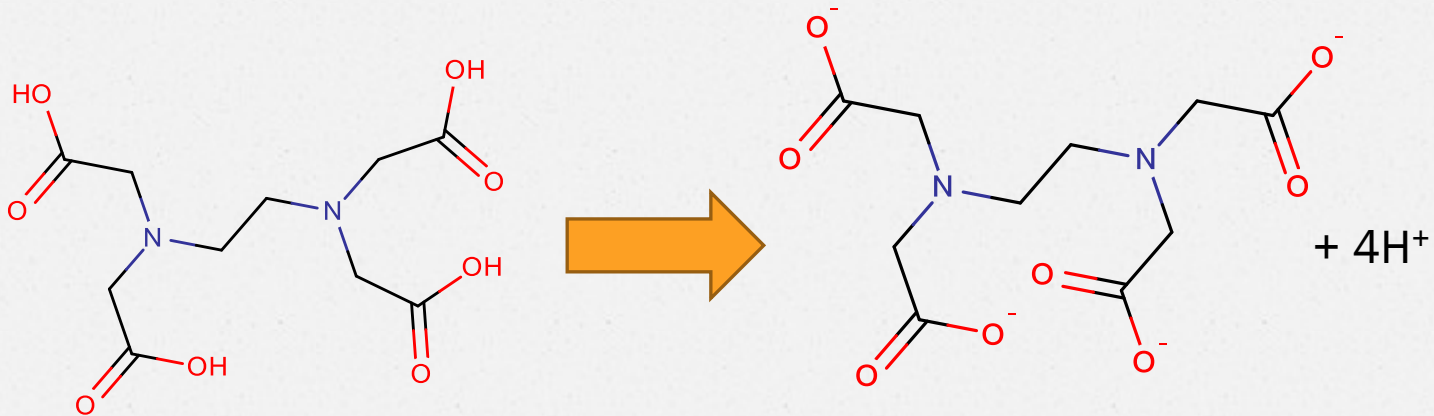
# Bidentados; caso de la etilendiamina



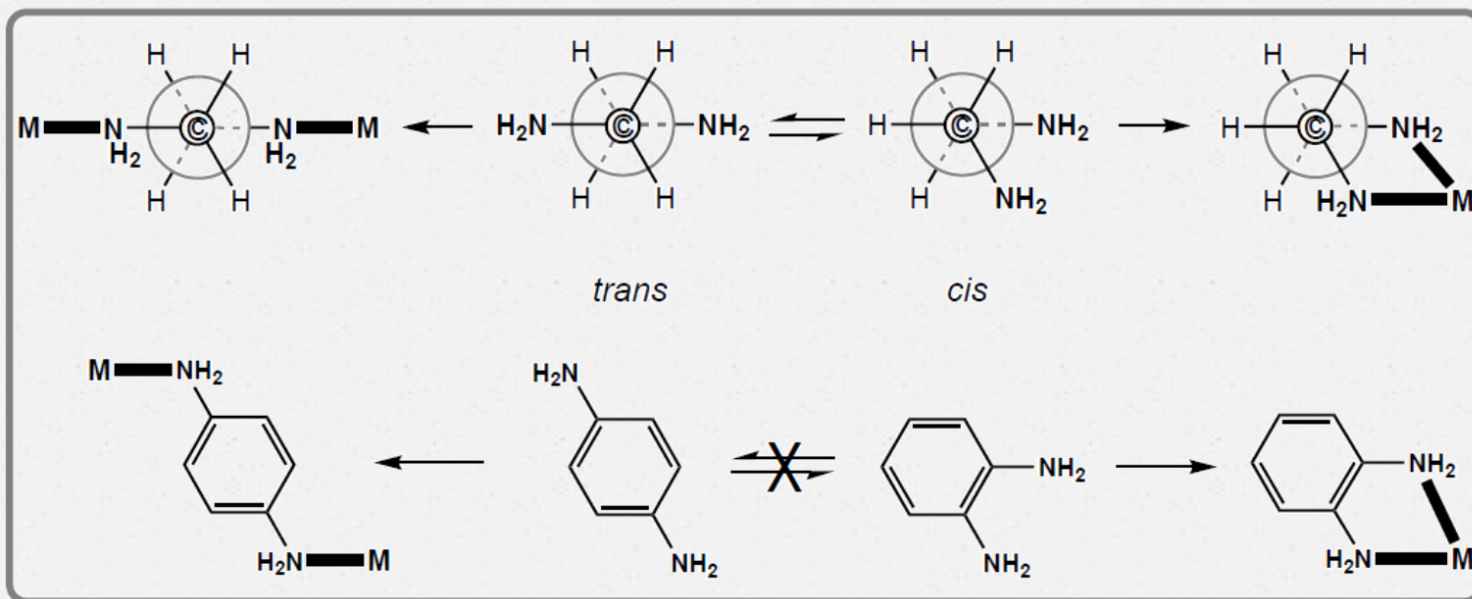
# Muy Comunes



EDTA= ácido etilen diamin tetraacético

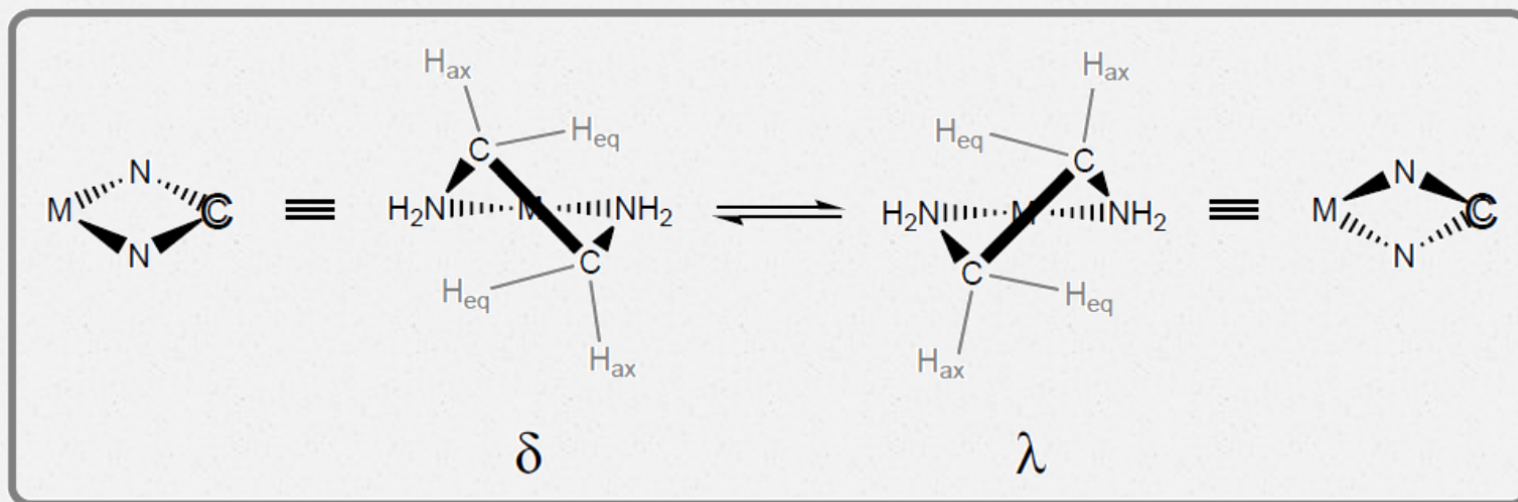


# La orientación es importante



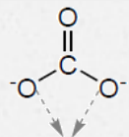


# La formación de anillos



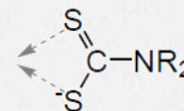
# Algunos bidentados comunes

carbonato



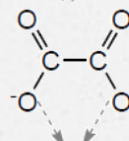
$\text{CO}_3^{2-}$

dialkylcarbamo-dithioato  
(or dithiocarbamato)



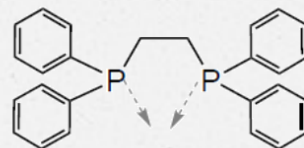
dtc<sup>-</sup>

oxalato



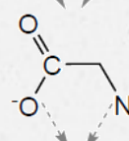
ox<sup>2-</sup>

1,2-ethanediy-l-  
bis(diphenylphosphane)



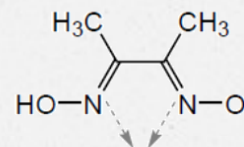
dppe

glycinato



