

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, $\text{Al}_2(\text{SO}_4)_3$

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Answers

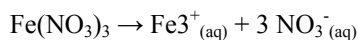
1. Write balanced reaction equation that show which ions are produced when the following substances are dissolved in water.

- a. lithium hydroxide $\text{LiOH}_{(s)} \rightarrow \text{Li}^+_{(aq)} + \text{OH}^-_{(aq)}$
- b. potassium phosphate $\text{K}_3\text{PO}_4(s) \rightarrow 3 \text{K}^+_{(aq)} + \text{PO}_4^{3-}_{(aq)}$
- c. strontium chloride $\text{SrCl}_2(s) \rightarrow \text{Sr}^{2+}_{(aq)} + 2 \text{Cl}^-_{(aq)}$
- d. chromium(III) sulfate $\text{Cr}_2(\text{SO}_4)_3(s) \rightarrow 2 \text{Cr}^{3+}_{(aq)} + 3 \text{SO}_4^{2-}_{(aq)}$

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:



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

$$[\text{Fe}^{3+}] = 1 \times [\text{Fe}(\text{NO}_3)_3] = 1 \times 0.15 = 0.15 \text{ M}$$

$$[\text{NO}_3^-] = 3 \times [\text{Fe}(\text{NO}_3)_3] = 3 \times 0.15 = 0.45 \text{ M}$$

3. Calculate ion concentrations in a 2.00 L solution containing 17.1 g aluminum sulfate, $\text{Al}_2(\text{SO}_4)_3$

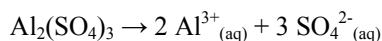
Solution:

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

	$2 \text{ Al} = 2 \times 27.0$	$=$	$54.0 \text{ g}\cdot\text{mol}^{-1}$
We will need to find the molar mass of $\text{Al}_2(\text{SO}_4)_3$:	$3 \text{ S} = 3 \times 32.0$	$=$	$96.0 \text{ g}\cdot\text{mol}^{-1}$
	$12 \text{ O} = 12 \times 16.0$	$=$	$192.0 \text{ g}\cdot\text{mol}^{-1}$
Calculate the concentration of $\text{Al}_2(\text{SO}_4)_3$:	$\text{Al}_2(\text{SO}_4)_3$	$=$	$\frac{342.0 \text{ g}\cdot\text{mol}^{-1}}{\quad}$

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

Write a balanced equation for the dissociation reaction:



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

$$[\text{Al}^{3+}] = 2 \times [\text{Al}_2(\text{SO}_4)_3] = 2 \times 0.0249 = 0.0498 \text{ M or } 4.98 \times 10^{-2} \text{ M}$$

$$[\text{SO}_4^{2-}] = 3 \times [\text{Al}_2(\text{SO}_4)_3] = 3 \times 0.0249 = 0.0747 \text{ M or } 7.47 \times 10^{-2} \text{ M}$$