

CHAPTER 2—LIFE, CHEMISTRY, AND WATER

MULTIPLE CHOICE

1. According to studies by Norman Terry and coworkers, some plants can perform a version of bioremediation of selenium in wastewater by
- converting selenium to a form that kills waterfowl.
 - using selenium to make a necessary supplement for humans.
 - converting selenium into a relatively nontoxic gas.
 - storing selenium in the soil.
 - increasing the selenium concentration in the water.

ANS: C

DIF: Easy

OBJ: Bloom's Taxonomy: Knowledge

2. The laws of chemistry and physics that govern living things are ____ the laws of chemistry and physics that govern nonliving things.
- different from
 - the same as
 - roughly half the same as and half different from
 - mostly different from
 - mostly the same as

ANS: B

DIF: Easy

OBJ: Bloom's Taxonomy: Knowledge

The Organization of Matter: Elements and Atoms

3. A substance that cannot be broken down into simpler substances by ordinary chemical or physical techniques is a(n) ____.
- molecule
 - chemical
 - compound
 - element
 - all of these

ANS: D

DIF: Easy

OBJ: Bloom's Taxonomy: Knowledge

4. Four elements make up more than 96% of the mass of most living organisms. Which of the following is NOT one of those four elements?
- sodium
 - carbon
 - oxygen
 - nitrogen

Why It Matters

e. hydrogen

ANS: A

DIF: Moderate

OBJ: Bloom's Taxonomy: Knowledge

5. A trace element is one found in specific organisms in ____ quantities and is ____ for normal biological functions.

a. moderate; unnecessary

b. moderate; vital

c. small; unnecessary

d. large; unnecessary

e. small; vital

ANS: E

DIF: Moderate

OBJ: Bloom's Taxonomy: Knowledge

6. The smallest unit that retains the chemical and physical properties of an element is a(n) ____.

a. proton

b. compound

c. molecule

d. neutron

e. atom

ANS: E

DIF: Easy

OBJ: Bloom's Taxonomy: Knowledge

7. The substance H₂O is considered to be

a. both a molecule and a compound.

b. a compound but not a molecule.

c. neither a molecule nor a compound.

d. a molecule but not a compound.

ANS: A

DIF: Easy

OBJ: Bloom's Taxonomy: Comprehension

8. The substance O₂ is considered to be

a. both a molecule and a compound.

b. a compound but not a molecule.

c. neither a molecule nor a compound.

d. a molecule but not a compound.

ANS: D

DIF: Moderate

OBJ: Bloom's Taxonomy: Comprehension

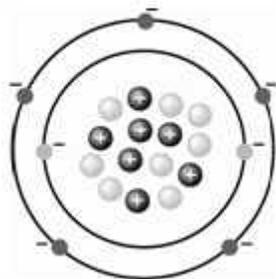
Atomic Structure

9. An oxygen atom has ____ surrounding a nucleus composed of ____.
- neutrons; electrons and protons
 - electrons; protons and neutrons
 - protons and electrons; neutrons
 - protons; neutrons and electrons
 - electrons and neutrons; protons

ANS: B

DIF: Easy

OBJ: Bloom's Taxonomy: Knowledge



Use the figure above for the following question(s).

10. The mass number of the atom depicted in the figure is

- 5.
- 7.
- 8.
- 15.
- 22.

ANS: D

DIF: Moderate

OBJ: Bloom's Taxonomy: Analysis

11. The atomic number of the atom depicted in the figure is

- 5.
- 7.
- 8.
- 15.
- 22.

ANS: B

DIF: Moderate

OBJ: Bloom's Taxonomy: Analysis

12. The number of electrons for the atom depicted in the figure is

- 5.
- 7.
- 8.
- 15.
- 22.

ANS: B

DIF: Easy

OBJ: Bloom's Taxonomy: Analysis

13. The number of neutrons for the atom depicted in the figure is

- 5.
- 7.
- 8.
- 15.
- 22.

ANS: C

DIF: Easy

OBJ: Bloom's Taxonomy: Analysis

14. Which of the following are charged particles?

- electrons and protons
- neutrons only
- protons and neutrons
- electrons only
- protons, neutrons, and electrons

ANS: A

DIF: Moderate

OBJ: Bloom's Taxonomy: Knowledge

15. What is the atomic mass number of an atom with 7 electrons, 7 neutrons, and 7 protons?

- 7 daltons
- 10 daltons
- 14 daltons
- 21 daltons
- 28 daltons

ANS: C

DIF: Easy

OBJ: Bloom's Taxonomy: Comprehension

16. Isotopes of the same element differ from each other in the number of

- electrons and protons.
- neutrons only.
- protons and neutrons.
- electrons only.
- protons, neutrons, and electrons.