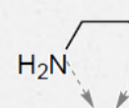
gly<sup>-</sup>

dimethylglyoximato



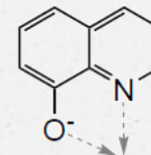
dmg<sup>-</sup>

ethane-1,2-diamine



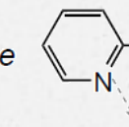
en

8-hydroxyquinolinato



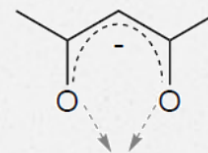
oxinate

2-aminomethylpyridine



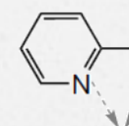
ampy

2,4-dioxopentane-3-ido  
(or acetylacetonato)



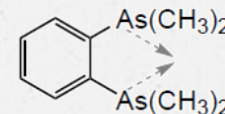
acac

2,2'-bipyridine



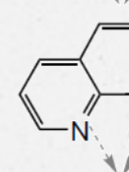
bpy

1,2-phenylene-  
bis(dimethylarsine)



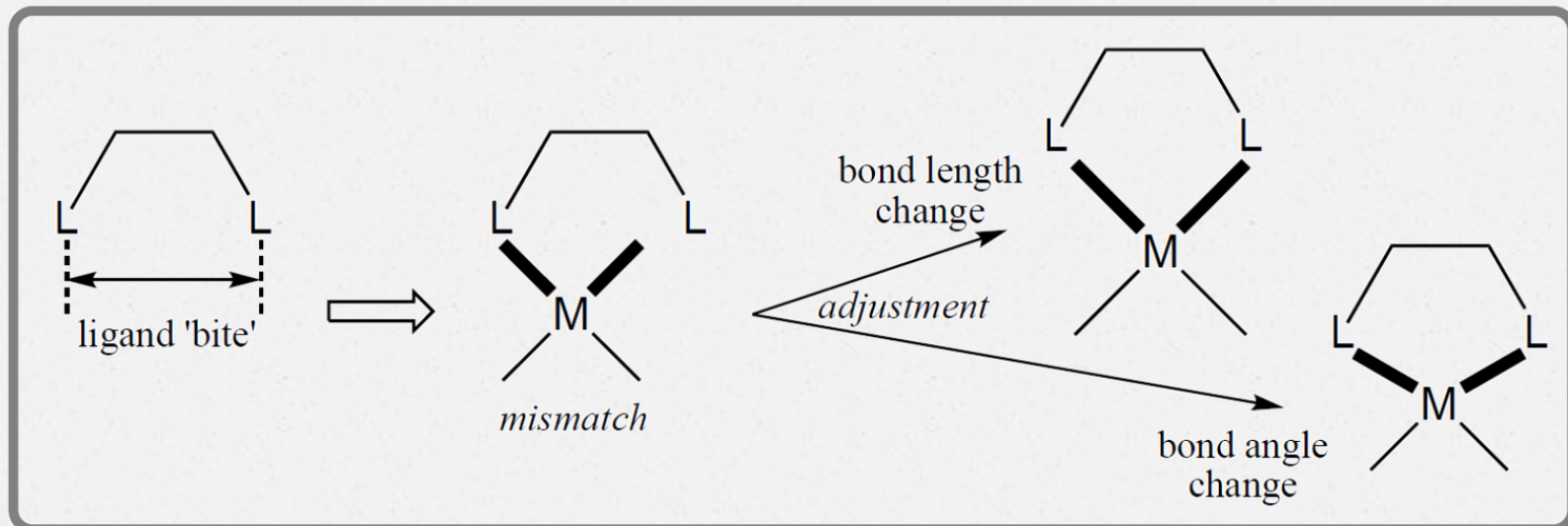
diars

1,10-phenanthroline



phen

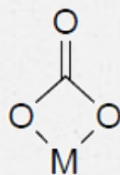
Para que un ligante bidentado actúe como tal se deben de cumplir algunos requisitos



