

**Analytical Chemistry****Problem Set 6—due Friday, March 28, 2008 (at 4:00 p.m.)**Total Number of Points = 63

- 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

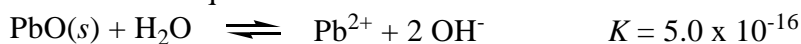


(Things could be a whole lot more complicated; see Harris pp. 151-152.)

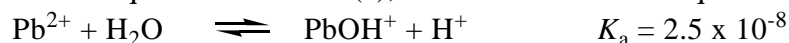
- Iterate until two consecutive predictions of  $[Ca^{2+}]$  agree to two significant figures.
- All of your work should be written out for Iteration #1 (which assumes that  $[Ca^{2+}] = [SO_4^{2-}] = 0$ ) and Iteration #2 (which assumes that  $[Ca^{2+}]$  and  $[SO_4^{2-}]$  are at the concentrations 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 ( $\mu$ ,  $\gamma(Ca^{2+})$ ,  $\gamma(SO_4^{2-})$ ,  $[Ca^{2+}]$ , 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:  $[Ca^{2+}] = 0.0099 \text{ M}$ ]

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)  $5.0 \times 10^{-9}$  mol  $PbO$ ; (b)  $4.0 \times 10^{-6}$  mol  $PbO$ ]