CHAPTER 2—THE CHEMISTRY OF LIFE

TRUE/FALSE

1. Our liver converts toxic ammonia to a harmless substance called urea through its enzymes.

ANS: T PTS: 1 NOT: Through enzymes, the liver converts toxic ammonia to a harmless substance called urea.

2. ATP is the high-energy fuel molecule that the cell needs in order to function.

ANS: T PTS: 1 NOT: ATP allows the body cells to do work.

3. Water serves as a medium or solvent in which other reactions occur, and water is referred to as the universal solvent.

ANS: T PTS: 1 NOT: Water serves as a medium or solvent in which other reactions occur, and water is referred to as the universal solvent.

4. Chloride (Cl⁻) is necessary for muscle contraction, as well as for building strong bones.

ANS: F PTS: 1 NOT: Chloride is necessary for nervous transmission.

5. Energy storage is the more common function of carbohydrates.

ANS: T PTS: 1 NOT: Carbohydrates have two important functions: energy storage and cell strengthening. Energy storage is the more common function of carbohydrates.

6. Enzymes are protein catalysts that block a chemical reaction.

ANS: F PTS: 1 NOT: Enzymes are protein catalysts, which increase the rate of chemical reactions without being affected by the reaction.

7. The plasma membrane of cells is a selectively permeable membrane.

ANS: T PTS: 1 NOT: The plasma membrane of cells is a selectively permeable membrane.

8. Concerning the effect of temperature on diffusion, the higher the temperature, the faster the movement.

ANS: T PTS: 1 NOT: The higher the temperature, the faster the movement of diffusion.

9. Ammonia (NH₃) is a by-product of the breakdown of amino acids.

ANS: T PTS: 1

NOT: Ammonia comes from the decomposition of proteins via the digestive process and the conversion of amino acids in cellular respiration.

10. Electrons are the smallest particles of an element that maintain all the characteristics of that element and enter into chemical reactions.

ANS: F PTS: 1 NOT: Atoms are the smallest particles of an element that maintain all the characteristics of that element and enter into chemical reactions.

11. An element is a substance whose atoms all contain the same number of protons and the same number of electrons.

ANS: T PTS: 1 NOT: An element is a substance whose atoms all contain the same number of protons and the same number of electrons.

12. The breakdown of the glucose molecule and other nutrients provides the energy to make ATP molecules.

ANS: T PTS: 1 NOT: The breakdown of the glucose molecule and other nutrients provides the energy to make ATP molecules.

13. The cell membrane is composed of one layer of protein and one layer of carbohydrate.

ANS: F PTS: 1 NOT: The cell membrane is composed of an outer and inner layer of protein with a double phospholipid layer in between.

14. Osmosis pertains only to the movement of carbon dioxide molecules.

ANS: F PTS: 1 NOT: Osmosis pertains only to the movement of water molecules.

MULTIPLE CHOICE

- 1. A chemical fuel that allows the body cells to do work and to function is known as _____.
 - a. ATP
 - b. DNA d. RNA

ANS: A

	Feedback		
Α	ATP allows the body cells to do work and to function.		
В	DNA is the genetic material of cells located in the nucleus of the cell.		
С	H_20 or water serves as a medium or solvent in which other reactions occur, and water is		
	referred to as the universal solvent.		
D	RNA is structurally related to DNA and is important for protein synthesis.		

c. H₂0

PTS: 1

A substance whose atoms all contain the same number of protons and the same number of electrons is a(n) _____.

a.	compound	с.	element
b.	electron	d.	catalyst

ANS: C

	Feedback		
Α	A compound is formed when atoms of two or more different elements combine.		
В	Electrons orbit the nucleus of the atom.		
С	An element is a substance whose atoms all contain the same number of protons and the		
	same number of electrons.		
D	A catalyst is an enzyme that increases the rate of a chemical reaction without being		
	affected by the reaction.		

- The individual who developed the atomic theory was _____.
 a. John Dalton
 c. Dimitri Mendeleev

 - b. William Harvey

- d. Andreas Vesalius

ANS: A

	Feedback
Α	John Dalton developed the atomic theory.
В	William Harvey discovered the circulation of blood.
С	Dimitri Mendeleev was the Russian chemist who developed the periodic table of the
	elements.
D	Andreas Vesalius was an anatomist.

