

## Chapter 20 REVIEW

### CONCEPT PRACTICE

34. Write formulas for these compounds. 20.1
- nitrous acid
  - aluminum hydroxide
  - hydroselenic acid
  - strontium hydroxide
  - phosphoric acid
  - ethanoic acid
35. Write an equation showing the ionization of water. 20.2
36. What are the concentrations of  $H^+$  and  $OH^-$  in pure water at  $25^\circ C$ ? 20.2
37. How is the pH of a solution calculated? 20.2
38. Why is the pH of pure water at  $25^\circ C$  equal to 7.00? 20.2
39. Calculate the pH for the following solutions and indicate whether each solution is acidic or basic. 20.2
- $[H^+] = 1.0 \times 10^{-2} M$
  - $[OH^-] = 1.0 \times 10^{-2} M$
  - $[OH^-] = 1.0 \times 10^{-6} M$
  - $[H^+] = 1.0 \times 10^{-6} M$
40. What are the hydroxide-ion concentrations for solutions with the following pH values? 20.2
- 4.00
  - 8.00
  - 12.00
41. Calculate the pH or  $[H^+]$  for each solution. 20.2
- $[H^+] = 2.4 \times 10^{-6}$
  - $[H^+] = 9.1 \times 10^{-9}$
  - pH = 13.20
  - pH = 6.70
42. A soft drink has a pH of 3.80. What is the hydrogen-ion concentration in the drink? 20.2
43. Write the reaction for the dissociation of each compound in water. 20.3
- potassium hydroxide
  - magnesium hydroxide
44. How did Arrhenius describe acids and bases? 20.3
45. Classify each as an Arrhenius acid or an Arrhenius base. 20.3
- |               |                 |
|---------------|-----------------|
| a. $Ca(OH)_2$ | d. $C_2H_3COOH$ |
| b. $HNO_3$    | e. $HBr$        |
| c. $KOH$      | f. $H_2SO_4$    |
46. Identify each acid in Problem 45 as monoprotic, diprotic, or triprotic. 20.3
47. Write balanced equations for the reaction of each metal with water. 20.3
- lithium
  - barium
48. Identify each reactant in the following equations as a hydrogen-ion donor (acid) or a hydrogen-ion acceptor (base). 20.3
- $HNO_3 + H_2O \rightleftharpoons H_3O^+ + NO_3^-$
  - $CH_3COOH + H_2O \rightleftharpoons H_3O^+ + CH_3COO^-$
  - $NH_3 + H_2O \rightleftharpoons NH_4^+ + OH^-$
  - $H_2O + CH_3COO^- \rightleftharpoons CH_3COOH + OH^-$
49. Label the conjugate acid-base pairs in each equation in Problem 48. 20.3
50. What is an amphoteric substance? 20.3
51. What is a Lewis acid? A Lewis base? In what sense is the Lewis theory more general than the Arrhenius and Brønsted-Lowry theories? 20.3
52. Identify each compound as a strong or weak acid or base. 20.4
- $NaOH$
  - $HCl$
  - $NH_3$
  - $H_2SO_4$
53. Would a strong acid have a large or a small  $K_a$ ? Explain. 20.4
54. Why are  $Mg(OH)_2$  and  $Ca(OH)_2$  considered to be strong bases even though their saturated solutions are only mildly basic? 20.4
55. Write the expression for  $K_a$  for each acid. Assume only one hydrogen is ionized. 20.4
- $HI$
  - $H_2CO_3$
56. A 0.0250M solution of  $KHCrO_4$  has a pH of 3.50. Calculate the  $K_a$  for the equilibrium between  $HCrO_4^-$  and  $CrO_4^{2-}$ . 20.4

### CONCEPT MASTERY

57. Is it possible to have a concentrated weak acid? Explain.
58. Write equations showing that the hydrogen phosphate ion ( $HPO_4^{2-}$ ) is amphoteric.
59. The pH of a 0.50M  $HNO_2$  solution is 1.83. What is the  $K_a$  of this acid?
60. Write the formula and name of the conjugate base of each Brønsted-Lowry acid.
- |              |              |
|--------------|--------------|
| a. $HCO_3^-$ | c. $NH_4^+$  |
| b. $HI$      | d. $H_2SO_3$ |

