

## chapter 02

### True / False Questions

1. Minerals are organic elements extracted from the soil by plants.

True False

2. Molecules composed of two or more atoms are called compounds.

True False

3. Hydrogen, deuterium, and tritium are three isotopes of hydrogen.

True False

4. Potassium, sodium, and chlorine are trace elements.

True False

5. Ionic bonds break apart in water more easily than covalent bonds do.

True False

6. A solution is a mixture composed of two or more substances that are physically blended but not chemically combined.

True False

7. Blood pH is approximately 7.4, which is slightly acidic.

True False

8. The high heat capacity of water makes it a very ineffective coolant.

True False

9. In an exchange reaction, covalent bonds are broken and new covalent bonds are formed.

True False

10. All the chemical reactions in which larger molecules are broken down to smaller ones are called catabolic reactions.

True False

11. The opposite of a dehydration synthesis is a hydrolysis.

True False

12. Unsaturated fatty acids have as much hydrogen as they can carry.

True False

13. A dipeptide is a molecule with two peptide bonds.

True False

14. All amino acids have both a carboxyl group and an amino group attached to a central carbon.

True False

15. ATP is the body's most important form of long-term energy storage.

True False

### Multiple Choice Questions

16. The most abundant element in the human body, by weight, is

- A. nitrogen.
- B. hydrogen.
- C. carbon.
- D. oxygen.
- E. calcium.

17. Sodium has an atomic number of 11 and an atomic mass of 23. Sodium has
- A. 12 neutrons and 11 protons.
  - B. 12 protons and 11 neutrons.
  - C. 12 electrons and 11 neutrons.
  - D. 12 protons and 11 electrons.
  - E. 12 electrons and 11 protons.
18. The chemical properties of an atom are determined by its
- A. protons.
  - B. electrons.
  - C. neutrons.
  - D. protons and neutrons.
  - E. particles.
19. Sodium, which has an atomic number of 11, will react with chlorine, which has an atomic number of 17. When these two atoms react, both become stable. To become stable, sodium will \_\_\_\_\_, while chlorine will \_\_\_\_\_.
- A. accept one electron; give up one electron
  - B. give up one proton; accept one proton
  - C. share one electron with chlorine; share one electron with sodium
  - D. become an anion; become a cation
  - E. give up one electron; accept one electron
20. Consider oxygen, which has an atomic number of 8 and an atomic mass of 16. How many valence electrons does it have?
- A. 2
  - B. 4
  - C. 6
  - D. 8
  - E. 16

21. Oxygen has an atomic number of eight. When two oxygen atoms come together, they form a(n) \_\_\_\_\_ bond.
- A. hydrogen
  - B. nonpolar covalent
  - C. polar covalent
  - D. ionic
  - E. Van der Waals
22. When table salt, sodium chloride (NaCl), is placed in water
- A.  $\text{Na}^+$  and  $\text{Cl}^-$  form ionic bonds with each other.
  - B.  $\text{Na}^+$  and  $\text{Cl}^-$  form polar covalent bonds with each other.
  - C.  $\text{Na}^+$  and  $\text{Cl}^-$  form hydrogen bonds with water.
  - D. Ionic bonds between  $\text{Na}^+$  and  $\text{Cl}^-$  are broken.
  - E.  $\text{Na}^+$  and  $\text{Cl}^-$  become separated by their Van der Waals forces.
23. The bonding properties of an atom are determined by its
- A. electrons.
  - B. protons.
  - C. positrons.
  - D. neutrons.
  - E. photons.
24. What type of bond attracts one water molecule to another?
- A. an ionic bond
  - B. a peptide bond
  - C. a hydrogen bond
  - D. a covalent bond
  - E. a hydrolytic bond

25. Which of these is a cation?

- A. O<sub>2</sub>
- B. K
- C. Na
- D. Ca<sup>2+</sup>
- E. Cl<sup>-</sup>

26. \_\_\_\_\_ account for 98.5% of the body's weight.

- A. Carbon, oxygen, hydrogen, sodium, potassium, and chlorine
- B. Carbon, oxygen, iron, sodium, potassium, and chlorine
- C. Carbon, nitrogen, hydrogen, sodium, potassium, and chlorine
- D. Carbon, oxygen, hydrogen, nitrogen, sodium, and potassium
- E. Carbon, oxygen, hydrogen, nitrogen, calcium, and phosphorus

27. Varieties of elements called \_\_\_\_\_ differ from one another only in number of neutrons and therefore in atomic mass.

- A. cations
- B. anions
- C. isotopes
- D. electrolytes
- E. free radicals

28. When you jump off a high diving board into water, you notice great resistance of water. This resistance is called \_\_\_\_\_ and is caused by water's great \_\_\_\_\_.

- A. surface tension; adhesiveness
- B. surface tension; cohesiveness
- C. hydrophobic tension; adhesiveness
- D. hydrophilic tension; cohesiveness
- E. hydrophilic tension; adhesiveness

29. Which of these is hydrophobic?

- A. sugar
- B.  $K^+$
- C.  $Cl^-$
- D. water
- E. fat

30. Consider a mixture of blood, which contains sodium chloride, protein, and cells or formed elements. The sodium chloride is in a(n) \_\_\_\_\_, the protein is in a(n) \_\_\_\_\_, and the cells are in a \_\_\_\_\_.

