Problem set 9

**1.** The solution ^{31}P NMR spectrum of the cluster $PtRu_5C(CO)_{14}(PMe_2Ph)_2$ shows five signals due to three isomers (note: J_{PtP} appear as satellites):

A:	δ 9.62, J_{PtP} = 63 Hz
	δ −13.45, J_{PtP} = 5999 Hz
B:	δ 4.35, J_{PtP} = 63 Hz
C:	δ −1.11
	δ −11.80, J_{PtP} = 6111 Hz

Propose plausible structures for the three isomers.

2. How could NMR be used to determine the distribution of the metal atoms in the core of the trigonal prismatic cluster $[Fe_3Rh_3(\mu_6\text{-}C)(CO)_{17}]^-$? Consider both ^{103}Rh and $^{13}C_{interstitial}$ nuclei.

3. The ruthenium cluster $[Ru_6C(CO)_{16}]^{2-}$ (**A**) when heated in solution produces $[Ru_{10}C_2(CO)_x]^{2-}$ (**B**):

$$[Ru_6C(CO)_{16}]^{2-} \xrightarrow{\Delta}$$

A   **B**
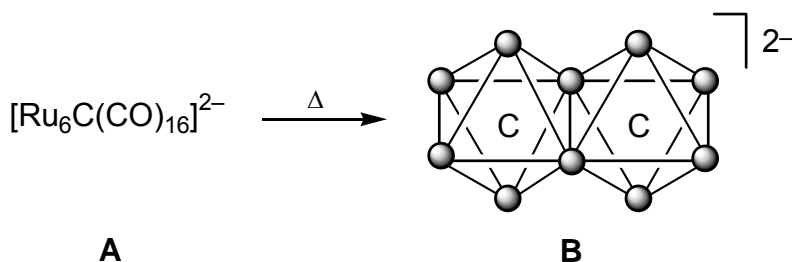
Use suitable electron-counting rules to predict the structure of **A** and to calculate x, the number of CO ligands on cluster **B**.

[from 2004 midterm]

4. Use the following statements to help you illustrate the different types of electronic transition encountered in complexes of the heavy metals.

(i) Rh^{III} complexes tend to have a characteristic rose color.
(ii) $[Ru(bipy)_3]^{2+}$ complexes are intensely colored (bipy = 2,2'-bipyridyl).
(iii) $[Re_2Cl_8]^{2-}$ is royal blue and $[Mo_2Cl_8]^{4-}$ an intense red.

[part of a question from the 2004 final exam]