ANS: B

DIF: Moderate

OBJ: Bloom's Taxonomy: Knowledge | Bloom's Taxonomy: Comprehension

17. A carbon atom with six protons, seven neutrons, and six electrons has a mass number of

- 6.
- 7.

- c. 12.
- d. 13.
- e. 19.

ANS: D

DIF: Moderate

OBJ: Bloom's Taxonomy: Application

18. Which element would the element lithium most likely form an ionic bond with?

- a. Aluminum; atomic number = 13
- b. Chlorine; atomic number = 17
- c. Magnesium; atomic number = 12
- d. Nitrogen; atomic number = 7
- e. Silicon; atomic number = 14

ANS: B

DIF: Moderate

OBJ: Bloom's Taxonomy: Analysis

19. ^{14}C is heavier than ^{12}C because it has _____.

- a. two more electrons than ^{12}C
- b. two more neutrons than ^{12}C
- c. two more protons than ^{12}C
- d. one more proton and one more electron than ^{12}C
- e. one more proton and one more neutron than ^{12}C

ANS: B

DIF: Moderate

OBJ: Bloom's Taxonomy: Analysis

20. The isotope ^{14}C undergoes radioactive decay with a neutron splitting into an electron and a proton. This decay produces an atom of

- a. iron.
- b. carbon.
- c. hydrogen.
- d. oxygen.
- e. nitrogen.

ANS: E

DIF: Difficult

OBJ: Bloom's Taxonomy: Knowledge

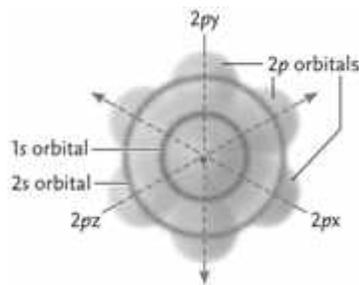
21. An orbital describes the ____ of an electron.

- a. exact location
- b. exact path
- c. most frequent locations
- d. charge
- e. chemical bonds

ANS: C

DIF: Moderate

OBJ: Bloom's Taxonomy: Comprehension



Use the figure above for the following question(s).

22. The electrons at the lowest energy level in the neon atom depicted in the figure above are found in which orbital?

- a. 1s
- b. 2s
- c. 2px
- d. 2py
- e. 2pz

ANS: A

DIF: Moderate

REF: Figure 2.5

OBJ: Bloom's Taxonomy: Comprehension

23. All of the orbitals shown in the neon atom in the figure are completely filled with electrons. How many electrons does this neon atom have?

- a. 5
- b. 6
- c. 8
- d. 10
- e. 16

ANS: D

DIF: Moderate

REF: Figure 2.5

OBJ: Bloom's Taxonomy: Application

24. Under the right conditions, an electron will

- a. move to a lower energy level.
- b. enter an orbital shared by two atoms.
- c. move to a higher energy level.
- d. move from one atom to another atom.
- e. all of these

ANS: E

DIF: Moderate

OBJ: Bloom's Taxonomy: Knowledge

25. Sodium has one valence electron in its third energy level. To reach a stable energy configuration, sodium will tend to
- take up an electron from another atom.
 - move its valence electron to the second energy shell.
 - give up an electron to another atom.
 - share its valence electron with another atom.
 - move an electron from the second energy level to the valence shell.

ANS: C

DIF: Moderate

OBJ: Bloom's Taxonomy: Application

26. Which of the following is most likely to share electrons with other atoms in joint orbitals?
- chlorine (7 valence electrons)
 - calcium (2 valence electrons)
 - argon (8 valence electrons)
 - carbon (4 valence electrons)
 - potassium (1 valence electron)

ANS: D

DIF: Difficult

OBJ: Bloom's Taxonomy: Synthesis

27. Which of the following is likely to be chemically unreactive?
- chlorine (7 valence electrons)
 - calcium (2 valence electrons)
 - argon (8 valence electrons)
 - carbon (4 valence electrons)
 - potassium (1 valence electron)

ANS: C

DIF: Difficult

OBJ: Bloom's Taxonomy: Synthesis

28. Which of the following is most likely to take up an electron from another atom?
- chlorine (7 valence electrons)
 - calcium (2 valence electrons)
 - neon (8 valence electrons)
 - carbon (4 valence electrons)
 - potassium (1 valence electron)