- A. emulsion; solution; suspension
- B. solvent; emulsion; colloid
- C. colloid; suspension; solution
- D. suspension; colloid; solution
- E. solution; colloid; suspension

31. Which of these is the most appropriate to express number of molecules per volume?

- A. molarity
- B. volume
- C. percentage
- D. weight per volume
- E. milliequivalents per liter

32. A solution with pH 4 has \_\_\_\_\_ the  $H^+$  concentration of a solution with pH 8.

- A.  $\frac{1}{2}$
- B. twice
- C. 4 times
- D. 10,000 times
- E. 1/10,000

33. Which of these has the highest  $H^+$  concentration?
- A. lemon juice, pH = 2.3
  - B. red wine, pH = 3.2
  - C. tomato juice, pH = 4.7
  - D. saliva, pH = 6.6
  - E. household ammonia, pH = 10.8
34. Blood has a pH ranging from 7.35 to 7.45. Slight deviations from this can cause major problems, even death. You are doing an intense workout, and your skeletal muscle cells are producing metabolic acids such as lactic acid. Your blood pH does not drop significantly in spite of the metabolic acids released into the blood. You maintain a constant blood pH because
- A. metabolic acids are neutralized in muscle cells before released into the blood.
  - B. metabolic bases are produced at the same rate by muscle cells to neutralize the acids.
  - C. the respiratory system removes excess  $H^+$  from the blood before the pH is lowered.
  - D. the body contains chemicals called buffers that resist changes in pH.
  - E. endothelial cells secrete excess  $H^+$  to prevent a decrease in pH.
35. A solution that resists a change in pH when acid or base is added to it is
- A. a buffer.
  - B. a catalyst.
  - C. a reducing agent.
  - D. an oxidizing agent.
  - E. a colloid.
36. Any chemical reaction that removes electrons from an atom is called
- A. reduction.
  - B. condensation.
  - C. hydrolysis.
  - D. anabolism.
  - E. oxidation.

37. The most relevant free energy in human physiology is the energy stored in
- A. electrolytes ionized in water.
  - B. free radicals with an odd number of electrons.
  - C. radioisotopes.
  - D. the chemical bonds of organic molecules.
  - E. Van der Waals forces.
38. The breakdown of glycogen (an energy-storage compound) is an example of a(n) \_\_\_\_\_ reaction.
- A. exergonic
  - B. endergonic
  - C. exchange
  - D. synthesis
  - E. equilibrium
39. When ATP breaks down to ADP, potential energy stored in bonds is released. This energy stored in bonds is \_\_\_\_\_ energy.
- A. electromagnetic
  - B. electrical
  - C. chemical
  - D. heat
  - E. kinetic
40. Glucose is broken down in most of your cells to form carbon dioxide, oxygen, and the energy currency of the cell called ATP. What type of chemical reaction is this?
- A. anabolic or endergonic
  - B. catabolic or exergonic
  - C. anabolic or exergonic
  - D. catabolic or endergonic
  - E. anabolic or exothermic



41. Which one of the following would *not* increase the rate of a reaction?

- A. reactants being more concentrated
- B. rise in temperature
- C. presence of a catalyst
- D. presence of an enzyme
- E. decrease in reactant concentrations

42. Which of the following words includes all of the other terms?

- A. catabolism
- B. anabolism
- C. metabolism
- D. oxidative reactions
- E. reductive reactions

43. Digestive enzymes breakdown the starch in a potato into thousands of glucose molecules. This exemplifies a(n) \_\_\_\_\_ reaction.

- A. synthesis
- B. decomposition
- C. exchange
- D. anabolic
- E. reductive

44. Which of the following equations depicts an exchange reaction?

- A.  $AB \rightarrow A + B$
- B.  $A + B \rightarrow AB$
- C.  $AB + CD \rightarrow AC + BD$
- D.  $AB \rightarrow A^- + B^+$
- E.  $A + B \rightarrow AB \rightarrow C + D$

45. A(n) \_\_\_\_\_ is a group of atoms that determines many of the properties of an organic molecule.

- A. carboxyl group
- B. functional group
- C. hydroxyl group
- D. amino group
- E. phosphate group

46. \_\_\_\_\_ is *not* an organic compound.

- A.  $C_{16}H_{18}N_3ClS$
- B.  $Na_2HPO_3(H_2O)_5$
- C.  $CH_4$
- D.  $C_3H_7O_2N$

47. A \_\_\_\_\_ converts a \_\_\_\_\_ to its monomers.

- A. hydrolysis; polymer
- B. dehydration synthesis; molecule
- C. dehydration synthesis; polymer
- D. polymer; molecule
- E. condensation; reactant

48. The formula for an amino group is \_\_\_\_\_ whereas the formula of a carboxyl group is \_\_\_\_\_

- A.  $-COOH$ ;  $-OH$ .
- B.  $-CH_3$ ;  $-NH_2$ .
- C.  $-OH$ ;  $-SH$ .
- D.  $-NH_2$ ;  $-COOH$ .
- E.  $-SH$ ;  $-H_2PO_4$ .

