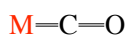
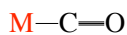
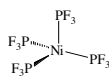
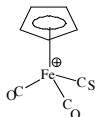
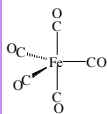


Organometallic Chemistry

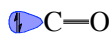
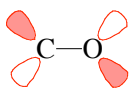
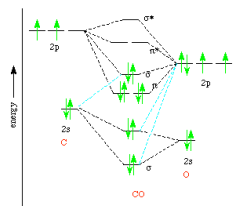
Carbonyl Complexes



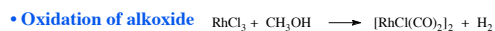
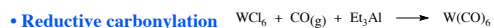
CO and Related Ligands



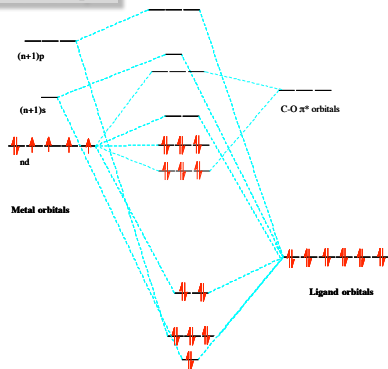
Molecular Orbitals



Synthesis of Carbonyl Complexes



Octahedral Complex



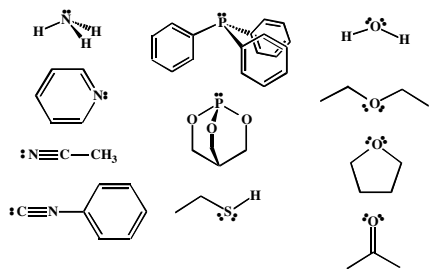
Electron Counting / Oxidation State

$$\text{charge on complex} = \text{metal oxidation state} + \text{sum of ligand oxidation states}$$

$$\text{d electron count} = \# \text{ valence electrons} - \text{oxidation state}$$

$$\text{total electron count} = \text{metal valence electrons} + \text{electrons donated by ligands} - \text{charge on complex}$$

Neutral, 2-electron donors






π -Acid Ligands

	Electrons Donated	Charge
$\text{:C}\equiv\text{O}$	2	0
$\text{:C}\equiv\text{S}$	2	0
$\cdot\text{N}\equiv\text{O}$	1 or 3	-1 or +1
$\text{:C}\equiv\text{N}-\text{CH}_3$	2	0
$\text{:N}\equiv\text{N}$	2	0
$\text{:O}=\text{O}$	2	0
	2	0
$\text{H}-\text{C}\equiv\text{C}-\text{H}$	2 or 4	0

Other π Ligands

	C_3H_5^-	3 e ⁻	-1
	C_4H_6^-	4 e ⁻	0
	$\text{C}_4\text{H}_4^{2-}$	4 e ⁻	-2
	$\text{C}_4\text{H}_4^{2+}$	4 e ⁻	+2
	C_5H_5^-	5 e ⁻	-1
	C_7H_7^-	5 e ⁻	-1
	C_6H_6	6 e ⁻	0
	C_8H_8^-	6 e ⁻	0

More π Ligands			
	$C_7H_7^+$	$7 e^-$	+1
	$C_8H_8^{2+}$	$8 e^-$	+2
	$C_8H_8^{2-}$	$8 e^-$	-2

Now it's your turn!

Make an 18 (or 16) electron complex with the metal-ligand combinations.
Draw its structure.

Mn, CO	Fe, NO, CO	Nb, CO, Cp
Mo, CO	Re, NO, CO	Fe, CO, Cp
Ru, CO	Ti, allyl	Cr, benzene
Ni, CO	Ni, Cp, CO	W, benzene, CO

Vibrational Spectroscopy

N-H, O-H	3500-3200 cm^{-1}
C-H	3250-2600
S-H	~2500
C=O	2000-1750
M-H	1950-1500
M=C	1420-1270
M=N-C	1360-1200
M=N	1150-1020
M=O	1100-850
M=S	850-650

Symmetry
Presence of Functional Groups
Bonding Mode
Bond Strength

$X - Y$ $X \text{---} Y$
 $\rightarrow \leftarrow$ \longleftrightarrow

Isotopic Labelling

$$\nu = \frac{1}{2\pi C} \left(\frac{f}{M_x M_y} \right)^{1/2}$$