PTS: 1

- 4. The number of protons or the number of electrons within an atom is known as the _____.
 - a. energy levels c. atomic number b. orbital d. weight

ANS: C

	Feedback
Α	Orbitals are grouped together to form energy levels.
В	Orbitals are where the electrons are located at any given moment.
С	The atomic number is the number of protons or the number of electrons within an atom.
D	Weight, atomic weight is the relative mass of an atom.

PTS: 1

- 5. The Russian chemist who developed the periodic table of the elements was _____.
 - a. John Dalton

c. Andreas Vesalius

b. William Harvey

d. Dimitri Mendeleev

ANS: D

	Feedback
Α	John Dalton developed the atomic theory.
В	William Harvey discovered the circulation of blood.
С	Andreas Vesalius was an anatomist.
D	Dimitri Mendeleev developed the periodic table of the elements.

- 6. The arrangement of the elements by increasing atomic number in such a way that similar properties repeat at periodic intervals is known as the _____.
 - a. orbital
 - b. periodic table

- c. energy levels
- d. atomic weight

ANS: B

Feedback		
Orbitals indicate where an electron may be located around the nucleus at any one given		
time.		
The periodic table is the arrangement of the elements by increasing atomic number in		
such a way that similar properties repeat at periodic intervals.		
Energy levels: orbitals are grouped together to form energy levels.		
Atomic weight is the relative mass of an atom.		

PTS: 1

- 7. A weak bond that helps hold water molecules together is which type of bond?
 - a. hydrogen c. covalent
 - b. ionic d. neutral

ANS: A

	Feedback
Α	A hydrogen bond is a weak bond that helps hold water molecules together.
В	In an ionic bond, one atom gains electrons while the other atom loses electrons from its outer shell or orbit.
С	In a covalent bond, the atoms share electrons to fill their outermost shells.
D	Neutral is not a correct answer.

PTS: 1

- 8. The universal solvent is _____.
 - a. hydrogen
 - b. chlorine

c. water

.

d. acid

ANS: C

	Feedback
Α	This is not a correct answer.
В	This is not a correct answer.
С	Water is the universal solvent.
D	This is not a correct answer.

PTS: 1

- 9. Approximately what percent of the gas in the atmosphere is oxygen?
 - a. 4% c. 21%
 - b. 16% d. 50%

ANS: C

	Feedback
Α	This is not a correct answer.
В	This is not a correct answer.
С	The level of oxygen in the atmosphere is about 21%.
D	This is not a correct answer.

- 10. Which body organ converts the toxic ammonia to a harmless substance called urea through the actions of its enzymes?
 - a. liver
 - b. pancreas

- c. stomach
- d. kidneys

ANS: A

	Feedback
Α	The liver converts the toxic ammonia to a harmless substance called urea through the actions of its enzymes.
В	This is not a correct answer.
С	This is not a correct answer.
D	This is not a correct answer.

PTS: 1

- 11. The more common of the two functions of carbohydrates is _____.
 - a. dissolving fats
 - b. strengthening muscles

- c. energy storage
- d. insulating the body

ANS: C

Feedback
This is not a correct answer.
This is not a correct answer.
Energy storage is the more common function of carbohydrates; the other function is cell
strengthening.
This is not a correct answer.

PTS: 1

- 12. Ninety-five percent of the fats in the human body are _____.
 - a. triacylglycerols c. amines
 - b. enzymes d. disaccharides

ANS: A

	Feedback
Α	Ninety-five percent of the fats in the human body are triglycerides, now called
	triacylglycerols.
В	Enzymes are proteins.
С	An amine is a substance derived from ammonia.
D	Disaccharides are carbohydrates.

- 13. An enzyme that increases the rate of a chemical reaction without being affected by the reaction is known as a(n) _____.
 - a. catalyst
 - b. antagonist

- c. nucleotide
- d. pyrimidine

ANS: A

	Feedback
Α	A catalyst is an enzyme that increases the rate of a chemical reaction without being
	affected by the reaction.
В	An antagonist is something opposing or resisting the action of another.
С	A nucleotide is a combination of a sugar, a nitrogen base, and a phosphate.
D	A pyrimidine is a nitrogen base that consists of a single ring of six atoms.

