## CHAPTER 9

1. Which one of the following is the acid in vinegar?
   a. acetic acid
   b. citric acid
   c. muriatic acid
   d. ascorbic acid

   ANS: a

2. Which is a basic or alkaline substance?
   a. gastric fluid
   b. black coffee
   c. vitamin C
   d. oven cleaner

   ANS: d

3. Which is an acidic substance?
   a. household ammonia
   b. soap
   c. aspirin
   d. oven cleaner

   ANS: c

4. Which of the following is a property of bases?
   a. feel slippery to the touch
   b. have pH below 7
   c. turn blue litmus red
   d. neutralize substances like NaOH

   ANS: a

5. Which of the following is associated with stomach fluid?
   a. $HNO_3$
   b. $H_3PO_4$
   c. HCl
   d. $H_3PO_4$ and HCl

   ANS: c

6. Which equation represents a neutralization reaction?

a. $KCl + H_2O \text{ -----> } K^+(aq) + Cl^-(aq)$

b. $H^+(aq) + OH^-(aq) \text{ ------> } H_2O$

c. $HCl + H_2O \text{ ----> } H_3O^+(aq) + Cl^-(aq)$

d. $NaOH + H_2O \text{ -------> } Na^+(aq) + OH^-(aq)$

ANS: b

7. Which equation represents the neutralization of acidic gastric fluid?

a. $2\ HNO_3(aq) + Mg(OH)_2(aq) \text{ -----> } Mg(NO_3)_2(aq) + 2\ H_2O$

b. $H^+(aq) + OH^+(aq) \text{ --------> } H_2O$

c. $2\ HCl(aq) + Mg(OH)_2(aq) \text{ ----> } 2\ H_2O + MgCl_2(aq)$

d. $NaOH + H_2O \text{ ------> } Na^+(aq) + OH^-(aq)$

ANS: c

8. The strength of an acid is related to its

a. extent of ionization
b. reaction with a salt
c. concentration
d. commercial ranking in the economy

ANS: a

9. Carbonic acid, $H_2CO_3(aq)$ is present in

a. eye drops
b. milk
c. carbonated beverages
d. vinegar

ANS: c

10. Which reactant substance is the base, in the following reaction,

$NH_3(g) + H_2O(l)$ ----------> $NH_4^+(aq) + OH^-(aq)$ ?

a. $OH^-$
b. $NH_4^+$
c. $H_2O$
d. $NH_3$

ANS: d

11. What volume (in liters) of 1 M NaOH contains 40 g sodium hydroxide?
a. 100 L
b. 1 L
c. 10 L
d. 1000 L

ANS: b

12. Which of the following indicates a basic solution?
a. pH = 7
b. pH < 7
c. pH = 11
d. pH = 0

ANS: c

13. In an acidic solution,

a. $[H_3O^+]$ is greater than $[OH^-]$
b. $[H_3O^+]$ equals $[OH^-]$
c. $[OH^-]$ is greater than $[H_3O^+]$
d. none of these

ANS: a

14. Which common substance would have a pH less than 7?
a. milk of magnesia
b. wine
c. borax solution
d. bleach

ANS: b

15. A buffer is a mixture that
    a. maintains pH
    b. causes a solution not to conduct electricity
    c. neutralize salts
    d. causes high blood pressure

    ANS: a

16. An ion commonly found in many antacids is
    a. $OH^-$
    b. $H_3O^+$
    c. $SO_4^{2-}$
    d. $NH_4^+$

    ANS: a

17. A solution with pH = 4 has
    a. relatively high concentration of $OH^-$
    b. relatively low concentration of $H_3O^+$
    c. zero concentration of $OH^-$
    d. relatively high concentration of $H_3O^+$

    ANS: d

18. What is the pH of a 0.0001 M HCl solution?
    a. $10^{-4}$
    b. 0.0001
    c. –4
    d. 4

    ANS: d

19. What is the pH of a 0.001 M HCl solution?
    a. $10^{-3}$
    b. 0.001
    c. 3
    d. -3

    ANS: c

20. What is the salt formed when an HCl solution reacts with $Mg(OH)_2$?
    a. $MgCl_2$
    b. $Mg_2Cl$
    c. MgCl
    d. $Mg_2Cl_2$

    ANS: a

21. The substance $Ca(OH)_2$ is
    a. an acid
    b. a hydrate
    c. a base
    d. an oxide

    ANS: c

22. Red cabbage can be used as a dye indicator used to measure pH, in basic solutions it has a _____ color.
    a. pink
    b. yellow
    c. red
    d. colorless

    ANS: b

23. Which of the following is a property of acids?
    a. turn red litmus blue
    b. have pH below 7
    c. feel slippery to the touch
    d. neutralize acids

    ANS: b

24. Hydrogen chloride gas has polar covalent molecules. An aqueous solution of HCl conducts electricity. How?
    a. HCl ionizes in water
    b. HCl molecules carry electrons from one electrode to the other electrode
    c. water molecules carry electrons from one electrode to the other electrode
    d. HCl molecules and water molecules carry the current

    ANS: a

25. $H_3O^+$ is the
    a. hydronium ion
    b. hydrogen ion
    c. proton
    d. hydridium ion

    ANS: a

26. What is the pH for a solution with hydrogen ion molarity of 0.01?
    a. -2
    b. 2
    c. 100
    d. $10^{-2}$

    ANS: b

27. If 3 moles of a substance are dissolved in 500 mL (0.5 L) of solution, the molarity of this solution is
    a. 3 M
    b. 1.5 M
    c. 3.5 M
    d. 6 M