49. Table sugar is a disaccharide called \_\_\_\_\_ and is made up of the monomer(s) \_\_\_\_\_.

- A. maltose; glucose
- B. sucrose; glucose and fructose
- C. lactose; glucose and galactose
- D. glycogen; glucose
- E. glucose; galactose and fructose

50. Which of the following is a disaccharide?

- A. galactose
- B. lactose
- C. glucose
- D. fructose
- E. amylose

51. \_\_\_\_\_ is a monosaccharide, whereas \_\_\_\_\_ is a polysaccharide.

- A. Fructose; sucrose
- B. Galactose; maltose
- C. Lactose; glycogen
- D. Glucose; starch
- E. Cellulose; glucose

52. In general, \_\_\_\_\_ have a 2:1 ratio of hydrogen to oxygen.

- A. enzymes
- B. proteins
- C. lipids
- D. carbohydrates
- E. nucleic acids

53. Proteoglycans are macromolecules that form gels, which help hold cells and tissues together, lubricate joints, and account for the tough rubbery texture of cartilage. Proteoglycans are composed of

- A. carbohydrates and fats.
- B. nucleic acids and fats.
- C. carbohydrates and proteins.
- D. proteins and fats.
- E. nucleic acids and proteins.

54. Triglycerides are molecules consisting of one 3-carbon compound called \_\_\_\_\_ bound to three \_\_\_\_\_.

- A. eicosanoid; fatty acids
- B. steroid; glycerols
- C. eicosanoid; steroid
- D. glycerol; fatty acids
- E. steroid; fatty acids

55. \_\_\_\_\_ are major components of cell membranes, and are said to be \_\_\_\_\_.

- A. Triglycerides; hydrophobic
- B. Steroids; hydrophilic
- C. Bile acids; fat-soluble
- D. Eicosanoids; water-soluble
- E. Phospholipids; amphiphilic

56. Which of these is (are) always hydrophobic?

- A. glucose
- B. cholesterol
- C. amino acids
- D. proteins
- E. disaccharides

57. Proteins can serve all of the following functions *except*

- A. catalyze metabolic reactions.
- B. give structural strength to cells and tissues.
- C. produce muscular and other forms of movement.
- D. regulate transport of solutes into and out of cells.
- E. store hereditary information.

58. A drastic conformational change in proteins in response to conditions such as extreme heat or pH will lead to loss of a protein's function. This drastic change in three-dimensional shape is called

- A. contamination.
- B. denaturation.
- C. saturation.
- D. sedimentation.
- E. deconformation.

59. Proteins are \_\_\_\_\_ built from \_\_\_\_\_ different amino acids.

- A. monomers; 10
- B. molecules; 10
- C. polymers; 20
- D. macromolecules; 40
- E. polypeptides; 80

60. The folding and coiling of proteins into globular and fibrous shapes determines the \_\_\_\_\_ structure of the protein.

- A. primary
- B. secondary
- C. tertiary
- D. quaternary
- E. denatured

61. Enzymes are specific to substrates because of the shape of their

- A. active sites.
- B. receptors.
- C. secondary structure.
- D. terminal amino acids.
- E. alpha chain.

62. \_\_\_\_\_ is the substrate of \_\_\_\_\_.

- A. Glucose; lactose
- B. Lactase; glucose
- C. Lactose; lactase
- D. Galactose; lactose
- E. Sucrase; sucrose

63. All enzymes are \_\_\_\_\_, but not all of those are enzymes.

- A. cofactors
- B. proteins
- C. lipids
- D. carbohydrates
- E. nucleic acids

64. Nucleic acids are \_\_\_\_\_ of \_\_\_\_\_.

- A. molecules; monosaccharides
- B. monomers; ATP
- C. polymers; nucleotides
- D. polymers; cAMP
- E. polymers; DNA

65. ATP \_\_\_\_\_ endergonic and exergonic reactions.

- A. opposes
- B. decomposes
- C. reduces
- D. links
- E. dehydrates



## chapter 02 Key

### True / False Questions

1. Minerals are organic elements extracted from the soil by plants.

**FALSE**

*Bloom's Level: 1. Remember  
Learning Outcome: 02.01.c State the functions of minerals in the body.  
Section: 02.01  
Topic: Chemistry*

2. Molecules composed of two or more atoms are called compounds.

**FALSE**

*Bloom's Level: 3. Apply  
Learning Outcome: 02.01.b Distinguish between chemical elements and compounds.  
Section: 02.01  
Topic: Chemistry*

3. Hydrogen, deuterium, and tritium are three isotopes of hydrogen.

**TRUE**

*Bloom's Level: 1. Remember  
Learning Outcome: 02.01.d Explain the basis for radioactivity and the types and hazards of ionizing radiation.  
Section: 02.01  
Topic: Chemistry*

