its ions in a saturated solution, each raised to the power that is the coefficient of that ion in the balanced chemical equation.

$$K_{sp} = [Ag^+][Cl^-]$$

This equation is the solubility equilibrium expression for the reaction. It expresses the fact that the solubility product constant, K_{sp}, of AgCl is the product of the molar concentrations of its ions in a saturated solution.

Calcium fluoride is another sparingly soluble salt. The equilibrium in a saturated CaF_2 solution is described by the following equation.

$$CaF_2(s) \rightleftharpoons Ca^{2+}(aq) + 2F^-(aq)$$

The solubility product constant has the following form.

$$K_{sp} = [Ca^{2+}][F^-]^2$$

Notice that this constant is the product of the molar concentration of Ca^{2+} ions and the molar concentration of F^- ions squared, as required by the general chemical equilibrium expression.

The numerical value of K_{sp} can be determined from solubility data. These data indicate that a maximum of 1.9×10^{-4} g of AgCl can dissolve in 100. g of water at 25°C. One mole of AgCl has a mass of 143.32 g. The saturation concentration, or solubility, of AgCl can therefore be expressed in moles per liter of water, which is very nearly equal to moles per liter of solution.

$$\frac{1.9 \times 10^{-4}\ \text{g AgCl}}{100.\ \text{g } H_2O} \times \frac{1\ \text{g } H_2O}{1\ \text{mL } H_2O} \times \frac{1000\ \text{mL}}{1\ \text{L}} \times \frac{1\ \text{mol AgCl}}{143.32\ \text{g AgCl}}$$
$$= 1.3 \times 10^{-5}\ \text{mol/L}$$

Silver chloride dissociates in solution, contributing equal numbers of Ag^+ and Cl^- ions. The ion concentrations in the saturated solution are therefore 1.3×10^{-5} mol/L.

$$[Ag^+] = 1.3 \times 10^{-5}$$
$$[Cl^-] = 1.3 \times 10^{-5}$$

and

$$K_{sp} = [Ag^+][Cl^-]$$
$$K_{sp} = (1.3 \times 10^{-5})(1.3 \times 10^{-5})$$
$$K_{sp} = (1.3 \times 10^{-5})^2$$
$$K_{sp} = 1.7 \times 10^{-10}$$

This result is the solubility product constant of AgCl at 25°C.

The solubility of CaF_2 is 8.6×10^{-3} g/100 g of water at 25°C. Expressed in moles per liter, as before, this concentration becomes 1.1×10^{-3} mol/L. CaF_2 dissociates in solution to yield twice as many F^- ions as