• Be able to set up mass balances for the hydrolysis of a metal. In terms of the hydrolysis K’s and OH- or H+ concs. (Rxn data would be provided.) For example, something like:

\[ \text{Cu(II)T} = [\text{Cu}^{2+}](1 + K_1[\text{OH}^-] + K_2[\text{OH}^-]^2 + K_3[\text{OH}^-]^3 + K_4[\text{OH}^-]^4 + 2K_5[\text{Cu}^{2+}][\text{OH}^-]^2) \]

• Given the necessary thermo data, be able to compare the relative strength of complexation of two metals with a given ligand or vice versa. There are some good examples of this in the practice problems and in the textbook.

• In the midterm I had you label the relevant parts of a pC-pH diagram. In the final I might provide a similar diagram for hydrolysis species and give you some data and have you label the various lines and regions.

• For solubility, I might present you with a practical scenario and some data, and ask you to either set up or (if simple enough) solve for the soluble concentrations of ions. There are examples of this in the practice problems and I would expect the exam to have something similar.

• Another example of that would be to have a water of a certain composition and then dose it with another compound to precipitate out a particular component to a desired level (like a waste treatment problem.)

• I might have you show (for a fairly simple system) how complexation quantitatively affects the solubility of a metal.

• For redox, be able to do the basic manipulations to combine half cell rxn to form balanced overall rxn. This would include combing more than two half cells, or, the ability to combine and acid base reaction with some redox expressions to obtain a new overall rxn.

• For redox, be able to quantitatively calculate the amount of one reactant consumed by another. For example, if I told you to make a mixture of a reductant with an oxidant, in redox rxn the reaction normally will go completely until the reagent in lesser amount is consumed. Be able to calculate the residual amount of the reactant that is in excess.

• Along these lines, be able to do a simple “oxygen demand” calculation like that Exercise 8.

• I might give you the concentrations of the reduced and oxidized forms of a half-rxn, along with a peo and ask you to calculate the pe.

• If I give you two half rxns and the data necessary to get the two pe’s, you should be able to tell me which one will be the oxidant and which will be the reductant. (E.g., suppose I told you to take a solution containing known amounts of Fe^{2+} and Fe^{3+}, and then mix it with a solution containing SO_{4} and HS-. What will happen next? Would Fe^{2+} reduce SO_{4} to HS, or, would HS- reduce Fe^{3+} to Fe^{2+}? And why?)

• Please review the solutions to the Case Study Exercises and make sure you understand all of the calculations and the reasoning behind it. I may ask you questions about something in the case study.

• Also, since I really want you to read the background material for the last 2 case studies, I might ask some very broad questions about the chemistry issues surrounding phosphate rock mining/processing and the behavior of Hg in the Everglades. This would not be anything obscure, but something pretty obvious and important like: What are the water quality problems associated with phosphogypsum disposal? Does the Hg problem in the Everglades stem primarily from industrial discharges in the Miami area? Which is more toxic: Hg(OH) or Hg(CH_3)_2?