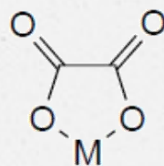
# Si se cambia la longitud de la cadena



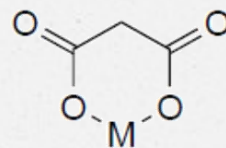
dioxygen



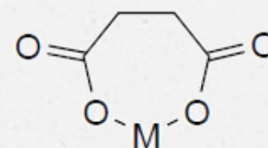
carbonate



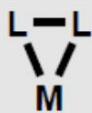
oxalate



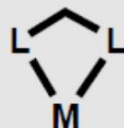
malonate



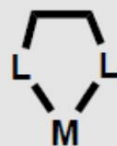
succinate



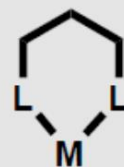
3



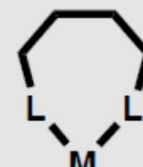
4



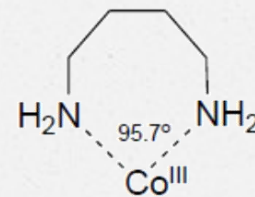
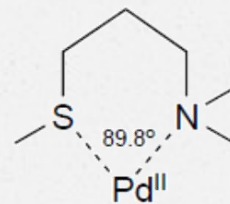
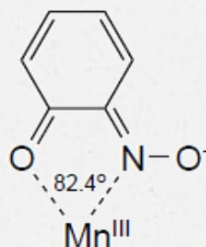
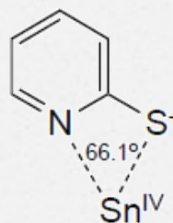
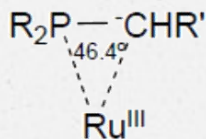
5



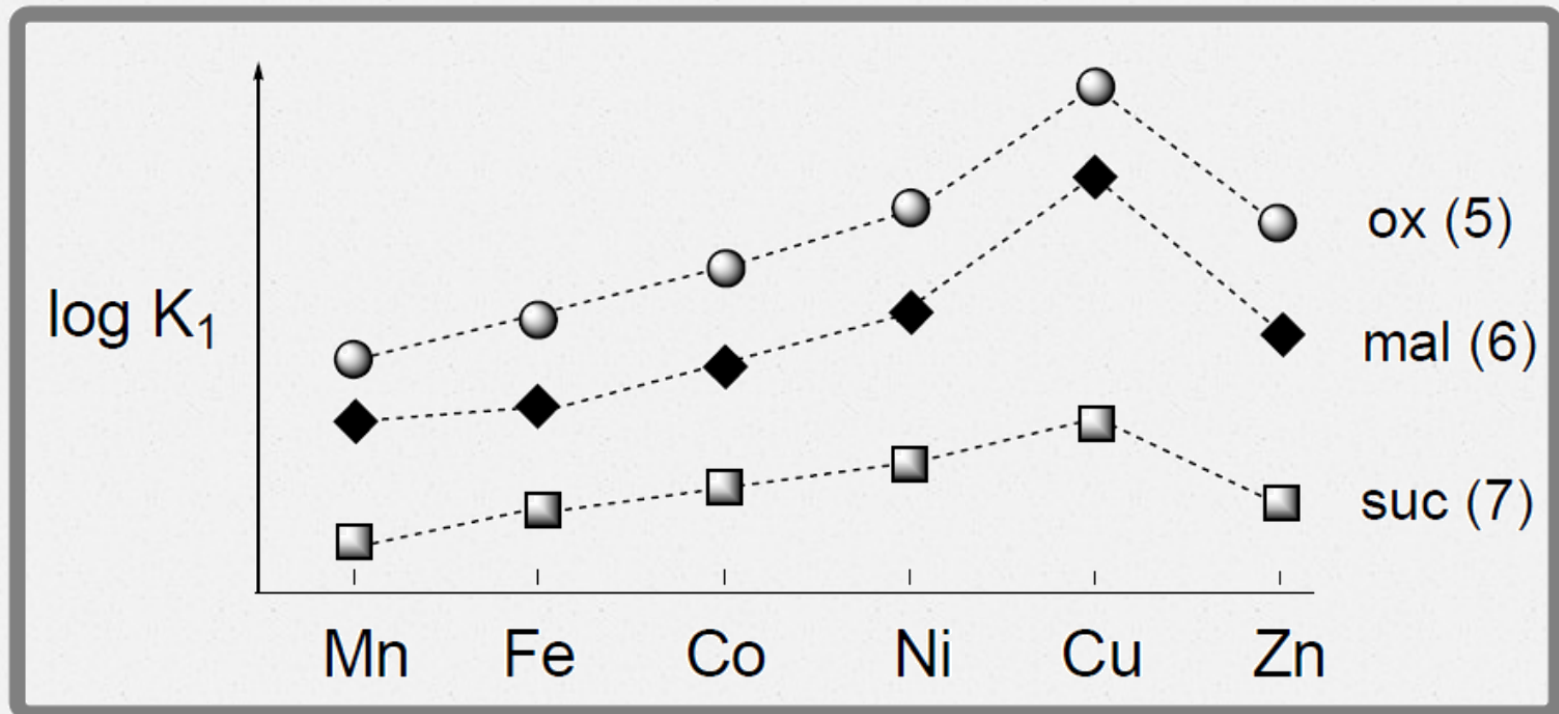
6



7

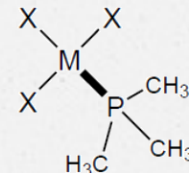
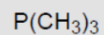
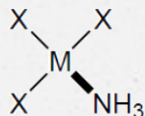


