

Ionic Equilibria in Water



#7

For CaF_2 the solubility in water $S = 1,7 \cdot 10^{-3}$ g per 100 mL solution. The molar mass of CaF_2 is $78.1 \frac{\text{g}}{\text{mol}}$. Calculate the solubility product of CaF_2 .

Solution

$$S = \frac{1,7 \times 10^{-3} \text{ g}}{100 \times 10^{-3} \text{ L}} = 1,7 \times 10^{-2} \frac{\text{g}}{\text{L}} = \frac{1,7 \times 10^{-2} \text{ g}}{78,1 \frac{\text{g}}{\text{mol}}} = 2,2 \times 10^{-4} \frac{\text{mol}}{\text{L}}$$



When $2,2 \times 10^{-4} \frac{\text{mol}}{\text{L}}$ CaF_2 dissolves,

$$[\text{Ca}^{2+}] = 2,2 \times 10^{-4} \frac{\text{mol}}{\text{L}} \text{ and } [\text{F}^{-}] = 2 \times 2,2 \times 10^{-4} \frac{\text{mol}}{\text{L}} = 4,4 \times 10^{-4} \frac{\text{mol}}{\text{L}}.$$

With this values we find for K_{sp} :

$$K_{\text{sp}} = [\text{Ca}^{2+}] \times [\text{F}^{-}]^2 = (2,2 \times 10^{-4} \frac{\text{mol}}{\text{L}}) \times (4,4 \times 10^{-4} \frac{\text{mol}}{\text{L}})^2 = 4,3 \times 10^{-11} \left(\frac{\text{mol}^3}{\text{L}^3} \right)$$