N41

[14] When solid BaF₂ is added to H₂O the following equilibrium is established.

$$BaF_2(s) \implies Ba^{2+}(aq) + 2 F(aq)$$
 $K_{sp} = 1.5 \times 10^{-6} \text{ at } 25 \text{ °C}$

- a. Calculate the molar solubility of barium fluoride at 25 °C.
- b. Explain how adding each of the following substances affects the solubility of BaF2 in water.
 - i. 0.10 M Ba(NO₃)₂
 - ii. 0.10 M HNO3
- c. In an experiment to determine the K_{sp} of PbF₂ a student starts with 0.10 M Pb(NO₃)₂ and 0.10 M KF and uses the method of serial dilutions to find the lowest [Pb²⁻¹] and [F] that form a precipitate when mixed. If the student uses the concentration of the ions in the combined solution to determine K_{sp}, will the value of K_{sp} calculated be too large, too small or just right? Explain.

$$K_{\rm sp}$$
 for PbF₂ = 4.0×10^{-8}

- d. i. In a solution of 0.010 M barium nitrate and 0.010 M lead(II) nitrate, which will precipitate first, BaF₂ or PbF₂, as NaF(s) is added? Assume volume changes are negligible. Explain (support your answer with calculations).
 - ii. When the more soluble fluoride begins to precipitate, what is the concentration of the cation for the less soluble fluoride that remains in solution?

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