# La estabilidad en función de la longitud de la cadena

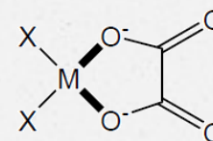
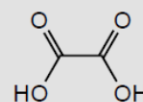
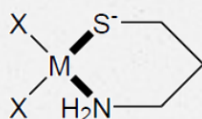
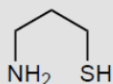


# ¿y tu cuantos dientes tienes?

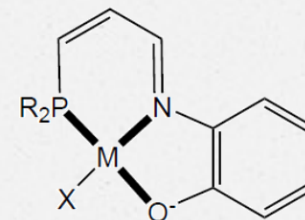
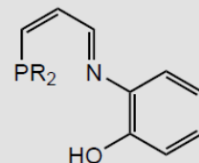
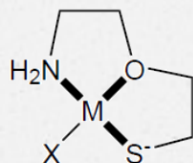
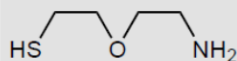
## monodentate



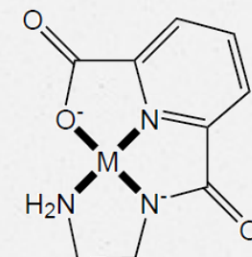
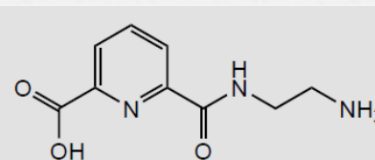
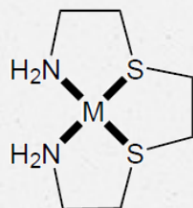
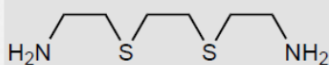
## didentate



## tridentate

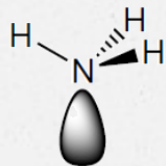


## tetradentate

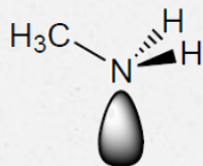


# Monodentados

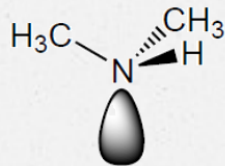
zeroth-order  
amine  
(ammonia)



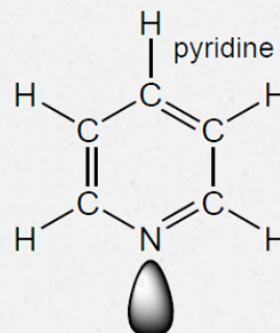
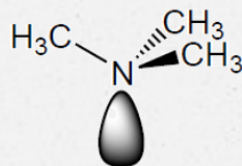
primary  
amine



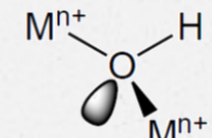
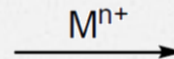
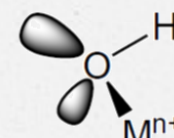
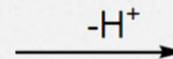
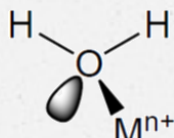
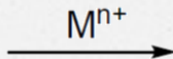
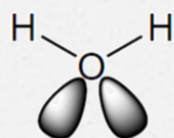
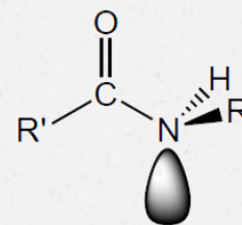
secondary  
amine



