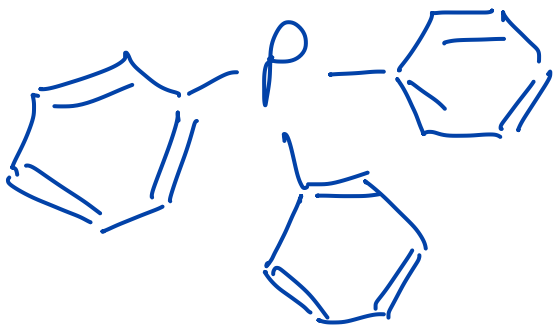
This Class

Coordination Number and Structure 9.4

Next Class

Chap 10 Bonding: Crystal and Ligand Field Theories

VSEPR cannot explain all shapes



factors in determining shape

VSEPR considerations

bond pairs + lone pairs will repell

occupancy of d orbitals

when the d shell is empty, half filled, or completely filled d^0, d^5, d^{10} VSEPR rules hold because e^- in d shell will be roughly spherical in distribution

steric interference

big ligands take up a lot of space

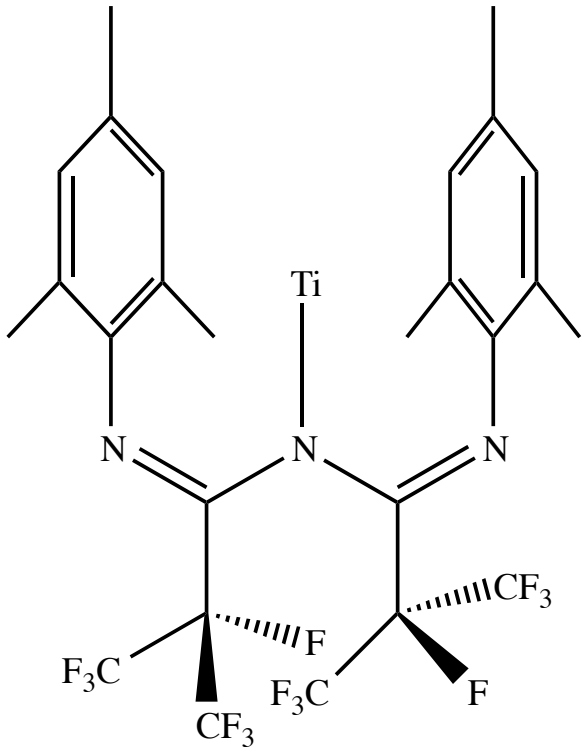
crystal packing effects

in the solid state crystal packing can greatly distort the geometries

One Coordinate metals complexes are rare.

Bulky ligands are needed to keep metals from forming bonds with each other.

Solvents often coordinate to the metal an increase the coordination number



lower coordination # to keep a coordinate site available for small molecule catalysis

To keep the coordination number low use big ligands

Some well known 2 coordinate complexes

0

$[Ag(NH_3)_2]^+$ since the NH_3 molecules are neutral, the Ag must be +1 d^{10}

-2

+1 (-1)

$[CuCl_2]^-$

Fe^{3+} Fe has 8 e^-

$4s^2 3d^6$

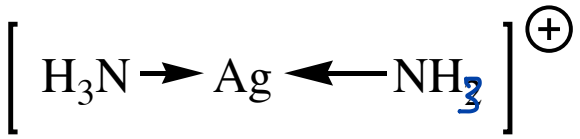
$4s^0 3d^5$

Ag^+ and Cu^+ are d^{10} metals

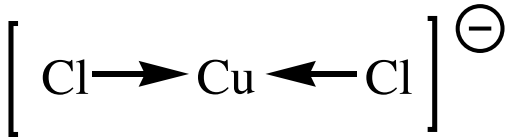
When metals lose e^- the first ones to go are out of the s orbitals

