Introduction to Organometallic Chemistry
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VI) Metallocenes  Questions dealing with cyclic polyenes.

25. $\eta^5$ Cyclopentadienyl - complexes
26. $\eta^6$ arene Metal complexes
27. Half sandwich complexes
28. Reactivity changes in coordinated ligands

1. Explain the following observations (If there are two possible explanations, give both)

M-C distances in metallocenes formed by M(II) ions of Fe, Co and Ni are as follows:

Ni 2.196(4) Å  Co 2.119(3) Å and Fe 2.064 (3) Å

2. Complete the following equations. Give the structure of the product and the electron count if it is a redox reaction.

(b) C$_5$H$_5$Re(CO)$_3$ + NO$_2$PF$_6$  \rightarrow

d) CpFe(CO)$_2$(CH$_2$OMe) + BF$_3$  \rightarrow

3. Suggest structures for A, B and C indicate the stereo-chemistry clearly in each case.

CpFe(CO)$_2$Na + (+R) Me-C(D) (X) H \rightarrow A \rightarrow B \rightarrow C

\begin{array}{ll}
\text{A} & \text{B} & \text{C} \\
\text{Ru(CO)$_n$ + C$_6$H$_6$ \rightarrow (C$_6$H$_6$)$_2$Ru \rightarrow [Ru(C$_6$H$_6$)$_2$]$^{2+}$} & \end{array}

(a) Draw structures for A, B and C assuming they are 18e$^-$ species.
(b) Room temperature $^1$H NMR of B and C show only one peak. Explain

4. Identify the various reactive sites in the following molecules towards nucleophilic and electrophilic attack: (Hint Use NaOMe and HBF$_4$ as reagents.)
Which reactant would be more reactive towards the organometallic species given?

(a) Ferrocene
(b) $[\eta^7$(cycloheptatrienyl)$\text{Mn(CO)}_3]^+$
(c) $[(\eta^6\text{C}_6\text{H}_5\text{CH}_2\text{Cl})\text{Cr(CO)}_3$
(d) $[(\eta^5\text{C}_3\text{H}_5)\text{Ni(C}_4\text{H}_6)]^+$