tertiary  
amine

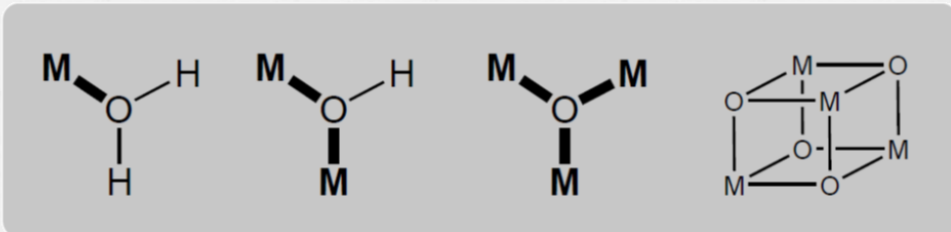


amide

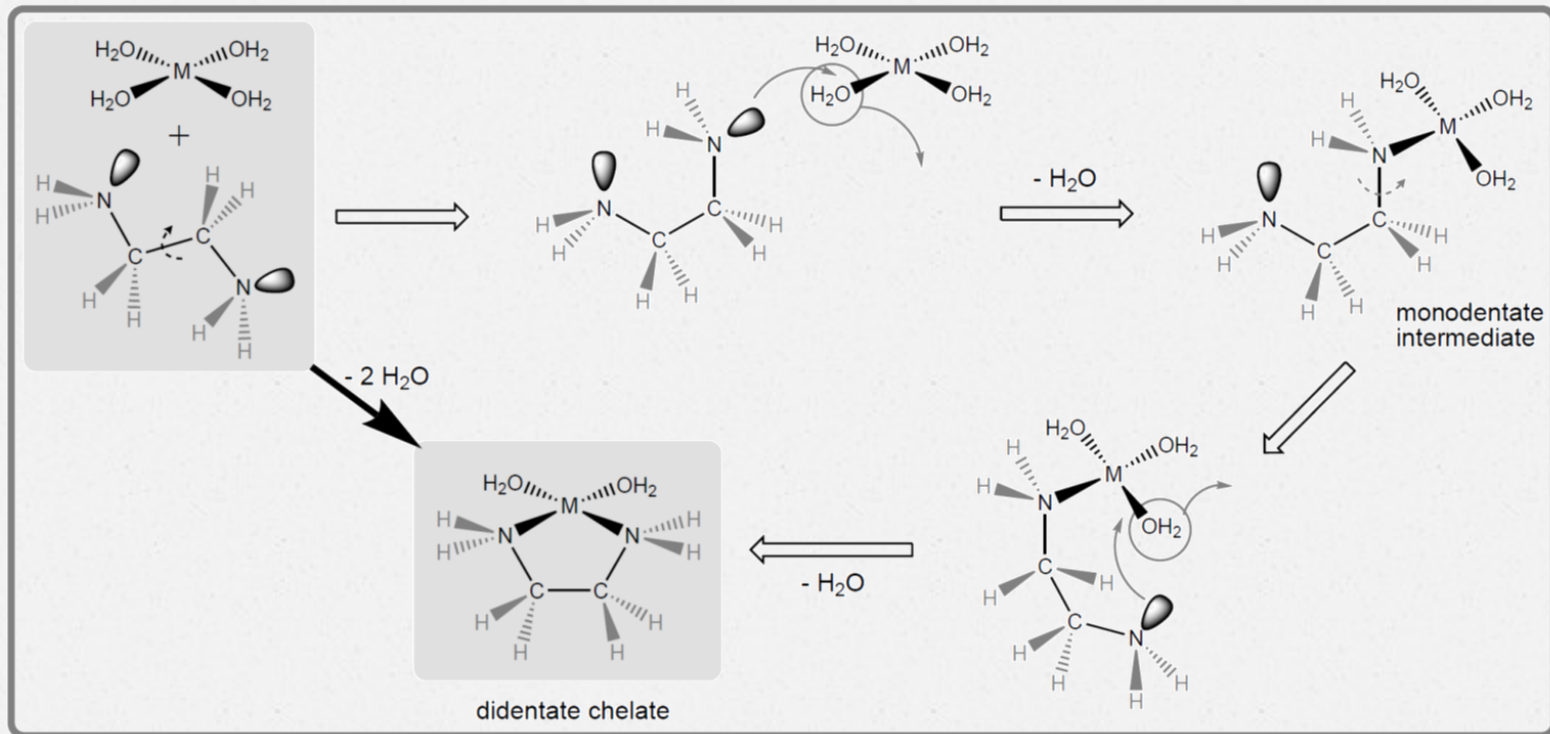


monodentate

bridging



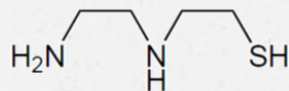
# Proceso de quelación



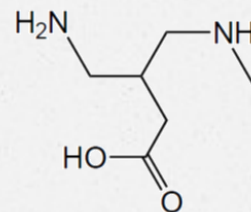
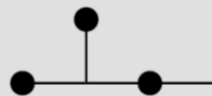


# Los polis...

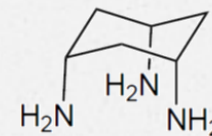
linear



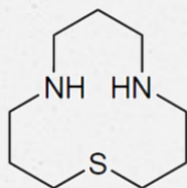
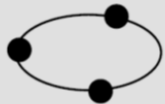
branched



