Practice Problems
In your notebook, solve the following problems.

SECTION 16.1 PROPERTIES OF SOLUTIONS
1. The solubility of \( \text{CO}_2 \) in water at 1.22 atm is 0.54 g/L. What is the solubility of carbon dioxide at 1.86 atm? Assume that temperature is constant.

2. What mass of KCl will produce a saturated solution in 500.0 g of water at 20°C? The solubility of KCl at 20°C is 34.0 g/100 g H\(_2\)O.

3. A saturated solution of silver nitrate is prepared in 100.0 g of water at 20°C. The solution is then heated to 50.0°C. How much more silver nitrate must now be added to obtain a saturated solution? (Use Table 16.1.)

SECTION 16.2 CONCENTRATIONS OF SOLUTIONS
1. Calculate the molarity of each of the following solutions.
   a. 0.40 mol of NaCl dissolved in 1.6 L of solution
   b. 20.2 g of potassium nitrate, KNO\(_3\), in enough water to make 250.0 mL of solution

2. Calculate the number of grams of solute needed to prepare each of the following solutions.
   a. 2500.0 mL of a 3.0 M solution of potassium hydroxide, KOH
   b. 2.0 liters of 2.0 M nitric acid, HNO\(_3\), solution

3. What is the molarity of a solution that contains 212.5 g of sodium nitrate (NaNO\(_3\)) in 3.0 liters of solution?

4. You must prepare 300.0 mL of 0.750 M NaBr solution using 2.00 M NaBr stock solution. How many milliliters of stock solution should you use?

5. In order to dilute 1.0 L of a 6.00 M solution of NaOH to 0.500 M solution, how much water must you add?

6. What is the concentration in percent by volume, \%(v/v), of the following solutions?
   a. 60.0 mL of methanol in a total volume of 500.0 mL
   b. 25.0 mL of rubbing alcohol (C\(_2\)H\(_5\)OH) diluted to a volume of 200.0 mL with water

7. How many grams of solute are needed to prepare each of the following solutions?
   a. 1.00 L of a 3.00\% (m/m) NaCl solution?
   b. 2.00 L of 5.00\% (m/m) KNO\(_3\) solution?
Chapter 19 Acids, Bases, and Salts

Practice Problems

In your notebook, solve the following problems.

SECTION 19.1 ACID–BASE THEORIES

1. Identify the hydrogen ion donor(s) and hydrogen ion acceptor(s) for ionization of \( \text{H}_2\text{SO}_4 \) in water. Label the conjugate acid–base pairs.

2. Identify all of the ions that may be formed when \( \text{H}_3\text{PO}_4 \) ionizes in water.

3. Classify the following acids as monoprotic, diprotic, or triprotic.
   a. \( \text{HCOOH} \)
   b. \( \text{HBr} \)
   c. \( \text{H}_2\text{SO}_3 \)
   d. \( \text{H}_3\text{ClO}_4 \)

4. What would you expect to happen when lithium metal is added to water? Show the chemical reaction.

5. In the following chemical reaction, identify the Lewis acid and base.
   \[ \text{BF}_3 + \text{F}^- \rightleftharpoons \text{BF}_4^- \]

6. Describe some distinctive properties of acids.

7. Describe some distinctive properties of bases.

SECTION 19.2 HYDROGEN IONS AND ACIDITY

1. A solution has a hydrogen ion concentration of \( 1 \times 10^{-6} \text{M} \). What is its pH?

2. What is the pH of a solution if the \( [\text{H}^+] = 7.2 \times 10^{-9} \text{M} \)?

3. What is the pOH of a solution if the \( [\text{OH}^-] = 3.5 \times 10^{-2} \text{M} \)?

4. What is the pOH of a solution that has a pH of 3.4?

5. Classify each solution as acidic, basic, or neutral.
   a. \( [\text{H}^+] = 2.5 \times 10^{-9} \text{M} \)
   b. \( \text{pOH} = 12.0 \)
   c. \( [\text{OH}^-] = 9.8 \times 10^{-11} \text{M} \)
   d. \( [\text{H}^+] = 1 \times 10^{-7} \text{M} \)
   e. \( \text{pH} = 0.8 \)
   f. \( [\text{OH}^-] = 2.2 \times 10^{-7} \text{M} \)

6. Calculate the pH of each solution.
   a. \( [\text{H}^+] = 1 \times 10^{-3} \text{M} \)
   b. \( [\text{H}^+] = 4.4 \times 10^{-11} \text{M} \)
   c. \( [\text{OH}^-] = 2.2 \times 10^{-7} \text{M} \)
   d. \( \text{pOH} = 1.4 \)

7. Classify the solutions in problem 6 as acidic or basic.

8. Why is there a minus sign in the definition of pH?

9. A solution has a pOH of 12.4. What is the pH of this solution?

10. What is the pH of a solution with \( [\text{H}^+] = 1 \times 10^{-3} \text{M} \)?