

Analytical Chemistry

Problem Set 6—due Friday, March 23, 2007 (at 4:00 p.m.)

- 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.
- Please see the attached for a simplified discussion (from the 6th edition of Harris) of how to solve problems with activity coefficients by iteration.

1. (4 points) Harris 8-3
2. (3 points) Harris 8-6(a)
3. (14 points) Harris 8-10. Hint: You should find that a second iteration does not (to two significant figures) change your predicted value of $[Ba^{2+}]$. Briefly explain qualitatively why this is the case.
4. (22 points) Calculate the concentration of dissolved Ca^{2+} in a saturated aqueous solution of $CaSO_4$, taking activity into account. Please note the following:

- Consider only the reaction

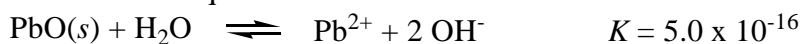


(Things could be a whole lot more complicated; see Harris pp. 151-152.)

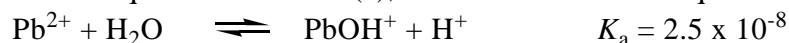
- Iterate until two consecutive predictions of $[Ca^{2+}]$ agree to two significant figures.
- All of your work should be written out for Iteration #1 (which assumes that $[Ca^{2+}] = [SO_4^{2-}] = 0$) and Iteration #2 (which assumes that $[Ca^{2+}]$ and $[SO_4^{2-}]$ are at the concentrations predicted at the end of 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 (μ , $\gamma(Ca^{2+})$, $\gamma(SO_4^{2-})$, $[Ca^{2+}]$, and $[SO_4^{2-}]$), 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.

[Final answer: $[Ca^{2+}] = 0.0099$ M]

5. (4 points) Harris 8-19. 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 8-23. Be sure to justify your answer clearly and completely.
7. (11 points) Consider the following (rather simple) problem involving a systematic treatment of equilibrium. To make things even simpler, neglect the effect of activity—that is, assume that all activity coefficients are 1.
 - (a) How many moles of PbO will dissolve in 1.00 L of water if the pH is fixed at 10.50? Consider the equilibrium



- (b) Answer the same question asked in (a), but also consider the equilibrium



[Final answers: (a) 5.0×10^{-9} mol PbO ; (b) 4.0×10^{-6} mol PbO]