4. Potassium, sodium, and chlorine are trace elements.

**FALSE**

*Bloom's Level: 1. Remember  
Learning Outcome: 02.01.b Distinguish between chemical elements and compounds.  
Section: 02.01  
Topic: Chemistry*

5. Ionic bonds break apart in water more easily than covalent bonds do.

**TRUE**

*Bloom's Level: 2. Understand  
Learning Outcome: 02.01.f Define the types of chemical bonds.  
Section: 02.01  
Topic: Chemistry*



6. A solution is a mixture composed of two or more substances that are physically blended but not chemically combined.

**TRUE**

*Bloom's Level: 2. Understand  
Learning Outcome: 02.02.c Show how three kinds of mixtures differ from each other.  
Section: 02.02  
Topic: Chemistry*

7. Blood pH is approximately 7.4, which is slightly acidic.

**FALSE**

*Bloom's Level: 1. Remember  
Learning Outcome: 02.02.e Define acid and base and interpret the pH scale.  
Section: 02.02  
Topic: Chemistry*

8. The high heat capacity of water makes it a very ineffective coolant.

**FALSE**

*Bloom's Level: 2. Understand  
Learning Outcome: 02.02.b Describe the biologically important properties of water.  
Section: 02.02  
Topic: Chemistry*

9. In an exchange reaction, covalent bonds are broken and new covalent bonds are formed.

**TRUE**

*Bloom's Level: 5. Evaluate  
Learning Outcome: 02.03.c List and define the fundamental types of chemical reactions.  
Section: 02.03  
Topic: Chemistry*

10. All the chemical reactions in which larger molecules are broken down to smaller ones are called catabolic reactions.

**TRUE**

*Bloom's Level: 1. Remember  
Learning Outcome: 02.03.e Define metabolism and its two subdivisions.  
Section: 02.03  
Topic: Chemistry*

11. The opposite of a dehydration synthesis is a hydrolysis.

**TRUE**

*Bloom's Level: 1. Remember  
Learning Outcome: 02.03.c List and define the fundamental types of chemical reactions.  
Section: 02.04  
Topic: Chemistry*

12. Unsaturated fatty acids have as much hydrogen as they can carry.

**FALSE**

*Bloom's Level: 2. Understand  
Learning Outcome: 02.04.e Discuss the types and functions of lipids.  
Section: 02.04  
Topic: Chemistry*

13. A dipeptide is a molecule with two peptide bonds.

**FALSE**

*Bloom's Level: 1. Remember  
Learning Outcome: 02.04.f Discuss protein structure and function.  
Section: 02.04  
Topic: Chemistry*

14. All amino acids have both a carboxyl group and an amino group attached to a central carbon.

**TRUE**

*Bloom's Level: 1. Remember  
Learning Outcome: 02.04.f Discuss protein structure and function.  
Section: 02.04  
Topic: Chemistry*

15. ATP is the body's most important form of long-term energy storage.

**FALSE**

*Bloom's Level: 2. Understand  
Learning Outcome: 02.04.h Describe the structure, production, and function of ATP.  
Section: 02.04  
Topic: Chemistry*

## Multiple Choice Questions

16. The most abundant element in the human body, by weight, is

- A. nitrogen.
- B. hydrogen.
- C. carbon.
- D.** oxygen.
- E. calcium.

*Bloom's Level: 1. Remember  
Learning Outcome: 02.01.a Name the chemical elements of the body from their chemical symbols.  
Section: 02.01*

17. Sodium has an atomic number of 11 and an atomic mass of 23. Sodium has
- A.** 12 neutrons and 11 protons.
  - B. 12 protons and 11 neutrons.
  - C. 12 electrons and 11 neutrons.
  - D. 12 protons and 11 electrons.
  - E. 12 electrons and 11 protons.

*Bloom's Level: 3. Apply*  
*Learning Outcome: 02.01.a Name the chemical elements of the body from their chemical symbols.*  
*Section: 02.01*  
*Topic: Chemistry*

18. The chemical properties of an atom are determined by its
- A. protons.
  - B.** electrons.
  - C. neutrons.
  - D. protons and neutrons.
  - E. particles.

*Bloom's Level: 3. Apply*  
*Learning Outcome: 02.01.b Distinguish between chemical elements and compounds.*  
*Section: 02.01*  
*Topic: Chemistry*

19. Sodium, which has an atomic number of 11, will react with chlorine, which has an atomic number of 17. When these two atoms react, both become stable. To become stable, sodium will \_\_\_\_\_, while chlorine will \_\_\_\_\_.
- A. accept one electron; give up one electron
  - B. give up one proton; accept one proton
  - C. share one electron with chlorine; share one electron with sodium
  - D. become an anion; become a cation
  - E.** give up one electron; accept one electron

*Bloom's Level: 3. Apply*  
*Learning Outcome: 02.01.b Distinguish between chemical elements and compounds.*  
*Section: 02.01*  
*Topic: Chemistry*

20. Consider oxygen, which has an atomic number of 8 and an atomic mass of 16. How many valence electrons does it have?

- A. 2
- B. 4
- C. 6**
- D. 8
- E. 16

*Bloom's Level: 5. Evaluate*  
*Learning Outcome: 02.01.b Distinguish between chemical elements and compounds.*