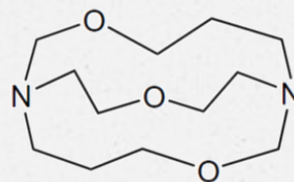
podal



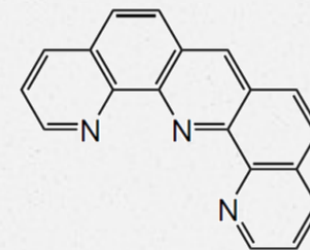
cyclic



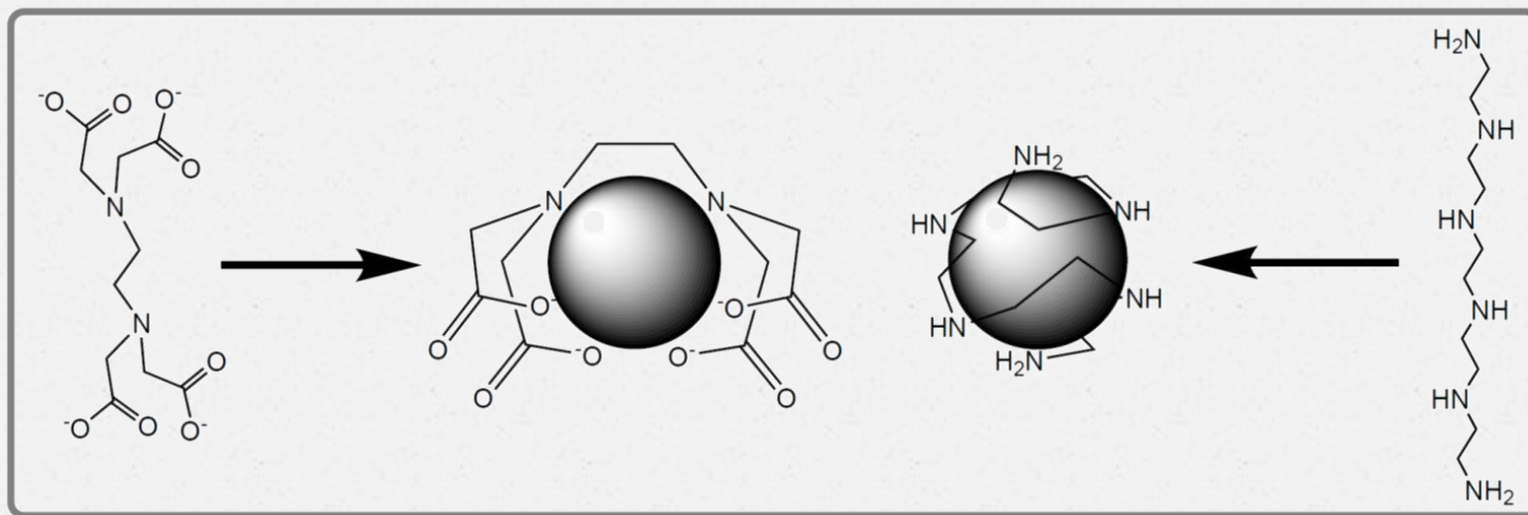
polycyclic



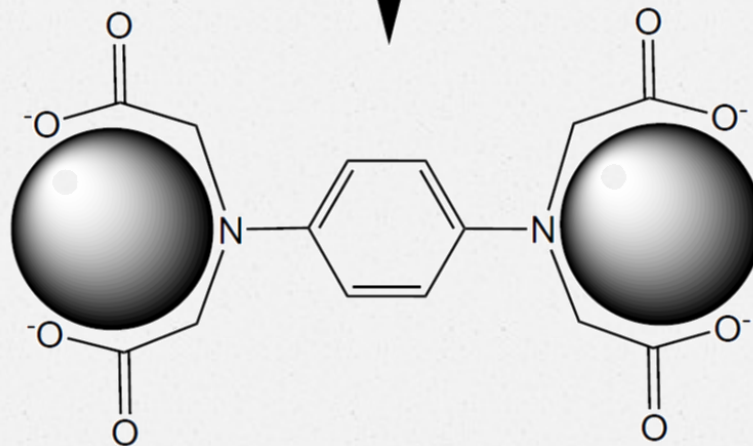
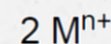
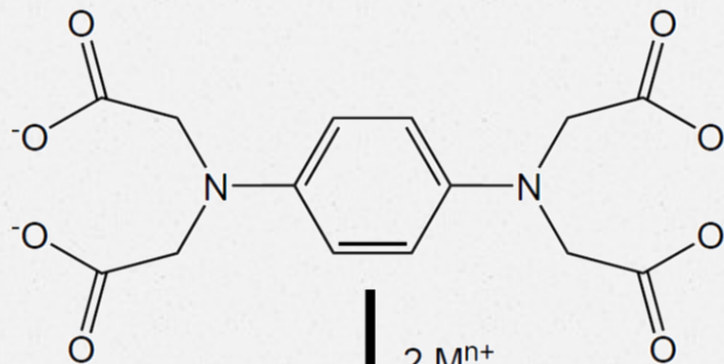
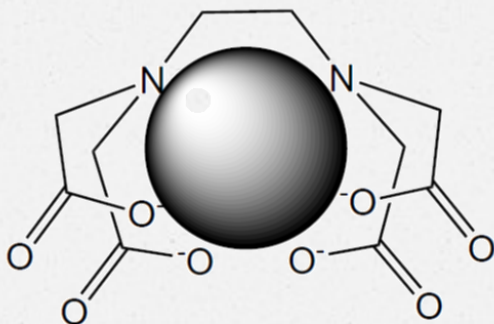
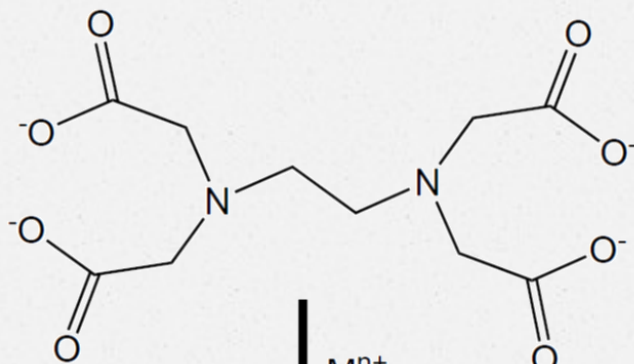
rigid aromatic



