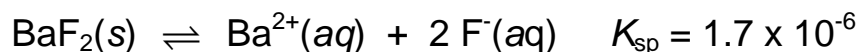


## Chapter 8 Example Problem

### Using Activities to Calculate the Solubility of a Salt

Find the molar solubility ( $S$ ) for  $\text{BaF}_2$  (to two significant figures) in a solution of 0.10 M  $\text{NaF}$ . Take activities into account.



(Forgetting activities for a minute), how would the solubility of  $\text{BaF}_2$  compare in (1) pure  $\text{H}_2\text{O}$  vs. (2) 0.10 M  $\text{NaF}$ ?

- The Concept: Ions in solution help stabilize the  $\text{Ba}^{2+}$  and the  $\text{F}^-$ , which pulls equilibrium to the right—that is, the solubility is increased.
- The Twist: Dissolved  $\text{Ba}^{2+}$  and  $\text{F}^-$  contribute to each other's ionic atmospheres—that is,  $\text{BaF}_2$  can help itself dissolve!
- The Challenge: How do we calculate the ionic strength ( $\mu$ ) if we don't know  $[\text{Ba}^{2+}]$  and  $[\text{F}^-]$ ?

#### Iteration #1

- (a) Make assumptions about  $[\text{Ba}^{2+}]$  and  $[\text{F}^-]$
- (b) Compute  $\mu$ , and activity coefficients  $\gamma(\text{Ba}^{2+})$  and  $\gamma(\text{F}^-)$ , based on your assumptions
- (c) Compute new values of  $[\text{Ba}^{2+}]$  and  $[\text{F}^-]$
- (d) If the calculated  $[\text{Ba}^{2+}]$  and  $[\text{F}^-]$  values agree with the assumed values (to the given number of significant figures), you can quit and go home! But if not...

#### Iteration #2, #3, ...

- (a) Re-compute  $\mu$ , and activity coefficients  $\gamma(\text{Ba}^{2+})$  and  $\gamma(\text{F}^-)$ , based on your new values of  $[\text{Ba}^{2+}]$  and  $[\text{F}^-]$
- (b) Re-compute  $[\text{Ba}^{2+}]$  and  $[\text{F}^-]$
- (c) Repeat Steps (a) and (b) until two successive iterations give the same values of  $[\text{Ba}^{2+}]$  and  $[\text{F}^-]$  to a given number of significant figures (that is, until the calculation has converged)