1. For each complex a) through d), do the following: i) classify each ligand within the typical LX scheme, ii) identify the metal oxidation state (M\(^{n+}\)) and corresponding d-electron count (d\(^n\)), iii) give the valence electron count of the metal (usually \(\leq 18\) electrons).

   a) ![Image of complex a)](image1.png)

   b) ![Image of complex b)](image2.png)

   c) ![Image of complex c)](image3.png)

   d) ![Image of complex d)](image4.png)

2. Rank in order of CO stretching frequency, from largest to smallest:

   a) \([\text{Ce(CO)}_4]^-\), \([\text{Fe(CO)}_4]^-\), \(\text{Ni(CO)}_4\)

   b) \([\text{PtCl(CO)(PPh}_3)_2]^+\), \(\text{IrCl(CO)(PPh}_3)_2\)

3. Rank in order of \(\pi\)-accepting ability, from best to worst:

   \(\text{NMe}_3, \text{PMe}_3, \text{PF}_3, \text{PPh}_3, \text{P(OMe)}_3, \text{CO}\)

4. Rank in order of Tolman cone angle, from largest to smallest:

   \(\text{PH}_3, \text{PF}_3, \text{PPh}_3, \text{PCy}_3, \text{PMe}_3, \text{PMePh}_2, \text{PMe}_2\text{Ph}, \text{P(tBu)}_3, \text{PET}_3\)

5. Rank in order of \textit{trans} effect, from largest to smallest:

   \(\text{Cl}^-, \text{NH}_3, \text{H}_2\text{O}, \text{PR}_3, \text{Me}^-, \text{CO}, \text{H}^-\)
6. Provide the missing structures a) through d):

\[
\begin{align*}
\text{a)} & \quad \begin{array}{c}
H_3N-\text{Pt}-NH_3 \\
\text{NH}_3
\end{array} \quad ^{2+} \quad \text{Cl}^- \quad -\text{NH}_3 \\
\text{b)} & \quad \text{Cl}^- \quad -\text{NH}_3 \\
\text{c)} & \quad \begin{array}{c}
\text{Cl} \quad \text{Pt} \quad \text{Cl} \\
\text{Cl} \quad \text{Cl}
\end{array} \quad ^{2-} \quad \text{NH}_3 \quad -\text{Cl}^- \\
\text{d)} & \quad \text{NH}_3 \quad -\text{Cl}^-
\end{align*}
\]

7. Indicate the correct stereoisomers of structures a) through c) in the following classic mechanistic study of Pd cross-coupling chemistry:
8. Indicate the correct stereoisomer of structure a) in the following classic mechanistic study of 1,1-migratory insertion:

\[ \text{(OC)\textsubscript{2}CpFe} \quad \text{PPh\textsubscript{3}} \quad \text{THF} \quad \text{(Ph\textsubscript{3}P)(OC)CpFe} \downarrow \text{H/D} \quad \text{D/H} \quad \text{H/D} \quad \text{H/Bu} \]

9. Predict the correct alkene stereoisomer that would result from a β-hydride elimination reaction through the following organorhodium intermediate:

10. For the following reaction, place the following in order of relative rate, from fastest to slowest: X = CH\textsubscript{3}, CF\textsubscript{3}, H, OMe.