1. (10) Provide the name of the element associated with each of the symbols below.

Fe  Cu  Mn  V  Zn  Pt  Y  Ti  W  Mo

2. (10) Draw neat, clear diagrams of all of the possible square planar and tetrahedral isomers of Cu(NH₃)₂FCl. Your diagrams should clearly indicate three-dimensional stereochemistry when appropriate. If any of the isomers are enantiomers, so indicate. Points will be subtracted if any structures are inadvertently repeated, so be careful in your analysis.

3. (10) Draw neat, clear diagrams of all of the possible octahedral isomers of CoCl₂F₄³⁻. The most efficient way to draw these is to first draw a set of xyz coordinate axes, then place the ligand atoms at the six positions at the ends of the axes. Points will be subtracted if any structures are inadvertently repeated, so be careful in your analysis.

4. (15) Tetrahedral complexes are almost always high-spin, while octahedral complexes can be either high- or low-spin depending on the metal and/or ligand. Provide a brief, clear explanation for these observations.

5. (10) First-row transition metals form labile complexes more readily than to second- and third-row transition metals. Describe one major factor that contributes to this difference.

6. (10) How many grams of K₂BaCo(NO₂)₆ (formula weight 550.50) would be required to produce 0.300 mole of gaseous nitrogen when reacted with excess sulfamic acid? Show all of your calculations in a neat and clear manner.

7. (15) The reaction series shown below obeys a first-order rate law (dependent only on the concentration of [Co(NH₃)₅H₂O]³⁺), and the rate constants, (in s⁻¹,) are shown in the accompanying table.

(a) Are the reactions in the series likely to be diffusion-controlled? Provide a brief justification for your answer.
(b) What type of mechanism, associative or a dissociative, does the data support? Provide a brief justification for your answer.

[Co(NH₃)₅H₂O]³⁺ + L⁻ → [Co(NH₃)₅L]³⁻⁻⁻, L⁻ = anionic ligand

8. (10) Carbon monoxide produces an exceptionally strong ligand field. Provide a brief, clear explanation for this effect. A diagram of relevant interactions of CO with a metal atom would be particularly useful.

9. (10) Two intermediate coordination complexes in the rhodium-catalyzed Monsanto process for production of acetic acid from methanol and carbon monoxide are shown below. Identify (a) the number of electrons in the coordination sphere of each of the two rhodium complexes, in terms of the 18-electron rule, and (b) the oxidation state of rhodium in each of the two complexes.