*Section: 02.01*

*Topic: Chemistry*

21. Oxygen has an atomic number of eight. When two oxygen atoms come together, they form a(n) \_\_\_\_\_ bond.

- A. hydrogen
- B. nonpolar covalent**
- C. polar covalent
- D. ionic
- E. Van der Waals

*Bloom's Level: 3. Apply*  
*Learning Outcome: 02.01.f Define the types of chemical bonds.*

*Section: 02.01*

*Topic: Chemistry*

22. When table salt, sodium chloride (NaCl), is placed in water

- A.  $\text{Na}^+$  and  $\text{Cl}^-$  form ionic bonds with each other.
- B.  $\text{Na}^+$  and  $\text{Cl}^-$  form polar covalent bonds with each other.
- C.  $\text{Na}^+$  and  $\text{Cl}^-$  form hydrogen bonds with water.
- D. Ionic bonds between  $\text{Na}^+$  and  $\text{Cl}^-$  are broken.**
- E.  $\text{Na}^+$  and  $\text{Cl}^-$  become separated by their Van der Waals forces.

*Bloom's Level: 3. Apply*  
*Learning Outcome: 02.01.f Define the types of chemical bonds.*

*Section: 02.01*

*Topic: Chemistry*

23. The bonding properties of an atom are determined by its

- A.** electrons.
- B. protons.
- C. positrons.
- D. neutrons.
- E. photons.

*Bloom's Level: 2. Understand*  
*Learning Outcome: 02.01.f Define the types of chemical bonds.*  
*Section: 02.01*  
*Topic: Chemistry*

24. What type of bond attracts one water molecule to another?

- A. an ionic bond
- B. a peptide bond
- C.** a hydrogen bond
- D. a covalent bond
- E. a hydrolytic bond

*Bloom's Level: 1. Remember*  
*Learning Outcome: 02.01.f Define the types of chemical bonds.*  
*Section: 02.01*  
*Topic: Chemistry*

25. Which of these is a cation?

- A. O<sub>2</sub>
- B. K
- C. Na
- D.** Ca<sup>2+</sup>
- E. Cl<sup>-</sup>

*Bloom's Level: 2. Understand*  
*Learning Outcome: 02.01.e Distinguish between ions, electrolytes, and free radicals.*  
*Section: 02.01*  
*Topic: Chemistry*

26. \_\_\_\_\_ account for 98.5% of the body's weight.

- A. Carbon, oxygen, hydrogen, sodium, potassium, and chlorine
- B. Carbon, oxygen, iron, sodium, potassium, and chlorine
- C. Carbon, nitrogen, hydrogen, sodium, potassium, and chlorine
- D. Carbon, oxygen, hydrogen, nitrogen, sodium, and potassium
- E.** Carbon, oxygen, hydrogen, nitrogen, calcium, and phosphorus

*Bloom's Level: 1. Remember*

*Learning Outcome: 02.01.a Name the chemical elements of the body from their chemical symbols.*

*Section: 02.01*

*Topic: Chemistry*

27. Varieties of elements called \_\_\_\_\_ differ from one another only in number of neutrons and therefore in atomic mass.

- A. cations
- B. anions
- C.** isotopes
- D. electrolytes
- E. free radicals

*Bloom's Level: 1. Remember*

*Learning Outcome: 02.01.d Explain the basis for radioactivity and the types and hazards of ionizing radiation.*

*Section: 02.01*

*Topic: Chemistry*

28. When you jump off a high diving board into water, you notice great resistance of water. This resistance is called \_\_\_\_\_ and is caused by water's great \_\_\_\_\_.

- A. surface tension; adhesiveness
- B.** surface tension; cohesiveness
- C. hydrophobic tension; adhesiveness
- D. hydrophilic tension; cohesiveness
- E. hydrophilic tension; adhesiveness

*Bloom's Level: 3. Apply*

*Learning Outcome: 02.02.b Describe the biologically important properties of water.*

*Section: 02.02*

*Topic: Chemistry*

29. Which of these is hydrophobic?

- A. sugar
- B.  $K^+$
- C.  $Cl^-$
- D. water
- E. fat**

*Bloom's Level: 3. Apply*  
*Learning Outcome: 02.02.b Describe the biologically important properties of water.*  
*Section: 02.02*  
*Topic: Chemistry*

30. Consider a mixture of blood, which contains sodium chloride, protein, and cells or formed elements. The sodium chloride is in a(n) \_\_\_\_\_, the protein is in a(n) \_\_\_\_\_, and the cells are in a \_\_\_\_\_.