ANS: A

DIF: Moderate

OBJ: Bloom's Taxonomy: Synthesis

Reactions and Save Lives

29. Radioactive ____ is commonly used to treat patients with dangerously overactive thyroid glands.
- carbon
 - radium
 - iodine
 - thallium
 - cobalt

ANS: C

DIF: Moderate

OBJ: Bloom's Taxonomy: Knowledge

30. Melvin Calvin and his coworkers used a radioisotope of ____ to trace the reactions of photosynthesis.
- carbon
 - radium
 - iodine
 - thallium
 - cobalt

ANS: A

DIF: Moderate

OBJ: Bloom's Taxonomy: Knowledge

Chemical Bonds and Chemical Reactions

31. The chemical bonds that form when atoms that have lost electrons are electrically attracted to atoms that have gained electrons are called ____.
- polar covalent bonds
 - van der Waals forces
 - ionic bonds
 - hydrogen bonds
 - nonpolar covalent bonds

ANS: C

DIF: Easy

OBJ: Bloom's Taxonomy: Knowledge

32. The chemical bonds that are formed when atoms share electrons equally are called ____.
- polar covalent bonds
 - van der Waals forces
 - ionic bonds
 - hydrogen bonds
 - nonpolar covalent bonds

ANS: E

DIF: Moderate

OBJ: Bloom's Taxonomy: Knowledge | Bloom's Taxonomy: Comprehension

33. The chemical bonds that are formed when atoms share electrons unequally are called ____.
- polar covalent bonds

Focus on Research: Using Radioisotopes to Trace

- b. van der Waals forces
- c. ionic bonds
- d. hydrogen bonds
- e. nonpolar covalent bonds

ANS: A

DIF: Moderate

OBJ: Bloom's Taxonomy: Knowledge | Bloom's Taxonomy: Comprehension

34. The chemical bonds that are formed when atoms with temporary zones of positive charge are attracted to other atoms with temporary zones of negative charge are called ____.
- a. polar covalent bonds
 - b. van der Waals forces
 - c. ionic bonds
 - d. hydrogen bonds
 - e. nonpolar covalent bonds

ANS: B

DIF: Difficult

OBJ: Bloom's Taxonomy: Knowledge | Bloom's Taxonomy: Comprehension

35. Chemical bonds that are formed when one atom with a partial positive charge (created from unequal sharing of electrons) is electrically attracted to another atom with a partial negative charge (also created from unequal sharing of electrons) are called ____.

- a. polar covalent bonds
- b. van der Waals forces
- c. ionic bonds
- d. hydrogen bonds
- e. nonpolar covalent bonds

ANS: D

DIF: Moderate

OBJ: Bloom's Taxonomy: Knowledge | Bloom's Taxonomy: Comprehension

36. Which of the following types of chemical linkages is the weakest?

- a. polar covalent bonds
- b. van der Waals forces
- c. ionic bonds
- d. hydrogen bonds
- e. nonpolar covalent bonds

ANS: B

DIF: Difficult

OBJ: Bloom's Taxonomy: Synthesis

37. The attraction between Na^+ cations and Cl^- anions forms ____ that hold together the compound NaCl .

- a. polar covalent bonds
- b. van der Waals forces
- c. ionic bonds
- d. hydrogen bonds

- e. nonpolar covalent bonds

ANS: C

DIF: Easy

OBJ: Bloom's Taxonomy: Application

38. Geckos are able to cling to vertical walls due to ____.

- a. polar covalent bonds
- b. van der Waals forces
- c. ionic bonds
- d. hydrogen bonds
- e. nonpolar covalent bonds

ANS: B

DIF: Difficult

OBJ: Bloom's Taxonomy: Knowledge

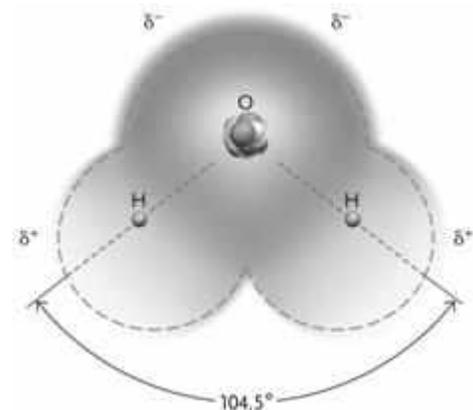
39. Molecules such as H_2O and O_2 are held together by ____.

