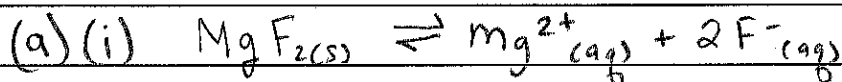


## AP Free Response Practice #3 [2013 #1, modified, 6 points]

1. Answer the following questions about the solubility of some fluoride salts of alkaline earth metals.
- a. A student prepares 100. mL of a saturated solution of  $\text{MgF}_2$  by adding 0.50 g of solid  $\text{MgF}_2$  to 100. mL of distilled water at  $25^\circ\text{C}$  and stirring until no more solid dissolves. (Assume that the volume of the undissolved  $\text{MgF}_2$  is negligibly small.) The saturated solution is analyzed, and it is determined that  $[\text{F}^-]$  in the solution is  $2.4 \times 10^{-3} \text{ M}$ .
- Write the chemical equation for the dissolving of solid  $\text{MgF}_2$  in water. [1 point]
  - Calculate the number of moles of  $\text{MgF}_2$  that dissolved. [2 points]
  - Determine the value of the solubility-product constant,  $K_{sp}$ , for  $\text{MgF}_2$  at  $25^\circ\text{C}$ . [3 points]



$$(ii) K_{sp} = [\text{Mg}^{2+}][\text{F}^-]^2 = x(2x)^2$$

$$[\text{F}^-] = 2x = 2.4 \times 10^{-3} \text{ M} \Rightarrow x = \frac{2.4 \times 10^{-3}}{2} = 1.2 \times 10^{-3} \text{ M}$$

$$1.2 \times 10^{-3} \text{ M} \times 0.100 \text{ L} = 1.2 \times 10^{-4} \text{ mol MgF}_2 \text{ dissolved}$$

$$(iii) K_{sp} = x(2x)^2 = 4x^3 = 4(1.2 \times 10^{-3})^3 = 6.9 \times 10^{-9}$$