- A. emulsion; solution; suspension
- B. solvent; emulsion; colloid
- C. colloid; suspension; solution
- D. suspension; colloid; solution
- E. solution; colloid; suspension**

*Bloom's Level: 3. Apply*  
*Learning Outcome: 02.02.c Show how three kinds of mixtures differ from each other.*  
*Section: 02.02*  
*Topic: Chemistry*

31. Which of these is the most appropriate to express number of molecules per volume?

- A. molarity**
- B. volume
- C. percentage
- D. weight per volume
- E. milliequivalents per liter

*Bloom's Level: 1. Remember*  
*Learning Outcome: 02.02.d Discuss some ways in which the concentration of a solution can be expressed, and explain why different expressions of concentration are used for different purposes.*  
*Section: 02.02*  
*Topic: Chemistry*

32. A solution with pH 4 has \_\_\_\_\_ the H<sup>+</sup> concentration of a solution with pH 8.

- A. ½
- B. twice
- C. 4 times
- D. 10,000 times**
- E. 1/10,000

*Bloom's Level: 5. Evaluate*  
*Learning Outcome: 02.02.e Define acid and base and interpret the pH scale.*  
*Section: 02.02*  
*Topic: Chemistry*

33. Which of these has the highest H<sup>+</sup> concentration?

- A. lemon juice, pH = 2.3**
- B. red wine, pH = 3.2
- C. tomato juice, pH = 4.7
- D. saliva, pH = 6.6
- E. household ammonia, pH = 10.8

*Bloom's Level: 3. Apply*  
*Learning Outcome: 02.02.e Define acid and base and interpret the pH scale.*  
*Section: 02.02*  
*Topic: Chemistry*

34. Blood has a pH ranging from 7.35 to 7.45. Slight deviations from this can cause major problems, even death. You are doing an intense workout, and your skeletal muscle cells are producing metabolic acids such as lactic acid. Your blood pH does not drop significantly in spite of the metabolic acids released into the blood. You maintain a constant blood pH because

- A. metabolic acids are neutralized in muscle cells before released into the blood.
- B. metabolic bases are produced at the same rate by muscle cells to neutralize the acids.
- C. the respiratory system removes excess H<sup>+</sup> from the blood before the pH is lowered.
- D. the body contains chemicals called buffers that resist changes in pH.**
- E. endothelial cells secrete excess H<sup>+</sup> to prevent a decrease in pH.

*Bloom's Level: 5. Evaluate*  
*Learning Outcome: 02.02.e Define acid and base and interpret the pH scale.*  
*Section: 02.02*  
*Topic: Chemistry*



35. A solution that resists a change in pH when acid or base is added to it is

- A.** a buffer.
- B. a catalyst.
- C. a reducing agent.
- D. an oxidizing agent.
- E. a colloid.

*Bloom's Level: 1. Remember  
Learning Outcome: 02.02.e Define acid and base and interpret the pH scale.  
Section: 02.02  
Topic: Chemistry*

36. Any chemical reaction that removes electrons from an atom is called

- A. reduction.
- B. condensation.
- C. hydrolysis.
- D. anabolism.
- E.** oxidation.

*Bloom's Level: 1. Remember  
Learning Outcome: 02.03.c List and define the fundamental types of chemical reactions.  
Section: 02.03  
Topic: Chemistry*

37. The most relevant free energy in human physiology is the energy stored in

- A. electrolytes ionized in water.
- B. free radicals with an odd number of electrons.
- C. radioisotopes.
- D.** the chemical bonds of organic molecules.
- E. Van der Waals forces.

*Bloom's Level: 3. Apply  
Learning Outcome: 02.03.a Define energy and work, and describe some types of energy.  
Section: 02.03  
Topic: Chemistry*

38. The breakdown of glycogen (an energy-storage compound) is an example of a(n) \_\_\_\_\_ reaction.

- A.** exergonic
- B. endergonic
- C. exchange
- D. synthesis
- E. equilibrium

*Bloom's Level: 2. Understand*  
*Learning Outcome: 02.03.c List and define the fundamental types of chemical reactions.*

*Section: 02.03*

*Topic: Chemistry*

39. When ATP breaks down to ADP, potential energy stored in bonds is released. This energy stored in bonds is \_\_\_\_\_ energy.

- A. electromagnetic
- B. electrical
- C.** chemical
- D. heat
- E. kinetic

*Bloom's Level: 1. Remember*  
*Learning Outcome: 02.03.c List and define the fundamental types of chemical reactions.*

*Section: 02.03*

*Topic: Chemistry*

40. Glucose is broken down in most of your cells to form carbon dioxide, oxygen, and the energy currency of the cell called ATP. What type of chemical reaction is this?

- A. anabolic or endergonic
- B.** catabolic or exergonic
- C. anabolic or exergonic
- D. catabolic or endergonic
- E. anabolic or exothermic

*Bloom's Level: 3. Apply*  
*Learning Outcome: 02.03.e Define metabolism and its two subdivisions.*

*Section: 02.03*

*Topic: Chemistry*

41. Which one of the following would *not* increase the rate of a reaction?

- A. reactants being more concentrated
- B. rise in temperature
- C. presence of a catalyst
- D. presence of an enzyme
- E.** decrease in reactant concentrations

*Bloom's Level: 2. Understand*  
*Learning Outcome: 02.03.d Identify the factors that govern the speed and direction of a reaction.*  
*Section: 02.03*  
*Topic: Chemistry*

42. Which of the following words includes all of the other terms?

- A. catabolism
- B. anabolism
- C.** metabolism
- D. oxidative reactions
- E. reductive reactions

*Bloom's Level: 3. Apply*  
*Learning Outcome: 02.03.e Define metabolism and its two subdivisions.*  
*Section: 02.03*  
*Topic: Chemistry*

43. Digestive enzymes breakdown the starch in a potato into thousands of glucose molecules. This exemplifies a(n) \_\_\_\_\_ reaction.

