Analytical Chemistry

Problem Set 6—due Friday, March 24, 2006 (at 5 p.m.)

Total possible points for this assignment = 73

- Consult Appendix F in your text for any $K_{sp}$ values you need for calculations.
- In activity calculations, carry two additional figures for any intermediate result.

1. (4 points) Harris 8-3

2. (3 points) Harris 8-7(a)

3. (13 points) Harris 8-13. Hint: You will need to perform only two iterations to converge your predicted value of $[\text{Ba}^{2+}]$ to two significant figures. Briefly explain why.

4. (24 points) Harris 8-15. Please note the following: (1) In part (a), iterate until two successive predictions of $[\text{Ca}^{2+}]$ agree to two significant figures. (3) You should use the extended Debye-Huckel equation to determine the activity coefficients. However, this approach will cause your final answer to differ slightly from the answer in the back of the book. This is because the answer in the back of the book was determined by interpolation of the activity coefficients in Table 8.1. (4) All of your work should be written out for Iteration #1 (which assumes that $[\text{Ca}^{2+}] = [\text{SO}_4^{2-}] = 0$) and Iteration #2 (which assumes that $[\text{Ca}^{2+}]$ and $[\text{SO}_4^{2-}]$ are at the concentrations predicted in Iteration #1). You do not need to show your work for the other iterations. You may either write down the key results for each iteration ($\mu$, $\gamma(\text{Ca}^{2+})$, $\gamma(\text{SO}_4^{2-})$, $[\text{Ca}^{2+}]$, and $[\text{SO}_4^{2-}]$), or use Excel to calculate and display your results. If you use Excel, be sure to include a copy of your spreadsheet with your problem set.

5. (4 points) Harris 9-4. Be sure your Lewis structure includes all lone pairs and non-zero formal charges. You need draw only one resonance structure for HAsO$_4^{2-}$.

6. (5 points) Harris 9-10. Be sure to justify your answer clearly and completely.

7. (20 points) Harris 9-21. Note: (1) In parts (a) and (b), you are to neglect the effect of activity—that is, assume that all activity coefficients are 1. (2) Whenever the pH is fixed at a certain value, it is impossible to write a charge balance equation. This is because there is at least one ionic species of unknown concentration helping to buffer the pH at this value. (3) Note that by definition, $\text{pH} \equiv -\log A_{\text{H}^+} = -\log[A^+] \gamma_{\text{H}^+}$