CHAPTER 19

Assessment

Reviewing Content

.1 Acid-Base Theories

. How did Arrhenius describe acids and bases?

. Classify each compound as an Arrhenius acid or an Arrhenius base.

a. $Ca(OH)_2$ **b.** HNO_3 **c.** KOH
d. C_2H_5COOH **e.** HBr **f.** H_2SO_4

. Write an equation for the dissociation of each compound in water.

a. potassium hydroxide
b. magnesium hydroxide

. Write balanced equations for the reaction of each metal with water.

a. lithium **b.** barium

. Identify each reactant in the following equations as a hydrogen-ion donor (acid) or a hydrogen-ion acceptor (base).

a. $HNO_3 + H_2O \longrightarrow H_3O^+ + NO_3^-$
b. $CH_3COOH + H_2O \rightleftharpoons H_3O^+ + CH_3COO^-$
c. $NH_3 + H_2O \rightleftharpoons NH_4^+ + OH^-$
d. $H_2O + CH_3COO^- \rightleftharpoons CH_3COOH + OH^-$

. Label the conjugate acid-base pairs in each equation in Problem 48.

. What is a Lewis acid? A Lewis base? In what sense is the Lewis theory more general than the Arrhenius and Brønsted-Lowry theories?

.2 Hydrogen Ions and Acidity

. Write an equation showing the ionization of water.

. What are the concentrations of H^+ and OH^- in pure water at 25°C?

. How is the pH of a solution calculated?

. Why is the pH of pure water at 25°C equal to 7.00?

. Calculate the pH for the following solutions and indicate whether each solution is acidic or basic.

a. $[H^+] = 1 \times 10^{-2} M$
b. $[OH^-] = 1 \times 10^{-2} M$
c. $[OH^-] = 1 \times 10^{-8} M$

. What are the hydroxide-ion concentrations for solutions with the following pH values?

a. 4.00 **b.** 8.00 **c.** 12.00

. Calculate the pH or $[H^+]$ for each solution.

a. $[H^+] = 2.4 \times 10^{-6} M$ **b.** pH = 13.20

19.3 Strengths of Acids and Bases

58. Identify each compound as a strong or weak acid or base.

a. NaOH **b.** HCl **c.** NH_3 **d.** H_2SO_4

59. Would a strong acid have a large or a small K_a? Explain.

60. Why are $Mg(OH)_2$ and $Ca(OH)_2$ considered to be strong bases even though their saturated solutions are only mildly basic?

61. Write the expression for K_a for each acid. Assume only one hydrogen is ionized.

a. HF **b.** H_2CO_3

19.4 Neutralization Reactions

62. Write a general word equation for a neutralization reaction.

63. Identify the products and write balanced equations for each neutralization reaction.

a. $HNO_3(aq) + KOH(aq) \longrightarrow$
b. $HCl(aq) + Ca(OH)_2(aq) \longrightarrow$
c. $H_2SO_4(aq) + NaOH(aq) \longrightarrow$

64. What is characteristic of the end point of a titration?

65. What is the molarity of sodium hydroxide if 20.0 mL of the solution is neutralized by each of the following 1.00*M* solutions?

a. 28.0 mL of HCl
b. 17.4 mL of H_3PO_4

19.5 Salts in Solution

66. What kinds of salts hydrolyze water?

67. Write an equation showing why an aqueous solution of sodium hydrogen carbonate is basic.

68. Explain why solutions of salts that hydrolyze water do not have a pH of 7.

69. Predict whether an aqueous solution of each salt will be acidic, basic, or neutral.

a. $NaHCO_3$ **b.** NH_4NO_3
c. KCl **d.** Na_2CO_3
e. Na_2SO_4 **f.** NH_4Cl

70. A buffered solution cannot absorb an unlimited amount of acid or base. Explain.