    ANS: d

28. The symbol, M, related to concentration of solution, refers to
    a. *much* meaning a very concentrated solution
    b. molal concentration
    c. moles of solute dissolved in a liter of solution
    d. *mixed* meaning the solution has been stirred well

    ANS: c

29. What carries the electrical current in an aqueous NaCl solution?
    a. electrons
    b. ions
    c. the solvent - water
    d. none of the above

    ANS: b

30. How many mols of sulfuric acid, $H_2SO_4(aq)$ are in 2 liters of 18 M $H_2SO_4$?
    a. 9
    b. 20
    c. 36
    d. 98

    ANS: c

31. A base is
    a. an $OH^-$ ion donor
    b. a hydrogen ion donor
    c. a substance like magnesium hydroxide, $Mg(OH)_2$
    d. both a and c

    ANS: d

32. Why is pure water neutral?
    a. pure water has no $H^+$ ions and no $OH^-$ ions
    b. pure water has equal numbers of $H^+$ ions and $OH^-$ ions
    c. pure water has no dissolved carbon dioxide
    d. the pH of pure water at $25^o$ is 0

    ANS: b

33. Which is the weak acid?
    a. HCl
    b. $H_2SO_4$
    c. $HNO_3$
    d. $HC_2H_3O_2$

    ANS: d

34. An acid ion pair such as $H_2CO_3$ and $HCO_3^-$ qualifies as a
    a. strong acid-strong base pair
    b. buffer system
    c. substitute for hemoglobin
    d. acid -base pair

    ANS: b

35. Chemical buffering systems
    a. maintain constant pH
    b. consist of a conjugate acid-base pair
    c. absorb added $H^+$ or $OH^-$ ions
    d. do all of the above

    ANS: d

36. All aqueous solutions of electrolytes must by definition
    a. be acids
    b. be neutral
    c. contain no ions
    d. conduct electricity

    ANS: d

37. The formula of a salt formed from $Ca^{2+}$ and $PO_4^{3-}$ ions is
    a. $CaPO_4$
    b. $Ca_2(PO_4)_3$
    c. $Ca_3(PO_4)_2$
    d. $Ca_3P_2O_4$

    ANS: c

38. What acid is found in stomach fluid?
    a. sulfuric acid, $H_2SO_4$
    b. hydrochloric acid, HCl
    c. citric acid, $HOC(COOH)(CH_2COOH)_2$
    d. acetic acid, $CH_3COOH$

    ANS: b

39. What substance is found in corrosive cleaners?
a. sulfuric acid, $H_2SO_4$
b. hydrochloric acid, HCl
c. sodium hydroxide, NaOH
d. acetic acid, $CH_3COOH$

ANS: c

40. How many mols of phosphoric acid, $H_3PO_4$ are in 0.50 liters of 6 M $H_3PO_4$(aq)?
a. 6.5
b. 24
c. 12
d. 3

ANS: d

41. Which of the following is a strong base?
a. $NH_3$
b. NaOH
c. KOH
d. both b and c

ANS: d

42. Which of the following is true about a solution with pH = 5?
a. the solution is basic
b. the $OH^-$ concentration > $H^+$ concentration
c. the solution is acidic
d. both a and b

ANS: c

43. Which of the following is true about a solution with pH = 8?
a. the solution is basic
b. the $H^+$ concentration equals 0.00000001 M
c. the $OH^-$ concentration > $H^+$ concentration
d. all of these

ANS: d

44. How many acidic hydrogen atoms are in the molecule of acetic acid, $CH_3COOH$?
    a. one
    b. two
    c. three
    d. four

    ANS: a

45. When $H_2SO_3$ dissolves in water, what are the solute particles in the solution?
    a. H, S, O
    b. $H^{1+}$, $S^{1+}$ and $O^{2-}$
    c. $H^{1+}$, $HSO_3^-$ and $SO_3^{2-}$
    d. $H_2^{1+}$ and $SO_3^{2-}$

    ANS: c

46. Identify the acid in the following reaction,

    $NH_3(g) + H_2O(l)$ ----------> $NH_4^+(aq) + OH^-(aq)$ ?

    a. $OH^-$
    b. $NH_4^+$
    c. $H_2O$
    d. $NH_3$

    ANS: c

47. What is the molarity of a solution when 15.0 g of NaCl is dissolved to a final volume of 500 mL with water?
    a. 0.153 M
    b. 117 M
    c. 0.0300 M
    d. 30.0 M

    ANS: a

48. Which pair would make a good buffer?
    a. $H^+/OH^-$
    b. $Na^+/Cl^-$
    c. $HPO_4^{2-}/PO_4^{3-}$
    d. $Na^+/OH^-$

    ANS: c

49. What is the pH of a 0.0525 M HCl solution?
    a. 5.25
    b. 0.0525
    c. 1.28
    d. 3.00

    ANS: c

50. What is the pH of a solution with a $[H_3O^+] = 1.0 \times 10^{-10}$?
    a. $10^{-10}$
    b. 1.0
    c. -10
    d. 10

    ANS: d

51. What is the pH of a 0.00125 M NaOH solution?
    a. 2.90
    b. 11.1
    c. 12.5
    d. 1.25

    ANS: b

52. $OH^-$ is the
    a. hydroxide ion
    b. hydrogen ion
    c. oxygen hydride
    d. hydronium ion

    ANS: a

53. What is the concentration difference between pH = 10 and pH = 7?
    a. 100
    b. 0.001
    c. 3
    d. 1000

    ANS: d

54. What is the hydronium concentration with pH = 9.5?
    a. $3.16 \times 10^{-10}$
    b. $9.50 \times 10^{-10}$
    c. 9.15
    d. $3.16 \times 10^{10}$

    ANS: a