Chapter 6

Supplementary *Check for Understanding* Problems

Formation of Aqueous Solutions

1.   A teaspoon of salt will readily dissolve in a pot of water. What happens to the salt concentration as the solution boils? Explain.

2.   Describe how an ionic compound dissolves in water. How are the strong electrostatic forces in the ionic solid overcome? How are the dissolved cations and anions prevented from recombining to form the solid?

3.   Use the model for an ionic compound dissolving in water to explain why smaller solute particles dissolve faster than large ones.

4.   Why is a concentrated solution of an ionic compound a good conductor of electricity?

5.   Why is a sugar solution a very poor conductor of electricity?

6.   What does the label "concentrated HNO_3" on a bottle mean?

Solution Mass Percent

1.   An aqueous NaCl solution that is 3.2% by mass NaCl contains _____ g NaCl for every _____ g water.

2.   Calculate the mass in grams of KCl in 18.6 g of a solution that is 0.15% KCl by mass.

3.   What mass of a solution that is 4.8% by mass $NaHCO_3$ is needed to obtain 75 g $NaHCO_3$?

Molarity

1.   Which of the following are needed to calculate the molarity of an aqueous solution? Select all that apply. Explain your answer.

     A. the mass of the solute

     B. the molar mass of the solute

     C. the volume of water added

     D. the total volume of the solution

E. the solution density

2.   What is the sodium ion molarity in a 0.115 M Na_3PO_4 solution?

3.   What is the molarity of a solution prepared from 5.62 g NH_4NO_3 dissolved in water and diluted to 125 mL?

4.   What volume (in mL) of a 0.204 M NaOH solution contains 8.53 g NaOH?

5.   How many moles of NaF are present in 22.9 mL of a 5.16 mM NaF solution?

6.   What mass of $Na_2C_2O_4$ is needed to prepare 75.0 mL of a 0.226 M $Na_2C_2O_4$ solution?

7.   What is the nitrate ion molarity in a solution prepared from 26.8 mg aluminum nitrate dissolved in water and diluted to 0.750 L?

8.   What is the density of a 15.8 M HNO_3 aqueous solution if it is 70.4% by mass HNO_3?

Dilutions

1.   Explain why the equation $M_1V_1 = M_2V_2$ works for solving dilution problems.

2.   If a salt solution is diluted by adding a volume of water equal to 50% of the solution volume, by what factor has the salt concentration been diluted? Assume that the volumes are additive.

3.   How many milliliters of 14.8 M H_3PO_4 are needed to prepare 2.50 L of 3.0 M H_3PO_4?

Solution Stoichiometry

1.   Barium sulfate is an exception to the rule that sulfates tend to be soluble in water. How many milliters of 0.25 M Na_2SO_4 are needed to precipitate all of the barium as $BaSO_4$ from 10.0 mL of 0.15 M $Ba(NO_3)_2$?

$$Ba(NO_3)_2(aq) + Na_2SO_4(g) \rightarrow BaSO_4(s) + 2NaNO_3(aq)$$
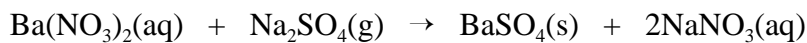
2.   If 35.0 mL of a 0.162 M $CaCl_2$ solution are added to 20.0 mL of 0.211 M Na_2CO_3, what is the maximum number of moles of $CaCO_3$ that can form?

Acid-Base Neutralizations

1.   If 33.3 mL of 0.150 M HCl are needed to neutralize 0.0250 L of a NaOH solution, what is the molarity of the NaOH?

2.   How many milliliters of 0.150 M HCl are needed to completely react 0.245 g Na_2CO_3?

$$Na_2CO_3(s) + 2HCl(aq) \rightarrow 2NaCl(aq) + H_2O(l) + CO_2(g)$$