- A. synthesis
- B.** decomposition
- C. exchange
- D. anabolic
- E. reductive

*Bloom's Level: 2. Understand*  
*Learning Outcome: 02.03.c List and define the fundamental types of chemical reactions.*  
*Section: 02.03*  
*Topic: Chemistry*

44. Which of the following equations depicts an exchange reaction?

- A.  $AB \rightarrow A + B$
- B.  $A + B \rightarrow AB$
- C.**  $AB + CD \rightarrow AC + BD$
- D.  $AB \rightarrow A^- + B^+$
- E.  $A + B \rightarrow AB \rightarrow C + D$

*Bloom's Level: 2. Understand*

*Learning Outcome: 02.03.b Understand how chemical reactions are symbolized by chemical equations.*

*Section: 02.03*

*Topic: Chemistry*

45. A(n) \_\_\_\_\_ is a group of atoms that determines many of the properties of an organic molecule.

- A. carboxyl group
- B.** functional group
- C. hydroxyl group
- D. amino group
- E. phosphate group

*Bloom's Level: 1. Remember*

*Learning Outcome: 02.04.b Identify some common functional groups of organic molecules from their formulae.*

*Section: 02.04*

*Topic: Chemistry*

46. \_\_\_\_\_ is *not* an organic compound.

- A.  $C_{16}H_{18}N_3ClS$
- B.**  $Na_2HPO_3(H_2O)_5$
- C.  $CH_4$
- D.  $C_3H_7O_2N$

*Bloom's Level: 3. Apply*

*Learning Outcome: 02.04.a Explain why carbon is especially well suited to serve as the structural foundation of many biological molecules.*

*Section: 02.04*

*Topic: Chemistry*

47. A \_\_\_\_\_ converts a \_\_\_\_\_ to its monomers.

- A.** hydrolysis; polymer
- B. dehydration synthesis; molecule
- C. dehydration synthesis; polymer
- D. polymer; molecule
- E. condensation; reactant

*Bloom's Level: 3. Apply*

*Learning Outcome: 02.04.c Discuss the relevance of polymers to biology and explain how they are formed and broken by dehydration synthesis and hydrolysis.*

*Section: 02.04*

*Topic: Chemistry*

48. The formula for an amino group is \_\_\_\_\_ whereas the formula of a carboxyl group is \_\_\_\_\_

- A. -COOH; -OH.
- B. -CH<sub>3</sub>; -NH<sub>2</sub>.
- C. -OH; -SH.
- D.** -NH<sub>2</sub>; -COOH.
- E. -SH; -H<sub>2</sub>PO<sub>4</sub>.

*Bloom's Level: 1. Remember*

*Learning Outcome: 02.04.f Discuss protein structure and function.*

*Section: 02.04*

*Topic: Chemistry*

49. Table sugar is a disaccharide called \_\_\_\_\_ and is made up of the monomer(s) \_\_\_\_\_.

- A. maltose; glucose
- B.** sucrose; glucose and fructose
- C. lactose; glucose and galactose
- D. glycogen; glucose
- E. glucose; galactose and fructose

*Bloom's Level: 1. Remember*

*Learning Outcome: 02.04.d Discuss the types and functions of carbohydrates.*

*Section: 02.04*

*Topic: Chemistry*

50. Which of the following is a disaccharide?

- A. galactose
- B. lactose**
- C. glucose
- D. fructose
- E. amylose

*Bloom's Level: 1. Remember*  
*Learning Outcome: 02.04.d Discuss the types and functions of carbohydrates.*  
*Section: 02.04*  
*Topic: Chemistry*

51. \_\_\_\_\_ is a monosaccharide, whereas \_\_\_\_\_ is a polysaccharide.

- A. Fructose; sucrose
- B. Galactose; maltose
- C. Lactose; glycogen
- D. Glucose; starch**
- E. Cellulose; glucose

*Bloom's Level: 3. Apply*  
*Learning Outcome: 02.04.d Discuss the types and functions of carbohydrates.*  
*Section: 02.04*  
*Topic: Chemistry*

52. In general, \_\_\_\_\_ have a 2:1 ratio of hydrogen to oxygen.

- A. enzymes
- B. proteins
- C. lipids
- D. carbohydrates**
- E. nucleic acids

*Bloom's Level: 2. Understand*  
*Learning Outcome: 02.04.d Discuss the types and functions of carbohydrates.*  
*Section: 02.04*  
*Topic: Chemistry*

53. Proteoglycans are macromolecules that form gels, which help hold cells and tissues together, lubricate joints, and account for the tough rubbery texture of cartilage. Proteoglycans are composed of

- A. carbohydrates and fats.
- B. nucleic acids and fats.
- C.** carbohydrates and proteins.
- D. proteins and fats.
- E. nucleic acids and proteins.

