

Take Home Assignment #3

Please turn in neatly worked solutions for the following problems. Answers are due by 4:00 PM on Wednesday, September 5th.

These problems provide experience in drawing and working with ladder diagrams. See Appendix 3B for a list of acid dissociation constants and Appendix 3C for a list of metal-ligand formation constants.

1. Draw a ladder diagram for the amino acid asparagine. What range of pH levels can you use if you wish to ensure that the amino acid is almost completely in its neutral form?
2. Using a ladder diagram as an aid, identify a range of pH levels where you could separate the amino acids glutamine and glutamic acid based on a difference in their charge.
3. Draw a ladder diagram that includes both carbonic acid, H_2CO_3 and phenol, $\text{C}_6\text{H}_5\text{OH}$. Based on your diagram, what acid–base reactions are feasible? What acid–base reactions are not feasible? Pick one example of a favorable reaction and one example of an unfavorable reaction and determine the equilibrium constant for each.
4. Suppose you wish to prepare a precipitate of calcium oxalate, CaC_2O_4 . To what range of pH levels should you adjust the pH to minimize its solubility? Briefly defend your choice.
5. Masking agents are used in many analytical procedures as a way to prevent one metal ion from interfering in an analysis for a second metal ion. The idea is to add a ligand that binds strongly to the interfering metal ion, leaving the other metal ion free in solution. One common masking agent is cyanide, CN^- . Using a ladder diagram, determine if there are conditions where cyanide can prevent Ni^{2+} from interfering in an analysis for Fe^{3+} . If so, then state the range of conditions.