Chapter 6-
1. Define the equations for the Latimer diagram of iron (Appendix B). Assume the conditions are acidic. Which steps are spontaneous?

Chapter 9 and 10-
1. Name the following compounds:
   a. \([\text{Cu(NH}_3\text{)}_4][\text{PtBr}_4]\)
   b. \([\text{Co(en)}_2\text{Cl(NO}_2\text{)}_2]\)Cl
   c. \(\text{Na}_3[\text{Al(C}_2\text{O}_4\text{)}_3]\)
   d. \(\text{W(CO)}_5\text{PMe}_3\)
   e. \[
   \begin{array}{c}
   \text{(H}_3\text{N)}_4\text{Co}
   \\
   \text{Co(NH}_3\text{)}_4
   \\
   \text{(NO}_3\text{)}_2
   \end{array}
   \]

2. Write structural formulas for the following:
   a. diamminetriaquahydroxochromium(III) nitrate
   b. tetrakis(pyridine)platinum(II) tetraphenylborate
   c. dibromotetracarbonyliron(II)
   d. tetraamminecobalt(III)-μ-amido-μ-hydroxobis(ethylenediamine)cobalt(III)

3. How might Werner have been able to distinguish between the following two formulations for a compound: \([\text{Co(NH}_3\text{)}_3]\)Cl\(_3\) and \([\text{Co(NH}_3\text{)}_5\text{Cl}]\)Cl\(_2\)? The cation would be trigonal bipyramidal in the former and octahedral in the latter.
4. To show your understanding of basic bonding models, describe the bonding in \([\text{NiF}_4]^2-\) with each of the following:

a. Valence bond theory

b. Crystal field theory

c. Molecular orbital theory

5. What bond angle would you expect for M-O-R

a. if there is no metal-oxygen π bonding?

b. if the alkoxide donates two π electrons?

c. if the alkoxide donates four π electrons?

6. If one \([\text{CuL}_6]^{2+}\) solution is blue and another is green, which would be expected to have the higher value of \(\Delta_G\)?

7. Write K and β expressions for the proton affinity of a tetraprotic ligand.

8. Write K and β expressions for the metal affinity of a tetraprotic ligand, which binds in a ratio of 1:1 metal:ligand.

9. A complex of nickel(II), \([\text{NiCl}_2(\text{PPh}_3)_2]\), is paramagnetic. The analogous complex of palladium(II) is diamagnetic. Predict the number of isomers that will exist for each of these formulations.

10. Determine the equilibrium constant for the following chemical reaction.

\[
\text{Ni(H}_2\text{O)}_6^{2+} + 6 \text{NH}_3 \leftrightarrow \text{Ni(NH}_3)_6^{2+} + 6 \text{H}_2\text{O} \quad \Delta G^\circ = -51.8 \text{ kJ/mol}
\]

Would you expect a major change in entropy?

11. Draw out all the isomers, geometric and optical, of the following: \([\text{Co(en)}_2\text{Cl}_2]^+\) and \([\text{Co(en)}_2(\text{NH}_3)\text{Cl}]^{2+}\)
12. Draw the molecular structure of the following complexes:
   a. *cis*-dichlorotetracyanochromate(III)
   b. *mer*-triamminetriclorocobalt(III)
   c. *trans*-dichlorobis(trimethylphosphine)palladium(II)
   d. *fac*-triaquatrinicotinocobalt(III)

13. The macrocycle ligand enterobactin has an extremely high affinity for Fe(III) with a stability constant of $10^{52}$ (the largest known stability constant for Fe(III) with a naturally occurring substance).

   [Chemical structure of enterobactin]


   a. Suggest a structure for the Fe(III) enterobactin complex that explains its high stability.

   b. If the concentration of the Fe(III)-enterobactin complex within the microorganism is $10^{-7}$ mol/L, how many liters of bacteria would have to be searched to find a single free Fe(III) ion?