- a. polar covalent bonds
- b. van der Waals forces
- c. ionic bonds
- d. hydrogen bonds
- e. nonpolar covalent bonds

ANS: E

DIF: Moderate

OBJ: Bloom's Taxonomy: Synthesis



40. The molecule shown in the figure above is held together by ____.

- a. polar covalent bonds
- b. van der Waals forces
- c. ionic bonds
- d. hydrogen bonds
- e. nonpolar covalent bonds

ANS: A

DIF: Moderate

REF: Figure 2.9

OBJ: Bloom's Taxonomy: Application

41. Metallic ions such as Ca^{2+} , Na^+ , and Fe^{3+} readily form ____.

- a. polar covalent bonds

- b. van der Waals forces
- c. ionic bonds
- d. hydrogen bonds
- e. nonpolar covalent bonds

ANS: C

DIF: Moderate

OBJ: Bloom's Taxonomy: Comprehension

42. The chemical linkages that exert an attractive force over the greatest distance are ____.
- a. polar covalent bonds
 - b. van der Waals forces
 - c. ionic bonds
 - d. hydrogen bonds
 - e. nonpolar covalent bonds

ANS: C

DIF: Difficult

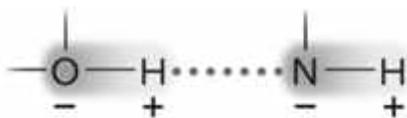
OBJ: Bloom's Taxonomy: Knowledge

43. In contrast to ionic bonds, covalent bonds ____.
- a. hold atoms together
 - b. have distinct, three-dimensional forms
 - c. transfer electrons from one atom to another
 - d. are relatively weak
 - e. are transient

ANS: B

DIF: Moderate

OBJ: Bloom's Taxonomy: Synthesis



44. The dotted line in the figure above indicates ____.
- a. a polar covalent bond
 - b. van der Waals forces
 - c. an ionic bond
 - d. a hydrogen bond
 - e. a nonpolar covalent bond

ANS: D

DIF: Easy

REF: Figure 2.10

OBJ: Bloom's Taxonomy: Analysis

45. In a molecule of methane, CH_4 , each hydrogen atom shares an orbital with the carbon atom. The total number of shared electrons in CH_4 is ____.
- a. 4
 - b. 2
 - c. 1
 - d. 8
 - e. 5

ANS: D

DIF: Difficult

OBJ: Bloom's Taxonomy: Analysis

46. A polar covalent bond would be most likely to form between
- a. atoms with different electronegativities.
 - b. cations and anions.
 - c. atoms with δ^+ and δ^- charges.
 - d. atoms with filled valence shells.
 - e. atoms of the same element.

ANS: A

DIF: Moderate

OBJ: Bloom's Taxonomy: Evaluation

47. Which of these types of chemical bonds would you not expect to find in biological molecules?
- a. covalent bonds
 - b. van der Waals forces
 - c. ionic bonds
 - d. hydrogen bonds
 - e. all of these types of bonds are found in biological molecules

ANS: E

DIF: Easy

OBJ: Bloom's Taxonomy: Synthesis

48. In the presence of water, nonpolar associations form between molecules or regions of molecules that are ____.
- a. partially charged
 - b. hydrophobic and hydrophilic
 - c. hydrophobic
 - d. fully charged
 - e. hydrophilic

ANS: C

DIF: Easy

OBJ: Bloom's Taxonomy: Knowledge

49. A mixture of vegetable oil and water will separate into layers because oil is ____ and forms ____.
- a. hydrophobic; nonpolar associations
 - b. hydrophilic; nonpolar associations
 - c. hydrophilic; polar associations
 - d. hydrophobic; polar associations

ANS: A

DIF: Moderate

OBJ: Bloom's Taxonomy: Application

50. Analyze this chemical reaction:



Which of the following is FALSE?

- a. Water is a reactant.
- b. $\text{C}_6\text{H}_{12}\text{O}_6$ is a product.

- c. Molecular oxygen is a product.
- d. CO₂ is a reactant.
- e. Molecular carbon is a reactant.

ANS: E

DIF: Moderate

OBJ: Bloom's Taxonomy: Analysis

51. The formation and breaking of bonds between atoms requires
- a. a chemical reaction.
 - b. van der Waals forces.
 - c. partial charges.
 - d. an empty valence shell.
 - e. an enzyme.

ANS: A

DIF: Moderate

OBJ: Bloom's Taxonomy: Knowledge

Hydrogen Bonds and the Properties of Water

52. What do cohesion, surface tension, and specific heat have in common concerning the properties of water?
- a. All are produced by covalent bonding.
 - b. All are properties related to hydrogen bonding.
 - c. All have to do with nonpolar covalent bonds.
 - d. All increase when temperature increases.
 - e. All are produced by covalent bonding and all increase when temperature increases.