## Chapter 21 REVIEW

### CONCEPT MASTERY

36. Write a general word equation for a neutralization reaction. 21.1
37. Identify the products and write balanced equations for each neutralization reaction. 21.1
- $\text{HNO}_3(\text{aq}) + \text{KOH}(\text{aq}) \longrightarrow$
  - $\text{HCl}(\text{aq}) + \text{Ca}(\text{OH})_2(\text{aq}) \longrightarrow$
  - $\text{H}_2\text{SO}_4(\text{aq}) + \text{NaOH}(\text{aq}) \longrightarrow$
38. What is characteristic of the end point of a titration? 21.1
39. What is the molarity of sodium hydroxide if 20.0 mL of the solution is neutralized by each of the following 1.00M solutions? 21.1
- 28.0 mL of HCl
  - 17.4 mL of  $\text{H}_3\text{PO}_4$
40. Determine the gram equivalent mass and the equivalents per mole for each compound. 21.1
- KOH
  - HCl
  - $\text{H}_2\text{SO}_4$
41. How many equivalents is each compound? 21.1
- 3.7 g  $\text{Ca}(\text{OH})_2$
  - 9.8 g  $\text{H}_3\text{PO}_4$
  - 189 g  $\text{H}_2\text{SO}_4$
42. How is the normality of a solution calculated? 21.1
43. What is the normality of each solution? 21.1
- 1M NaOH
  - 2M  $\text{HNO}_3$
  - 0.2M KOH
  - 0.1M  $\text{H}_2\text{SO}_4$
44. Determine the normality of each solution. 21.1
- 250 mL of solution containing 10 g NaOH
  - 750 mL of solution containing 4.9 g  $\text{H}_2\text{SO}_4$
  - 270 mL of solution containing 0.74 g HCl
  - 2.80 L of solution containing 18.6 g  $\text{HNO}_3$
  - 7.3 g HCl in 250 mL of solution
  - 18.4 g  $\text{HNO}_3$  in 1250 mL of solution
45. A student titrated several solutions of unknown concentration with various standard solutions to the point of neutralization. The volume of each unknown solution and the volume and normality of the standard solution used are given below. Calculate the normality for each unknown. 21.1
- 25.0 mL  $\text{H}_2\text{SO}_4$  required 15.0 mL of 0.100N NaOH
  - 10.0 mL NaOH required 20.0 mL of 0.200N HCl
  - 17.5 mL NaOH required 25.0 mL of 0.120N  $\text{HNO}_3$
  - 50.0 mL  $\text{CH}_3\text{COOH}$  required 39.6 mL of 0.0950N KOH

46. What kinds of salts hydrolyze water? 21.2
47. Write an equation showing why an aqueous solution of sodium hydrogen carbonate is basic. 21.2
48. Explain why solutions of salts that hydrolyze water do not have a pH of 7. 21.2
49. Predict whether an aqueous solution of each salt will be acidic, basic, or neutral. 21.2
- $\text{NaHCO}_3$
  - $\text{NH}_4\text{NO}_3$
  - KCl
  - $\text{Na}_2\text{CO}_3$
  - $\text{Na}_2\text{SO}_4$
  - $\text{NH}_4\text{Cl}$
50. A buffered solution cannot absorb an unlimited amount of acid or base. Explain. 21.2
51. Would a solution of HCl and NaCl be a good buffer? Explain. 21.2
52. Write the solubility product expression for each salt. 21.2
- NiS
  - $\text{BaCO}_3$
53. What does the solubility product constant ( $K_{sp}$ ) represent? 21.2
54. Use Table 21.4 on page 632 to rank these salts from most soluble to least soluble. 21.2
- CuS
  - $\text{BaSO}_4$
  - $\text{SrCO}_3$
  - AgI
55. How does the addition of a common ion affect the solubility of another substance? 21.2

### CONCEPT MASTERY

56. The graph shows the number of millimoles (mmol) of water formed by the dropwise addition of 1.0N HCl to a 25.0-mL sample of NaOH of unknown concentration.
- Write an equation for the reaction.
  - Estimate the concentration of NaOH.