*Bloom's Level: 1. Remember*

*Learning Outcome: 02.04.d Discuss the types and functions of carbohydrates.*

*Section: 02.04*

*Topic: Chemistry*

54. Triglycerides are molecules consisting of one 3-carbon compound called \_\_\_\_\_ bound to three \_\_\_\_\_.

- A. eicosanoid; fatty acids
- B. steroid; glycerols
- C. eicosanoid; steroid
- D.** glycerol; fatty acids
- E. steroid; fatty acids

*Bloom's Level: 1. Remember*

*Learning Outcome: 02.04.e Discuss the types and functions of lipids.*

*Section: 02.04*

*Topic: Chemistry*

55. \_\_\_\_\_ are major components of cell membranes, and are said to be \_\_\_\_\_.

- A. Triglycerides; hydrophobic
- B. Steroids; hydrophilic
- C. Bile acids; fat-soluble
- D. Eicosanoids; water-soluble
- E.** Phospholipids; amphiphilic

*Bloom's Level: 3. Apply*

*Learning Outcome: 02.04.e Discuss the types and functions of lipids.*

*Section: 02.04*

*Topic: Chemistry*

56. Which of these is (are) always hydrophobic?

- A. glucose
- B. cholesterol**
- C. amino acids
- D. proteins
- E. disaccharides

*Bloom's Level: 3. Apply*  
*Learning Outcome: 02.04.e Discuss the types and functions of lipids.*  
*Section: 02.04*  
*Topic: Chemistry*

57. Proteins can serve all of the following functions *except*

- A. catalyze metabolic reactions.
- B. give structural strength to cells and tissues.
- C. produce muscular and other forms of movement.
- D. regulate transport of solutes into and out of cells.
- E. store hereditary information.**

*Bloom's Level: 1. Remember*  
*Learning Outcome: 02.04.f Discuss protein structure and function.*  
*Section: 02.04*  
*Topic: Chemistry*

58. A drastic conformational change in proteins in response to conditions such as extreme heat or pH will lead to loss of a protein's function. This drastic change in three-dimensional shape is called

- A. contamination.
- B. denaturation.**
- C. saturation.
- D. sedimentation.
- E. deconformation.

*Bloom's Level: 1. Remember*  
*Learning Outcome: 02.04.f Discuss protein structure and function.*  
*Section: 02.04*  
*Topic: Chemistry*



59. Proteins are \_\_\_\_\_ built from \_\_\_\_\_ different amino acids.

- A. monomers; 10
- B. molecules; 10
- C.** polymers; 20
- D. macromolecules; 40
- E. polypeptides; 80

*Bloom's Level: 1. Remember  
Learning Outcome: 02.04.f Discuss protein structure and function.  
Section: 02.04  
Topic: Chemistry*

60. The folding and coiling of proteins into globular and fibrous shapes determines the \_\_\_\_\_ structure of the protein.

- A. primary
- B. secondary
- C.** tertiary
- D. quaternary
- E. denatured

*Bloom's Level: 1. Remember  
Learning Outcome: 02.04.f Discuss protein structure and function.  
Section: 02.04  
Topic: Chemistry*

61. Enzymes are specific to substrates because of the shape of their

- A.** active sites.
- B. receptors.
- C. secondary structure.
- D. terminal amino acids.
- E. alpha chain.

*Bloom's Level: 1. Remember  
Learning Outcome: 02.04.g Explain how enzymes function.  
Section: 02.04  
Topic: Chemistry*

62. \_\_\_\_\_ is the substrate of \_\_\_\_\_.

- A. Glucose; lactose
- B. Lactase; glucose
- C. Lactose; lactase**
- D. Galactose; lactose
- E. Sucrase; sucrose

*Bloom's Level: 3. Apply*  
*Learning Outcome: 02.04.g Explain how enzymes function.*  
*Section: 02.04*  
*Topic: Chemistry*

63. All enzymes are \_\_\_\_\_, but not all of those are enzymes.

- A. cofactors
- B. proteins**
- C. lipids
- D. carbohydrates
- E. nucleic acids

*Bloom's Level: 3. Apply*  
*Learning Outcome: 02.04.g Explain how enzymes function.*  
*Section: 02.04*  
*Topic: Chemistry*

64. Nucleic acids are \_\_\_\_\_ of \_\_\_\_\_.

- A. molecules; monosaccharides
- B. monomers; ATP
- C. polymers; nucleotides**
- D. polymers; cAMP
- E. polymers; DNA

*Bloom's Level: 3. Apply*  
*Learning Outcome: 02.04.j Identify the principal types of nucleic acids.*  
*Section: 02.04*  
*Topic: Chemistry*

65. ATP \_\_\_\_\_ endergonic and exergonic reactions.

- A. opposes
- B. decomposes
- C. reduces
- D.** links
- E. dehydrates

*Bloom's Level: 3. Apply*  
*Learning Outcome: 02.04.h Describe the structure, production, and function of ATP.*  
*Section: 02.04*  
*Topic: Chemistry*

## chapter 02 Summary

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