ANS: B

DIF: Easy

OBJ: Bloom's Taxonomy: Knowledge

53. A molecule of water in the middle of a chunk of ice will usually have ____ hydrogen bonds with other water molecules.
- a. 3
 - b. 3.4
 - c. 6
 - d. 4
 - e. 2

ANS: D

DIF: Moderate

OBJ: Bloom's Taxonomy: Application

54. Which of the following would have the most difficulty entering a water lattice?
- a. table salt (NaCl)
 - b. a nonpolar molecule
 - c. a sodium ion
 - d. a proton (H⁺)
 - e. an electron

ANS: B

DIF: Moderate

OBJ: Bloom's Taxonomy: Application

55. Ice floats in liquid water because
- a. ice forms hydrogen bonds with the surface of liquid water.
 - b. ice forms hydrogen bonds but liquid water does not.
 - c. the hydrogen bonds of liquid water are fixed in place.
 - d. liquid water forms hydrogen bonds but ice does not.
 - e. the distance between water molecules is maximized due to the hydrogen bonds which are fixed in place.

ANS: E

DIF: Difficult

OBJ: Bloom's Taxonomy: Application

56. Biological membranes are held together mainly by
- a. hydrogen bonds between lipid molecules.
 - b. hydration layers over lipid molecules.
 - c. exclusion of the nonpolar regions of lipids by water.
 - d. hydrogen bonds between water molecules.
 - e. surface tension at the interface between layers of water molecules.

ANS: C

DIF: Moderate

OBJ: Bloom's Taxonomy: Knowledge

57. A ____ is formed when a ____ is dissolved in a ____.
- a. solution; solute; solvent
 - b. solute; solvent; solution
 - c. solution; solvent; solute
 - d. solvent; solution; solute
 - e. solvent; solute; solution

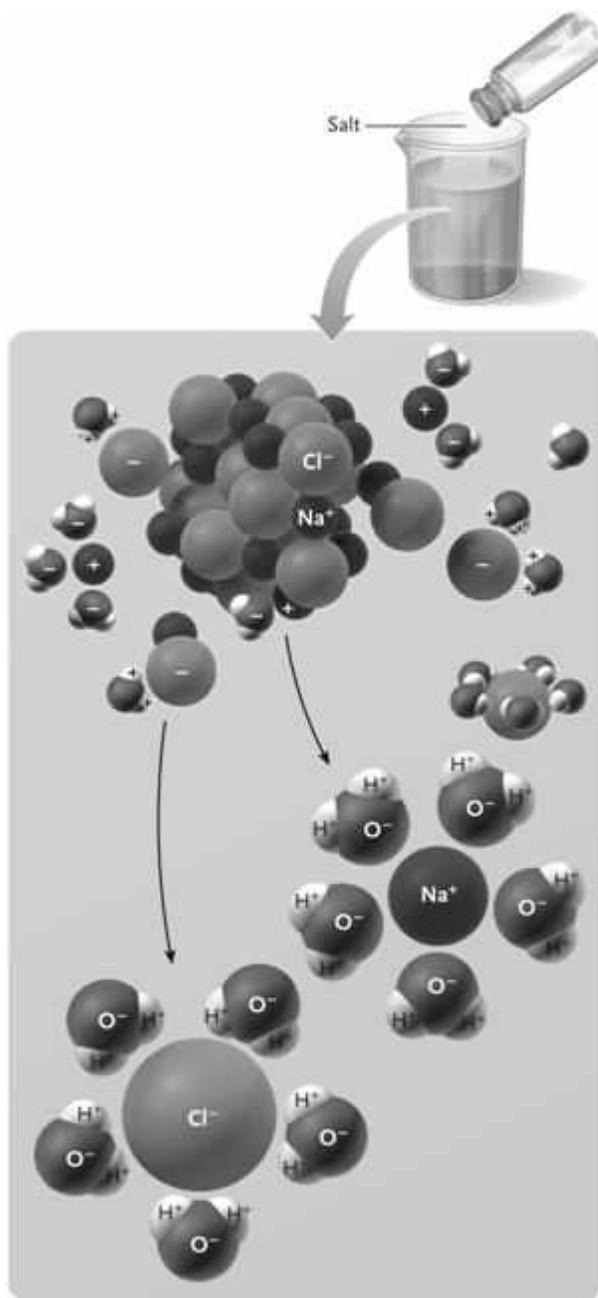
ANS: A

DIF: Moderate

OBJ: Bloom's Taxonomy: Knowledge

58. When sugar dissolves in water, water is acting as a ____ and the sugar molecules are acting as ____.
- a. solution; solvents
 - b. solute; solutions
 - c. solvent; solutes
 - d. solute; solvents

e. solvent; solutions
ANS: C
DIF: Moderate
OBJ: Bloom's Taxonomy: Application



59. When salt dissolves in water as illustrated in the figure above, the water molecules form ____ around the Na^+ and Cl^- ions.
- covalent bonds
 - hydration layers
 - nonpolar interactions
 - membranes
 - ionic bonds
- ANS: B
DIF: Easy

