Practice Questions Section 2.5

The Concentration of Ions in Solution

1. Write balanced reaction equation that show which ions are produced when the following substances are dissolved in water.

    a. lithium hydroxide

    b. potassium phosphate

    c. strontium chloride

    d. chromium(III) sulfate

2. Iron(III) nitrate has a solubility of 0.15 M. Find concentration of the ions in solution.

3. Calculate ion concentrations in a 2.00 L solution containing 17.1 g aluminum sulfate, $Al_2(SO_4)_3$

Practice Questions Section 2.5

The Concentration of Ions in Solution Answers

1. Write balanced reaction equation that show which ions are produced when the following substances are dissolved in water.

   a. lithium hydroxide $LiOH_{(s)} \rightarrow Li^+_{(aq)} + OH^-_{(aq)}$

   b. potassium phosphate $K_3PO_{4\,(s)} \rightarrow 3\ K^+_{(aq)} + PO_4^{3-}{}_{(aq)}$

   c. strontium chloride $SrCl_{2(s)} \rightarrow Sr^{2+}_{(aq)} + 2\ Cl^-_{(aq)}$

   d. chromium(III) sulfate $Cr_2(SO_4)_{3\,(s)} \rightarrow 2\ Cr^{3+}_{(aq)} + 3\ SO_4^{2-}{}_{(aq)}$

2. Iron(III) nitrate has a solubility of 0.15 M. Find concentration of the ions in solution.

   Solution:

   Begin by writing a balanced dissociation equation:

   $$Fe(NO_3)_3 \rightarrow Fe3^+_{(aq)} + 3\ NO_3^-{}_{(aq)}$$

   The concentration of the ions can be determined from the balancing coefficients from the equation:

   $$[Fe^{3+}] = 1\times [Fe(NO_3)_3] = 1 \times 0.15 = 0.15\ M$$

   $$[NO_3^-] = 3\times [Fe(NO_3)_3] = 3 \times 0.15 = 0.45\ M$$

3. Calculate ion concentrations in a 2.00 L solution containing 17.1 g aluminum sulfate, $Al_2(SO_4)_3$

   Solution:

   Before calculating the concentration of the ions, we must first calculate the concentration of the aluminum sulfate solution.

   We will need to find the molar mass of $Al_2(SO_4)_3$:

2 Al = 2 × 27.0	=	54.0 g·mol^{-1}
3 S = 3× 32.0.0	=	96.0 g·mol^{-1}
12 O = 12 × 16.0	=	192.0 g·mol^{-1}
$Al_2(SO_4)_3$	=	342.0 g·mol^{-1}

   Calculate the concentration of $Al_2(SO_4)_3$:

   $$\frac{mol}{L} = 17.1\ \ g \times \frac{1mol}{342.0g} \times \frac{1}{2.0L} = \frac{0.0249mol}{L} \quad \text{or} \quad 0.0249M$$

   Write a balanced equation for the dissociation reaction:

   $$Al_2(SO_4)_3 \rightarrow 2\ Al^{3+}_{(aq)} + 3\ SO_4^{2-}{}_{(aq)}$$

   Using the balanced equation, calculate the concentration of the individual ions:

   $$[Al^{3+}] = 2\times [Al_2(SO_4)_3] = 2 \times 0.0249 = 0.0498\ M \text{ or } 4.98 \times 10^{-2} M$$

   $$[SO42-] = 3\times [Al_2(SO_4)_3] = 3 \times 0.0249 = 0.0747\ M \text{ or } 7.47\times 10^{-2} M$$