PTS: 1

- 14. Crenulate means to _____.
 - a. expand
 - b. dissolve

c. shrivel up d. multiply

ANS: C

	Feedback
Α	This is not a correct answer.
В	This is not a correct answer.
С	Crenulate refers to shriveling up.
D	This is not a correct answer.

PTS: 1

- 15. A substance that combines with H^+ ions when dissolved in water is called a(n) _____.
 - a. acid
 - b. base

- c. catalyst
- d. disaccharide

ANS: B

	Feedback
Α	An acid is a substance that dissociates and forms an excess of H+ ions when dissolved
	in water.
В	A base is a substance that combines with H+ ions when dissolved in water.
С	A catalyst is a substance that increases the rate of a chemical reaction without being
	affected by the reaction.
D	A disaccharide is a carbohydrate.

PTS: 1

- 16. A substance that acts as a reservoir for hydrogen ions, donating them to a solution when their concentration falls and taking the hydrogen ions from a solution when their concentration rises, is known as a(n) _____.
 - a. acid

- c. buffer
- b. base d. catalyst

ANS: C

	Feedback
Α	An acid is a substance that dissociates and forms an excess of H+ ions when dissolved
	in water.
В	A base is a substance that combines with H+ ions when dissolved in water.
С	A buffer is a substance that acts as a reservoir for hydrogen ions, donating them to a
	solution when their concentration falls and taking the hydrogen ions from a solution
	when their concentration rises.
D	A catalyst is a substance that increases the rate of a chemical reaction without being
	affected by the reaction.

- 17. Atoms are electrically _____.
 - a. neutralb. negative

c. buffered

d. positive

ANS: A

	Feedback
Α	Atoms are electrically neutral.
В	This is an incorrect answer.
С	This is an incorrect answer.
D	This is an incorrect answer.

PTS: 1

- 18. The combination of the atoms of two or more elements is known as a(n) _____.
 - a. isotope
 - b. electron

- c. energy levels
- d. compound

ANS: D

	Feedback
Α	An isotope is an atom of an element with a different number of neutrons.
В	Electrons are practically weightless particles that orbit the nucleus.
С	Electron orbitals are grouped together to form energy levels.
D	A compound is the combination of the atoms of two or more elements.

PTS: 1

- 19. Molecules that furnish electrons during a chemical reaction are called _____.
 - a. electron acceptorsb. electron antagonists
- c. electron donorsd. orbitals

ANS: C

	Feedback
Α	Electron acceptors are molecules that gain electrons during a chemical reaction.
В	This is not a correct answer.
С	Electron donors are molecules that furnish electrons during a chemical reaction.
D	Orbitals indicate where an electron may be located around the nucleus at any given
	time.

- 20. A by-product of the breakdown of amino acids is _____.
 - a. ammonia
 - b. glucose

- c. cortisol
- d. carbon dioxide

ANS: A

	Feedback
Α	Ammonia is a by-product of the breakdown of amino acids.
В	Glucose is a carbohydrate.
С	Cortisol is a hormone.
D	Carbon dioxide is a waste product of cellular respiration.

PTS: 1

- 21. The mineral salt needed for muscle contraction and strong bones is _____.
 - a. phosphate c. carbon
 - b. calcium d. oxygen

ANS: B

	Feedback
Α	Phosphate is necessary to produce ATP.
В	Calcium is the mineral salt needed for muscle contraction and strong bones.
С	Carbon is an element found in all living matter.
D	Oxygen is required by all organisms that breathe air.

PTS: 1

- 22. If the fatty acids contain only single covalent bonds, the fat is called a(n) _____.
 - a. unsaturated fat

- c. glycerol
- b. suspended fat d. saturated fat

ANS: D

	Feedback
Α	An unsaturated fat has one or more double bonds.
В	This is not a correct answer.
С	Glycerol is the backbone of a triacylglycerol.
D	A saturated fat contains only single covalent bonds.

PTS: 1

- 23. If the fatty acids contain one or more double covalent bonds, the fat is called a(n) _____.
 - a. unsaturated fat

c. glycerol

b. suspended fat

d. saturated fat

ANS: A

	Feedback
Α	An unsaturated fat has one or more double bonds.
В	This is not a correct answer.
С	Glycerol is the backbone of a triacylglycerol.
D	A saturated fat contains only single covalent bonds.