Some well known 2 coordinate complexes

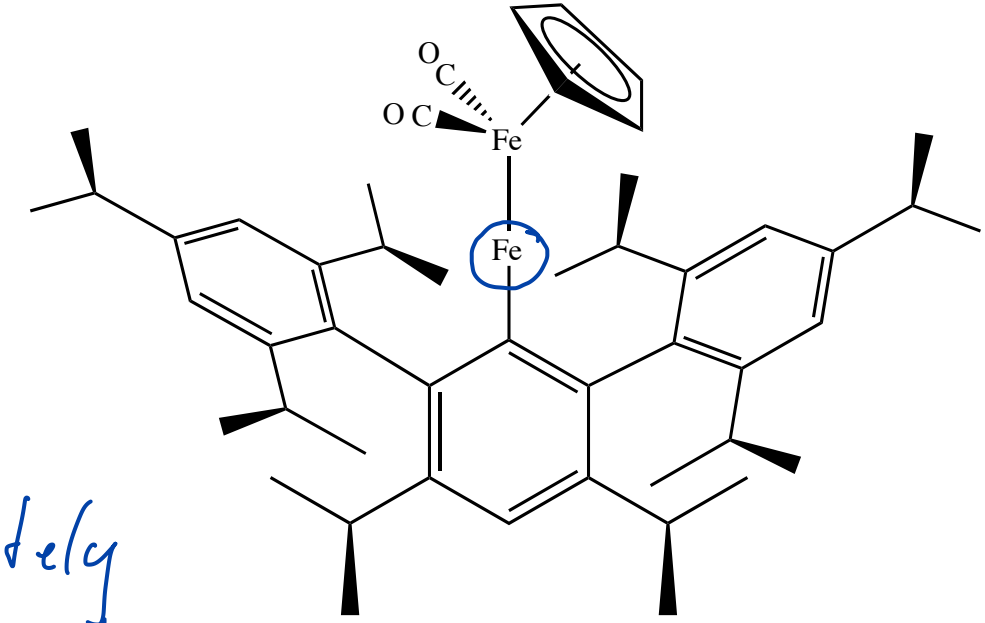
$[Ag(NH_3)_2]^+$



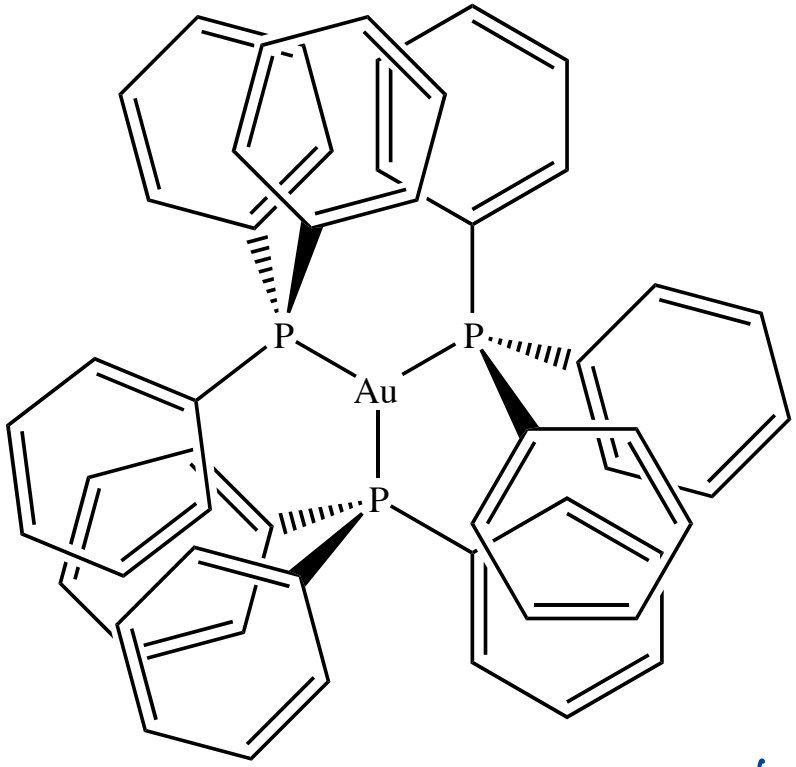
$[CuCl_2]^-$

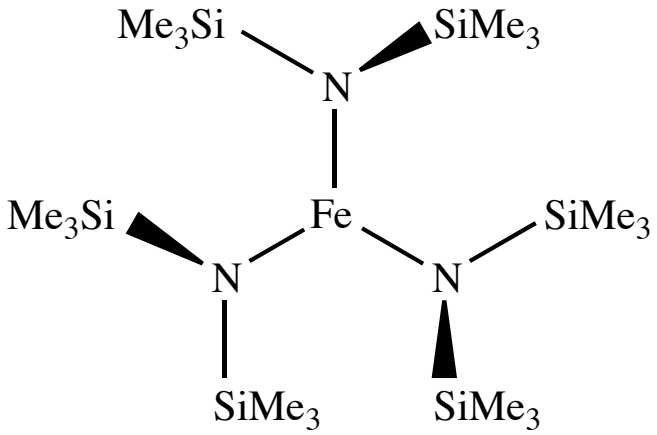


and then there's



again we see chemists using big ligands to stabilize coordinately unsaturated compounds