REF: Figure 2.14
OBJ: Bloom's Taxonomy: Comprehension

60. Water has a molecular weight of 18 g per mole, and glucose has a molecular weight of 180 g per mole. Which of the following would have an approximately equal number of water and glucose molecules?
- 1 g of water and 180 g of glucose
 - 90 g of water and 9 g of glucose
 - 180 g of water and 1 g of glucose
 - 9 g of water and 90 g of glucose
 - 90 g of water and 90 g of glucose
- ANS: D
DIF: Difficult
OBJ: Bloom's Taxonomy: Application

61. Water has a molecular weight of 18 Daltons or amu. Therefore, a mole of water would have a mass of ____.
- 1 g
 - 6.02×10^{23} g
 - 36 g
 - 1.08×10^{25} g
 - 18 g
- ANS: E
DIF: Moderate
OBJ: Bloom's Taxonomy: Knowledge

62. Water has an unusually high boiling point for its molecular weight because water molecules
- are very dense.
 - get much heavier as they are heated.
 - are held to each other by hydrogen bonds.
 - are held together by covalent bonds.
 - form hydration layers.
- ANS: C
DIF: Moderate
OBJ: Bloom's Taxonomy: Comprehension

63. The hydrogen-bond lattice causes water to have an unusually ____ specific heat and an unusually ____ heat of vaporization for its molecular weight.
- high; high
 - low; high
 - high; low
 - low; low
- ANS: A
DIF: Easy
OBJ: Bloom's Taxonomy: Comprehension

64. Water is useful for cooling organisms mainly due to its

- a. hydration layers.
- b. specific heat.
- c. low calories.
- d. surface tension.
- e. heat of vaporization.

ANS: E

DIF: Moderate

OBJ: Bloom's Taxonomy: Knowledge

65. Water has an important stabilizing effect on temperature in living organisms and their environments because as water absorbs heat, much of the energy is used to ____ instead of raising the temperature.

- a. create hydrogen bonds
- b. create covalent bonds
- c. break surface tension
- d. break hydrogen bonds
- e. create hydration layers

ANS: D

DIF: Moderate

OBJ: Bloom's Taxonomy: Comprehension



66. The water strider shown in the figure above is able to stand on water because of the ____ of water.

- a. covalent bonds
- b. surface tension
- c. van der Waals forces
- d. density
- e. hydration layer

ANS: B

DIF: Easy

REF: Figure 2.15

OBJ: Bloom's Taxonomy: Knowledge

Water Ionization and Acids, Bases, and Buffers

67. When added to water, a base will act as a ____ and cause the pH of the solution to ____.

- a. proton acceptor; rise
- b. proton donor; rise
- c. proton acceptor; fall
- d. proton donor; fall
- e. none of these

ANS: A

DIF: Easy

OBJ: Bloom's Taxonomy: Comprehension

68. When added to water at neutral pH (7.0), an acid will

- a. act as a proton donor, raising the pH of the solution.
- b. act as a proton acceptor, raising the pH of the solution.
- c. act as a proton donor, lowering the pH of the solution.
- d. act as a proton acceptor, lowering the pH of the solution.
- e. do nothing since the aqueous solution is neutral.

ANS: C

DIF: Moderate

OBJ: Bloom's Taxonomy: Application

69. A pH of 6 is ____ times more ____ than a pH of 2.

- a. 3; acidic
- b. 4; acidic
- c. 3; basic
- d. 10,000; basic
- e. 40; basic

ANS: D

DIF: Moderate

OBJ: Bloom's Taxonomy: Application

70. For pure water, which has a pH of 7.0, which of the following is true?

- a. $[H^+] < [OH^-]$
- b. $[H^+] = [OH^-]$
- c. $[H^+] = 0$
- d. $[OH^-] = 0$
- e. $[H^+] > [OH^-]$

ANS: B

DIF: Moderate

OBJ: Bloom's Taxonomy: Knowledge | Bloom's Taxonomy: Application

71. For acid rainwater, which has a pH as low as 3.0, which of the following is true?

- a. $[H^+] < [OH^-]$
- b. $[H^+] = [OH^-]$
- c. $[H^+] = 0$
- d. $[OH^-] = 0$
- e. $[H^+] > [OH^-]$