- 24. The building blocks of proteins are _____.
 - a. carbohydrates
 - b. hydrogen

- c. amino acids
- d. fatty acids

ANS: C

Feedback		
Carbohydrates are involved with energy storage and cell strengthening.		
Hydrogen is an element and a component of many compounds, including water.		
Amino acids are the building blocks of proteins.		
Fatty acids are in triacylglycerols.		

PTS: 1

- 25. The random collision of diffusing molecules is called _____.
 - a. Dalton's theory
 - b. Brownian movement

- c. Harvey's theory of combustion
- d. Mendeleev's theory of motion

ANS: B

	Feedback			
Α	Dalton's theory suggests that all matter consists of atoms.			
В	Brownian movement is the random collision of diffusing molecules.			
С	This is not a correct answer.			
D	This is not a correct answer.			

PTS: 1

- 26. Increased temperature causes the rate of diffusing molecules to _____.
 - a. stopb. decelerate

c. accelerate d. reverse

ANS: C

	Feedback		
Α	This is not a correct answer.		
В	This is not a correct answer.		
С	Increased temperature causes the rate of diffusing molecules to accelerate.		
D	This is not a correct answer.		

PTS: 1

- 27. A solution in which the salt concentration inside the cell is higher than outside the cell is known as
 - a. hypertonic
 - b. hypotonic

- c. isotonic
- d. base

ANS: B

 Feedback

 A
 A solution with the salt concentration higher outside the cell than inside the cell is

	hypertonic.		
В	A solution in which the salt concentration is higher inside the cell is hypotonic.		
С	If the salt concentration is the same in the solution and in the cell, it is isotonic.		
D	A base is a substance that combines with H+ ions when dissolved in water.		

- 28. A solution in which the salt concentration is greater outside the cell than inside the cell is known as
 - a.hypertonicc.isotonicb.hypotonicd.base

ANS: A

	Feedback			
Α	A solution with the salt concentration higher outside the cell than inside the cell is			
	hypertonic.			
В	A solution in which the salt concentration is higher inside the cell is hypotonic.			
С	If the salt concentration is the same in the solution and in the cell, it is isotonic.			
D	A base is a substance that combines with H+ ions when dissolved in water.			

PTS: 1

- 29. A solution in which the salt concentration outside a cell is the same as that inside the cell is known as
 - a. hypertonic
 - b. hypotonic

- c. isotonic
- d. base

ANS: C

	Feedback			
Α	A solution with the salt concentration higher outside the cell than inside the cell is			
	hypertonic.			
В	A solution in which the salt concentration is higher inside the cell is hypotonic.			
С	If the salt concentration is the same in the solution and in the cell, it is isotonic.			
D	A base is a substance that combines with H+ ions when dissolved in water.			

PTS: 1

- 30. Distilled pure water has a pH of 7 and is classified as _____.
 - a. an acidc. hypertonicb. a based. neutral

ANS: D

	Feedback			
Α	An acid is a substance that dissociates and forms an excess of H+ ions when dissolved			
	in water.			
В	A base is a substance that combines with H+ ions when dissolved in water.			
С	A solution with the salt concentration higher outside the cell than inside the cell is			
	hypertonic.			
D	Pure distilled water with a pH of 7 is neutral; the dissociation of water produces H+ ions			
	and OH- ions in equal amounts.			

- 31. Blood returning to the lungs is high in _____.
 - a. oxygen
 - b. nitrogen

- c. carbon dioxide
- d. ammonia

c. amino acid

d. lipid

ANS: C

	Feedback		
Α	Blood returning to the lungs is low in oxygen.		
В	This is not a correct answer.		
С	Blood returning to the lungs is high in carbon dioxide.		
D	This is not a correct answer.		

PTS: 1

- 32. A base is also called a(n) _____.
 - a. alkali
 - b. acid

ANS: A

	Feedback			
Α	A base is also called an alkali.			
В	This is not a correct answer.			
С	This is not a correct answer.			
D	This is not a correct answer.			

