has only one value for a given solid at a given temperature. The *solubility* of a solid is an equilibrium position that represents the amount of the solid required to form a saturated solution with a specific amount of solvent. It has an infinite number of possible values at a given temperature and is dependent on other conditions, such as the presence of a common ion.

SAMPLE PROBLEM B

Calculate the solubility product constant, K_{sp}, for copper(I) chloride, CuCl, given that the solubility of this compound at 25°C is 1.08×10^{-2} g/100. g H_2O.

SOLUTION

1 **ANALYZE**
Given: solubility of CuCl $= 1.08 \times 10^{-2}$ g CuCl/100. g H_2O
Unknown: K_{sp}

2 **PLAN**
Start by converting the solubility of CuCl in g/100. g H_2O to mol/L. You will need the molar mass of CuCl to get moles CuCl from grams CuCl. Then use the solubility of the $[Cu^+]$ and $[Cl^-]$ ions in the K_{sp} expression and solve for K_{sp}.

$$\frac{\text{g CuCl}}{100.\text{ g } H_2O} \times \frac{1 \text{ g } H_2O}{1 \text{ mL } H_2O} \times \frac{1000 \text{ mL}}{1 \text{ L}} \times \frac{1 \text{ mol CuCl}}{\text{g CuCl}} = \text{solubility in mol/L}$$

$$CuCl(s) \rightleftharpoons Cu^+(aq) + Cl^-(aq)$$
$$K_{sp} = [Cu^+][Cl^-]$$
$$[Cu^+] = [Cl^-] = \text{solubility in mol/L}$$

3 **COMPUTE**
The molar mass of CuCl is 99.0 g/mol.

$$\text{solubility} = \frac{1.08 \times 10^{-2} \text{ g CuCl}}{100.\text{ g } H_2O} \times \frac{1 \text{ g } H_2O}{1 \text{ mL}} \times \frac{1000 \text{ mL}}{1 L} \times \frac{1 \text{ mol CuCl}}{99.0 \text{ g CuCl}} =$$

$$1.09 \times 10^{-3} \text{ mol/L CuCl}$$

$$[Cu^+] = [Cl^-] = 1.09 \times 10^{-3} \text{ mol/L}$$
$$K_{sp} = (1.09 \times 10^{-3})(1.09 \times 10^{-3}) = 1.19 \times 10^{-6}$$

4 **EVALUATE**
The answer contains the proper number of significant figures and is close to the K_{sp} value given in **Table 3.**

PRACTICE
Answers in Appendix E

1. Calculate the solubility product constant, K_{sp}, of lead(II) chloride, $PbCl_2$, which has a solubility of 1.0 g/100. g H_2O at 20°C.

2. A 5.0 gram sample of Ag_2SO_4 will dissolve in 1.0 L of water. Calculate the solubility product constant for this salt.

extension
Go to **go.hrw.com** for more practice problems that ask you to calculate solubility product constants.

Keyword: HC6EQUX