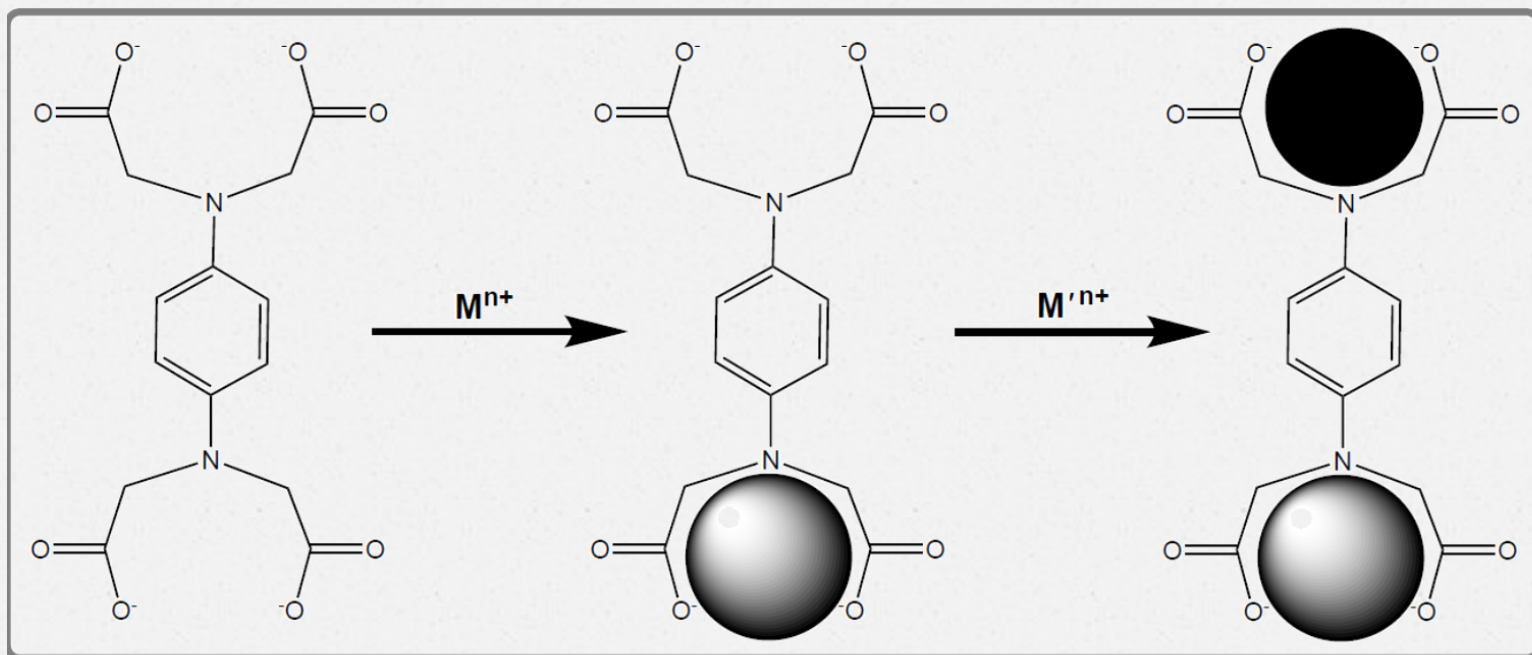
# Seguimos con polis

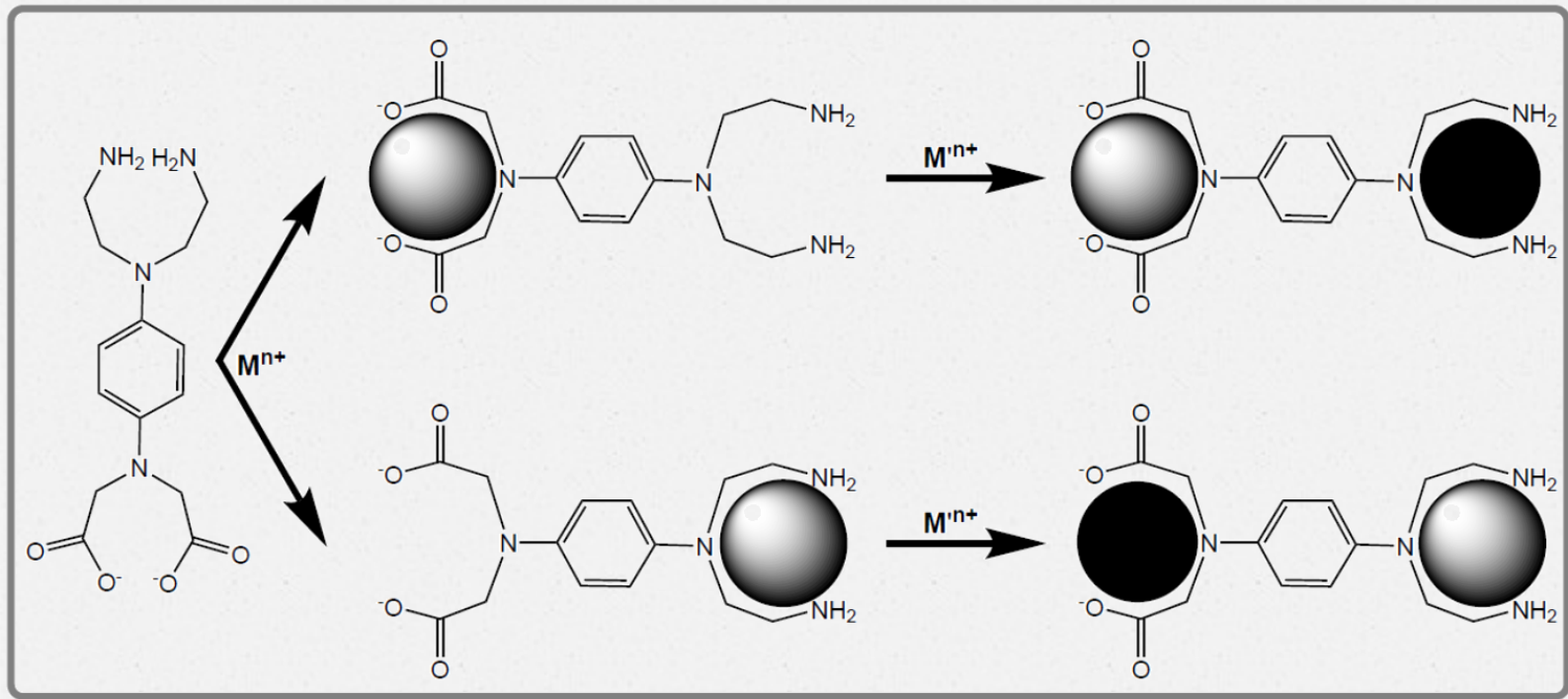


# ¿Y tu que tan flexible eres?

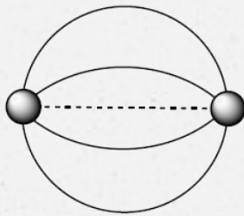


# ¿se valen las mezclas?

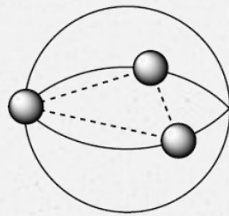




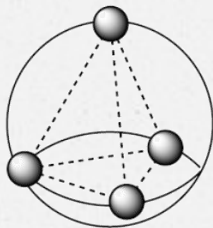
# ¿Y la geometría alrededor del metal central?