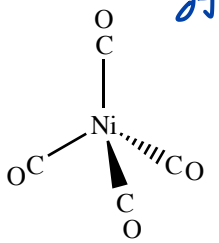


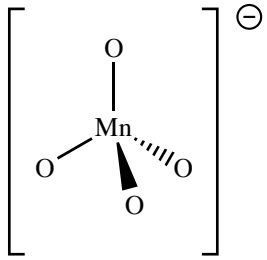
still using large ligands to keep coordination #'s low

tetrahedral

d^0, d^5, and d^{10}

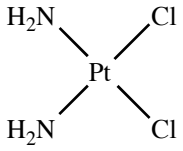
spherical distribution of d e⁻'s so tetrahedral geometry

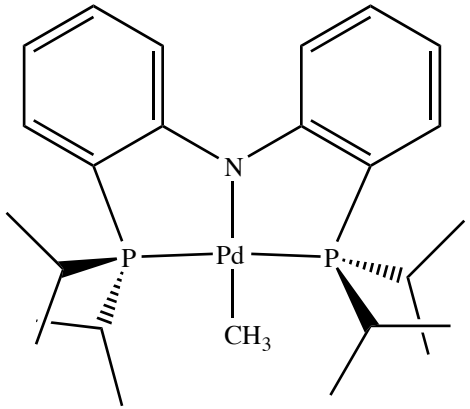




square planar

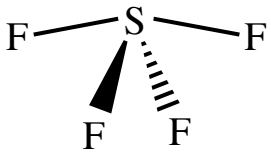
d^8



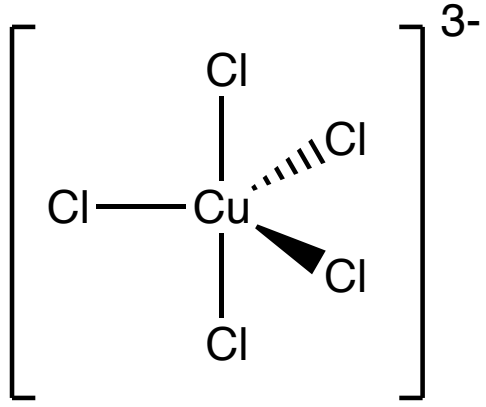


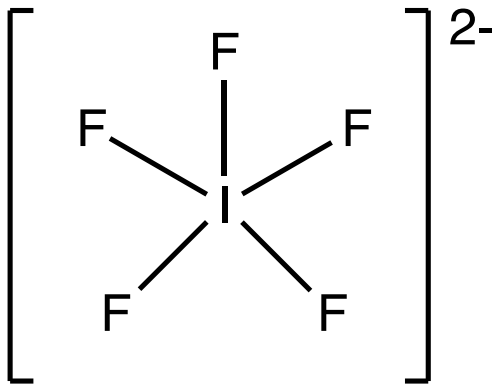
see-saw

four coordinate main group atoms with a steric number of 5



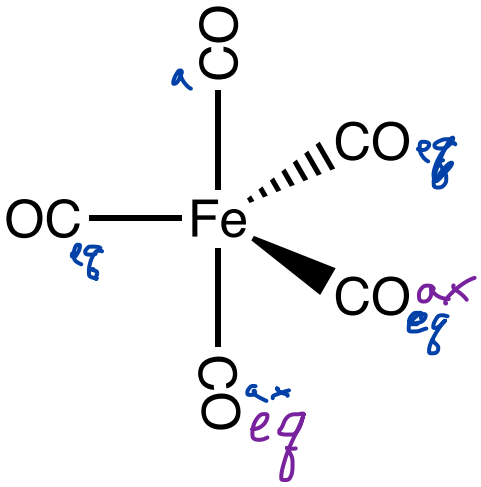
5 Coordinate