PTS: 1

- 33. _____ transport is the transportation of materials against a concentration gradient.
 - a. Diffusive c. pH
 - b. Osmotic d. Active

ANS: D

	Feedback		
Α	Diffusion is the movement of molecules through a medium from an area of high		
	concentration to an area of low concentration.		
В	Osmosis is a special kind of diffusion.		
С	pH is defined as the negative logarithm of the hydrogen ion concentration.		
D	Active transport is the transportation of materials against a concentration gradient.		

PTS: 1

COMPLETION

1. Approximately 60% to 80% of a cell is _____.

ANS: water

- 2. ______ is produced as a waste product of cellular respiration. ANS: Carbon dioxide PTS: 1 3. ______ is required by all organisms that breathe air. ANS: Oxygen PTS: 1 4. Carbohydrates have two important functions: structural strengthening of the cell and ANS: energy storage PTS: 1 5. The smallest particle of an element that maintains all of the characteristics of that element is a(n) ANS: atom PTS: 1 ______ is the movement of water molecules through a semipermeable membrane from an area of high concentration of water molecules to an area of low concentration of water 6. molecules. ANS: Osmosis PTS: 1 ______ is a small, simple molecule composed of two hydrogen atoms covalently 7. bonded to one oxygen atom. ANS: Water PTS: 1 8. The study of elements, their compounds, and the reactions that occur between them is _____ ANS: chemistry PTS: 1 9. The area where an electron can be found is referred to as the electron's ______.
- 9. The area where an electron can be found is referred to as the electron s

ANS: orbital

10.	Atoms combine chemically with one another to form		
	ANS: bonds		
	PTS: 1		
11.	About% of the gas in the atmosphere is oxygen.		
	ANS: 21 twenty-one		
	PTS: 1		
12.	A(n) is a substance whose atoms all contain the same number of protons and the same number of electrons.		
	ANS: element		
	PTS: 1		
13.	Since the number of protons equals the number of electrons, an atom is electrically		
	ANS: neutral		
	PTS: 1		
14.	In 1808, John Dalton proposed the theory that all matter consists of atoms. This proposal led to the development of the theory.		
	ANS: atomic		
	PTS: 1		
15.	The is the number of protons or the number of electrons.		
	ANS: atomic number		
	PTS: 1		
16.	The modern table of the elements arranges the elements by increasing atomic number in such a way that similar properties repeat at periodic intervals.		
	ANS: periodic		
	PTS: 1		
17.	is the genetic material of a cell located in the nucleus of the cell.		
	ANS: DNA Deoxyribonucleic acid		

18.	If a substance dissociates and forms an excess of H^+ ions when dissolved in water, it is referred to as $a(n)$		
	ANS:	acid	
	PTS:	1	
19.	A com	pound is a combin	ation of the atoms of two or more
	ANS:	elements	
	PTS:	1	
20.	Triacy	lglycerols consist	of two types of building blocks: glycerol and acids.
	ANS:	fatty	
	PTS:	1	
21.			are composed of carbon, hydrogen, oxygen, and nitrogen covalently bonded.
	ANS:	Proteins	
	PTS:	1	
22.			triphosphate (ATP) is the fuel that runs the cell's machinery.
	ANS:	Adenosine	
	PTS:	1	

MATCHING

Match each item with the correct statement below.

- a. osmosis d. atoms
- b. diffusion e. compound
- c. ion
- 1. the combination of the atoms of two or more elements
- 2. movement of water across a semipermeable membrane from an area of high concentration to an area of low concentration
- 3. movement of molecules through a medium from an area of high concentration to an area of low concentration
- 4. charged atoms
- 5. smallest particles of an element

1.	ANS:	E	PTS:	1
2.	ANS:	А	PTS:	1
3.	ANS:	В	PTS:	1
4.	ANS:	С	PTS:	1

5. ANS: D PTS: 1

Match each item with the correct statement below.

a. covalent bond

- d. carbon
- b. ionic bond
- c. acid

- e. water
- 6. element found in all living matter
- 7. the most abundant substance in living cells
- 8. bond in which one atom gains electrons while another atom loses electrons
- 9. bond in which atoms share electrons to fill their outermost shells
- 10. substance that dissociates and forms an excess of H⁺ ions
- 6. ANS: D PTS: 1
- 7. ANS: E PTS: 1
- 8. ANS: B PTS: 1
- 9. ANS: A PTS: 1
- 10. ANS: C PTS: 1