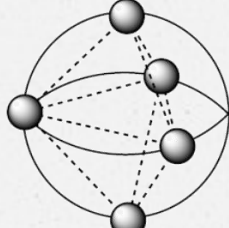
two point charges  
linear



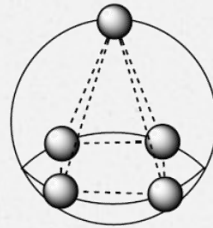
three point charges  
trigonal planar



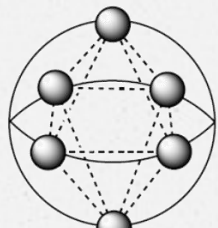
four point charges  
tetrahedral



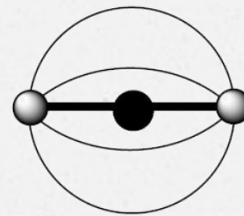
five point charges  
trigonal bipyramidal



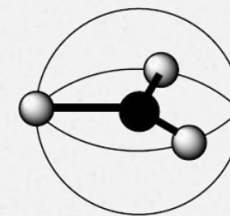
five point charges  
square pyramidal



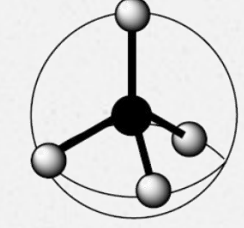
six point charges  
octahedral



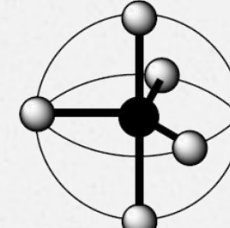
two-coordination  
linear



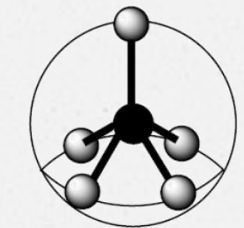
three-coordination  
trigonal planar



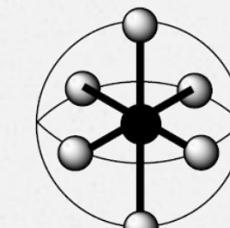
four-coordination  
tetrahedral



five-coordination  
trigonal bipyramidal

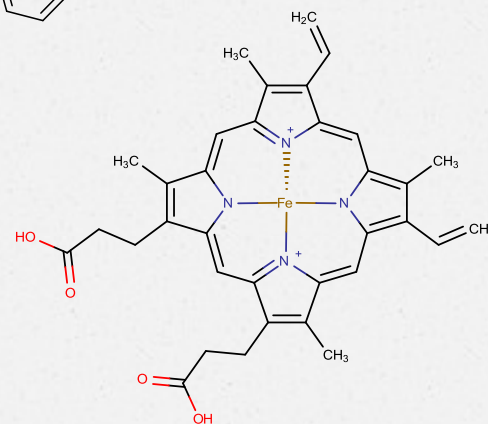
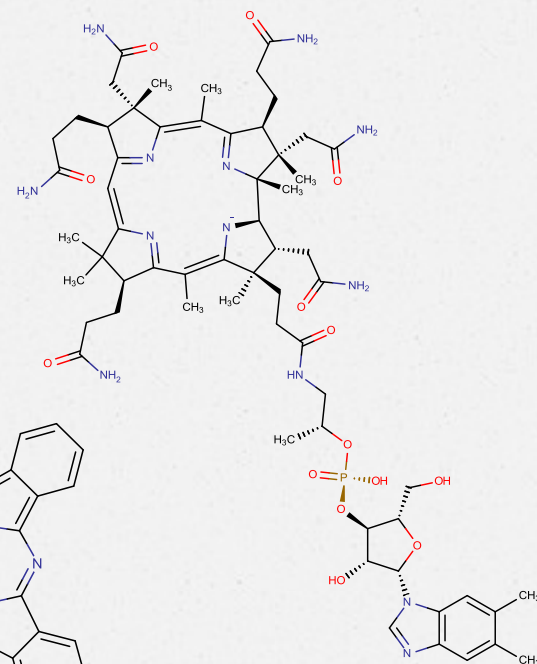
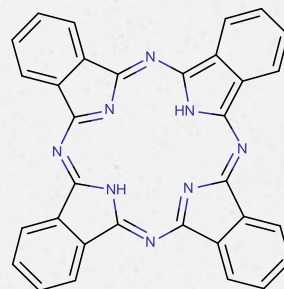
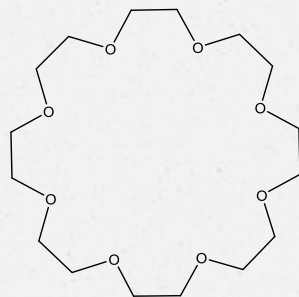
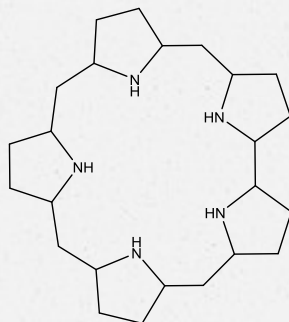
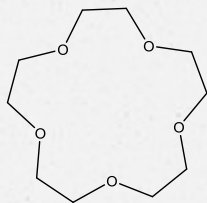
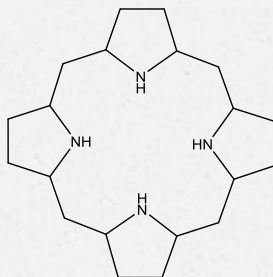
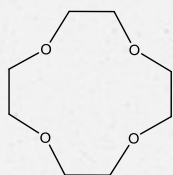


five-coordination  
square pyramidal

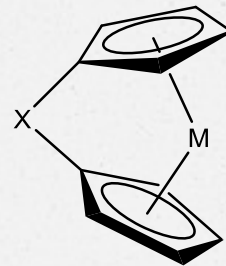
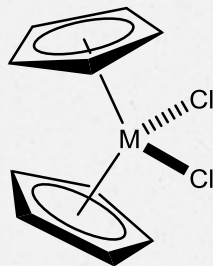
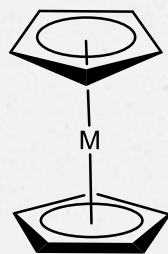
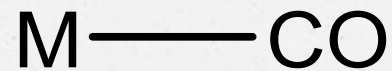


six-coordination  
octahedral

# Macrocyclics



# También el carbón actúa como base de Lewis



Pero eso se verá en organometálica.....