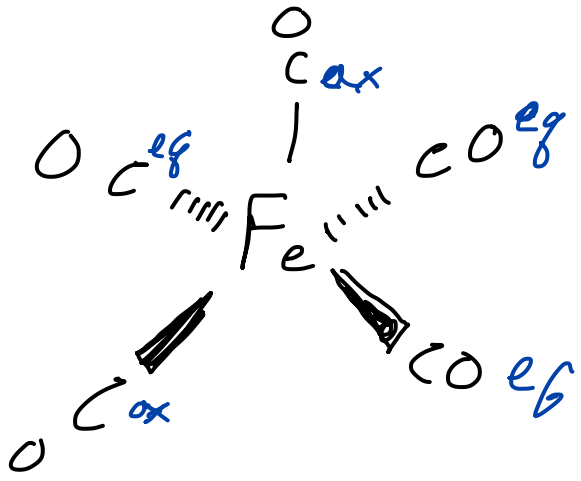




only 1 peak seen in the ^{13}C NMR spectrum

fluxional molecule

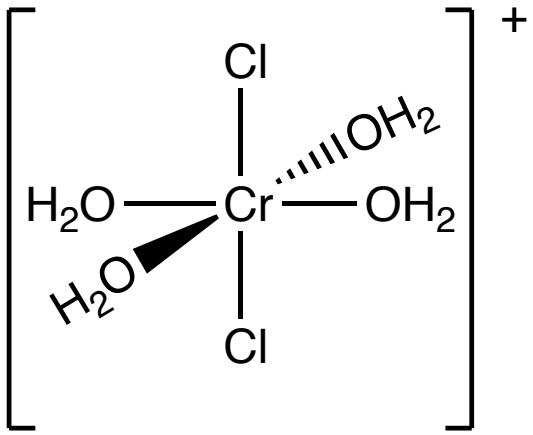




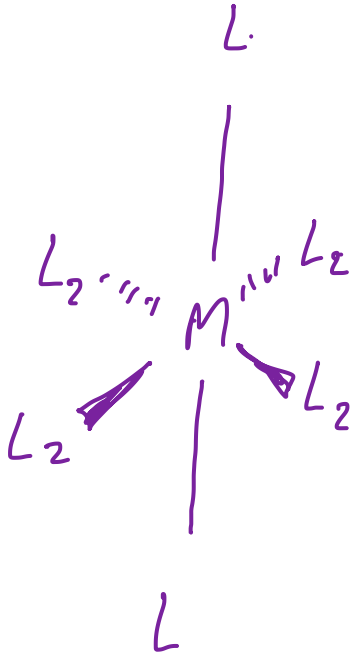
trigonal bipyramidal

square pyramidal

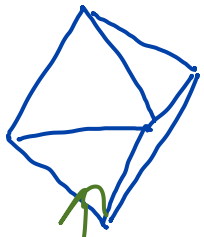
6 Coodinate



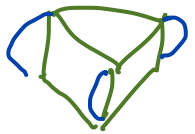
octahedral geometry



can be distorted by lengthening & compressing the axial bonds

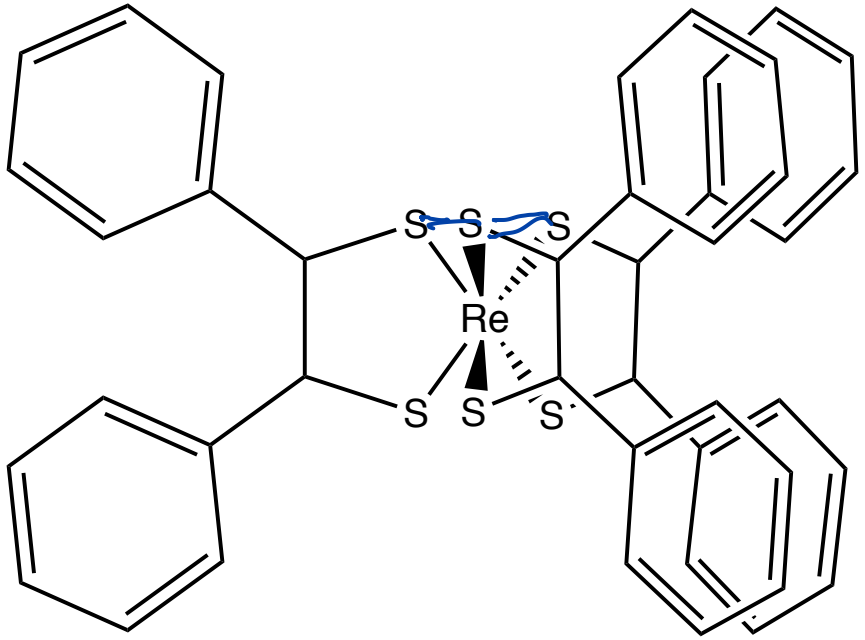


another distortion is that the triangular faces of the ligands can be twisted ...



Ligands link top to bottom

6 Coodinate



trigonal prismatic