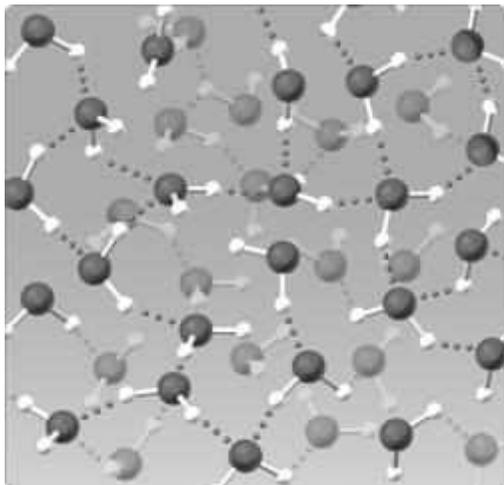
ANS: E

DIF: Moderate

OBJ: Bloom's Taxonomy: Knowledge | Bloom's Taxonomy: Application

72. Solution A has a pH of 6 and solution B has a pH of 8. Which of the following is true regarding the concentration of hydrogen ions in each solution?
- A has 100 times greater H^+ concentration than B.
 - B has 100 times greater H^+ concentration than A.
 - A has 7/9 of the H^+ concentration of B.
 - A has 9/7 of the H^+ concentration of B.
 - none of these
- ANS: A
DIF: Moderate
OBJ: BT: Analysis
73. In water, NaOH almost completely separates into Na^+ and OH^- ions. Thus, NaOH is ____.
- a strong acid
 - a strong base
 - a weak acid
 - a weak base
 - neutral
- ANS: B
DIF: Moderate
OBJ: Bloom's Taxonomy: Comprehension
74. Seawater typically is
- highly basic.
 - neutral.
 - somewhat basic.
 - somewhat acidic.
 - highly basic.
- ANS: C
DIF: Difficult
OBJ: Bloom's Taxonomy: Knowledge | Bloom's Taxonomy: Analysis
75. Without ____, living organisms would often experience major changes in pH in their cells.
- buffers
 - acids
 - surface tension
 - nonpolar bonds
 - bases
- ANS: A
DIF: Easy
OBJ: Bloom's Taxonomy: Knowledge
76. Most pH buffers are
- strong acids.
 - weak acids or weak bases.
 - weak acids.
 - strong bases.
 - strong acids or strong bases.
- ANS: B
DIF: Moderate
OBJ: Bloom's Taxonomy: Knowledge
77. A research group led by Joanne Santini has found a(n) ____ that potentially can be used in arsenic bioremediation.
- amoeba
 - plant
 - alga
 - bacterium
 - fungus
- ANS: D
DIF: Moderate
OBJ: Bloom's Taxonomy: Knowledge
78. Which of the following statements about irradiation of food is true?
- Irradiation does not affect viruses in food.
 - Irradiation kills many bacteria and parasites in food.
 - Studies have shown higher cancer rates in laboratory animals fed irradiated food.
 - Irradiation makes food radioactive.
 - Vitamins are completely destroyed when food is irradiated.
- ANS: B
DIF: Moderate
OBJ: Bloom's Taxonomy: Knowledge
79. The most common isotope of carbon has an atomic number of 6 and a mass number of 12, while the most common isotope of oxygen has an atomic number of 8 and a mass number of 16. A molecule of CO_2 made up of these common isotopes has a molecular weight of ____.
- 28
 - 44
 - 56
 - 14
 - 22
- ANS: B
DIF: Difficult
REF: Section 2.2 | Section 2.3 | Section 2.4
OBJ: Bloom's Taxonomy: Synthesis

Unanswered Questions



80. The water lattice illustrated in the figure above forms as a result of ____ between water molecules.

- covalent bonds
- hydrogen bonds
- nonpolar interactions
- ionic bonds
- van der Waals forces

ANS: B

DIF: Easy

REF: Figure 2.12 | Section 2.3 | Section 2.4

OBJ: Bloom's Taxonomy: Application | Bloom's Taxonomy: Synthesis

81. The isotope of hydrogen most commonly found in water is protium, which has no neutrons. However, the form of hydrogen with one neutron, deuterium, can also be found in water. If you were to compare water that only has protium (protium water) with water that only has deuterium (deuterium water) you would find that

- a mole of protium water weighs the same as a mole of deuterium water.
- a mole of deuterium water weighs considerably less than half as much as a mole of protium water.
- a mole of protium water weighs about twice as much as a mole of deuterium water.
- a mole of deuterium water weighs about twice as much as a mole of protium water.
- a mole of protium water weighs considerably less than half as much as a mole of deuterium water.

