

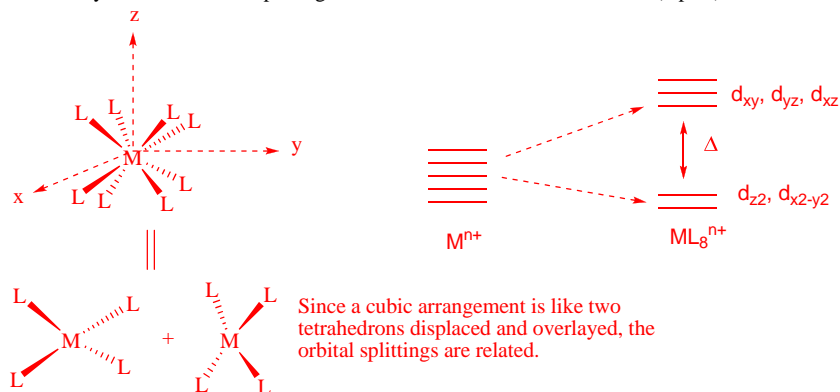
**Organometallic Chemistry**

**Problem Set #1**

Due: Sept. 11, 2008

Name: Michelle Obama

1. Draw a hypothetical transition metal complex with the molecular formula of  $ML_8$  (Hint: it has a cubic structure). Use ligand field theory to determine the splitting of d orbitals and label the d orbitals. (5 pts.)



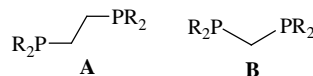
2. Explain why  $\Delta$  increases in the order  $CrCl_6^{3-}$ ,  $Cr(NH_3)_6^{3+}$ ,  $Cr(CN)_6^{3-}$ . (5 pts.)

$Cl$  is a  $\pi$  base, therefore it has a weak bond with  $Cr$  and a small  $\Delta$ .

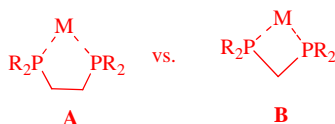
$NH_3$  has no lone pair e<sup>-</sup>'s, so it is neither a  $\pi$  base nor a  $\pi$  acid.

$CN^-$  is a  $\pi$  acid and can accept e<sup>-</sup>'s from  $Cr$  thereby allowing backbonding and forming a strong M-L bond.

3. Chelating ligands such as **A** are much more common than **B**? Explain. (4 pts.)



**A** forms a thermodynamically favorable five member ring with a metal,  $M$ , while **B** forms a less thermodynamically favorable 4 member rings.



4. For each transition metal complex shown list the following: (i) identify each ligand as L-type or X-type; (ii) the formal oxidation state of the metal; (iii) the  $d^n$  electron count; (iv) the total electron count of the metal. (6 pts.)

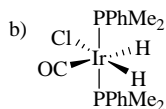
a)  $Pd(CH_3CN)_2Cl_2$

(i)  $L=CH_3CN$ ;  $X=Cl^-$

(ii)  $Pd^{+2}$

(iii)  $d^8$

(iv) 16 total e<sup>-</sup>'s



(i)  $L=CO, PPhMe_2$ ;  $X=H^-, Cl^-$

(ii)  $Ir^{+3}$

(iii)  $d^6$

(iv) 18 total e<sup>-</sup>'s