ANS: D

DIF: Moderate

REF: Section 2.2 | Section 2.4

OBJ: Bloom's Taxonomy: Application | Bloom's Taxonomy: Synthesis

MATCHING

Match each of the following terms with its correct definition.

- Anything that occupies space and has mass
- A pure substance that cannot be broken down into simpler substances by ordinary chemical or physical techniques
- An atom with the same number of protons as another atom but a different number of neutrons
- The locations around an atomic nucleus where an electron occurs most frequently
- A molecule whose component atoms are different from each other

82. element

85. orbital

83. compound

86. isotope

84. matter

82. ANS: B DIF: Moderate REF: Section 2.1 | Section 2.2
OBJ: Bloom's Taxonomy: Knowledge

83. ANS: E DIF: Moderate REF: Section 2.1 | Section 2.2
OBJ: Bloom's Taxonomy: Knowledge

84. ANS: A DIF: Moderate REF: Section 2.1 | Section 2.2
OBJ: Bloom's Taxonomy: Knowledge

85. ANS: D DIF: Moderate REF: Section 2.1 | Section 2.2
OBJ: Bloom's Taxonomy: Knowledge

93. ANS: B DIF: Moderate REF: Section 2.3
OBJ: Bloom's Taxonomy: Knowledge | Bloom's Taxonomy: Application
94. ANS: A DIF: Moderate REF: Section 2.3
OBJ: Bloom's Taxonomy: Knowledge | Bloom's Taxonomy: Application
95. ANS: E DIF: Moderate REF: Section 2.3
OBJ: Bloom's Taxonomy: Knowledge | Bloom's Taxonomy: Application
96. ANS: C DIF: Moderate REF: Section 2.3
OBJ: Bloom's Taxonomy: Knowledge | Bloom's Taxonomy: Application
97. ANS: B DIF: Moderate REF: Section 2.3
OBJ: Bloom's Taxonomy: Knowledge | Bloom's Taxonomy: Application
98. ANS: D DIF: Moderate REF: Section 2.3
OBJ: Bloom's Taxonomy: Knowledge | Bloom's Taxonomy: Application
99. ANS: B DIF: Moderate REF: Section 2.3
OBJ: Bloom's Taxonomy: Knowledge | Bloom's Taxonomy: Application

SHORT ANSWER

100. Place a large amount of hydrogen gas and oxygen gas in the presence of a fire and you will get an explosion. In light of this, explain how it is possible that water, which is composed of hydrogen and oxygen, is often used to put out fires.

ANS:

Water is a compound, and compounds typically have chemical and physical properties that are distinct from the atoms that make them up. So, water had different properties than the hydrogen and oxygen that it is made of and thus behaves differently from them in the presence of fire.

DIF: Moderate REF: Section 2.1 OBJ: Bloom's Taxonomy: Analysis

ESSAY

101. Oxygen generally forms two covalent bonds, while carbon generally forms four covalent bonds. In contrast, helium is inert (generally does not form any bonds). Explain the reason for the differences in chemical behavior between these three elements.

ANS:

The number of valence electrons in the outermost energy level, or valence shell, determines chemical reactivity. Atoms of an element with a filled valence shell, such as helium, are nonreactive. In contrast, atoms with an unfilled valence shell are reactive; they will tend to gain, lose, or share electrons so that they wind up with a filled valence shell. Oxygen needs two electrons to fill its valence shell, so it tends to form two covalent bonds. Carbon needs four electrons to fill its valence shell so it tends to form four covalent bonds.

DIF: Moderate REF: Section 2.2 OBJ: Bloom's Taxonomy: Application | Bloom's Taxonomy: Synthesis

102. Describe how the interaction of water with dual polarity lipid molecules establishes biological membranes.

ANS:

The hydrogen bonding between water molecules forms a lattice that resists invasion by nonpolar molecules. However, polar molecules can interact with the hydrogen-bond lattice. Lipid molecules with both polar and nonpolar regions can align in a bilayer, with the lipid molecules oriented so that their polar regions are on either side of the bilayer and their nonpolar regions are buried in the middle of the bilayer. In this arrangement only the polar ends are exposed to the water. This creates a membrane of lipid molecules that separates the watery solution on one side of the bilayer from the watery solution on the other side of the bilayer.

DIF: Moderate REF: Section 2.4 OBJ: Bloom's Taxonomy: Synthesis