Student Name _____

Basic Chemistry

2

Answer Key: Textbook page references are provided as a guide for answering these questions. A complete answer key was provided for your instructor.

OBJECTIVES

1. Define the terms *matter, element,* and *atom,* and do the following:
   - List the four elements that comprise 96% of body weight.
   - Describe the three components of an atom.
   - Describe the role of electrons in the formation of chemical bonds.
2. Differentiate among ionic, covalent, and hydrogen bonds.
3. Explain ions, including the differences among electrolytes, cations, and anions.
4. Explain the difference between a molecule and a compound, and list five reasons why water is essential to life.
5. Explain the role of catalysts and enzymes.
6. Differentiate between an acid and a base, and define pH.
7. List the six forms of energy and describe the role of adenosine triphosphate (ATP) in energy transfer.
8. Differentiate among a mixture, solution, suspension, colloidal suspension, and precipitate.

Part I: Mastering the Basics

MATCHING

Matter, Elements, and Atoms

Directions: Match the following words and symbols to the most appropriate definition by writing the correct letter in the space provided. Some words and symbols may be used more than once. See text, pp. 15-17.

A. chemistry
B. matter
C. element
D. atom
E. K
F. Cl
G. Na
H. Ca
I. O
J. N
K. H
L. Fe

1. _____ A fundamental substance that cannot be broken down into a simpler form by ordinary chemical means
2. _____ Smallest unit of an element that has that element's characteristics
3. _____ Anything that occupies space and has weight
4. _____ Symbol for iron
5. _____ Composed of three particles: protons, neutrons, and electrons
6. _____ Exists in three states: solid, liquid, and gas
7. _____ The study of matter
8. _____ Symbol for oxygen
9. _____ Symbol for sodium
10. _____ Symbol for nitrogen
11. _____ Symbol for potassium
12. _____ Symbol for hydrogen
13. _____ Symbol for calcium
14. _____ Symbol for chlorine
15. _____ Identify the two atoms in table salt.
16. _____ Identify the two atoms in calcium chloride.

MATCHING

The Atom

Directions: Match the following terms to the most appropriate definition by writing the correct letter in the space provided. Some terms may be used more than once. See text, pp. 16-17.

A. electron(s)
B. proton(s)
C. neutron
D. atomic number
E. atomic mass
F. radioisotope
G. radioactivity
H. isotope

1. _____ Number of protons in the nucleus
2. _____ Sum of the protons and the neutrons
3. _____ Helium has two protons and two neutrons; this is what the number 2 indicates.
4. _____ Helium has two protons and two neutrons; this is what the number 4 indicates.
5. _____ Carries a negative charge and circulates in orbits around the nucleus
6. _____ Carries a positive charge and is located within the nucleus
7. _____ Has a neutral charge and is located within the nucleus
8. _____ In each atom, the number of these is equal to the number of protons.
9. _____ Different form of the same element (same atomic number but a different atomic mass); an example is "heavy hydrogen"
10. _____ Unstable isotope
11. _____ Spontaneous decay of a radioisotope
12. _____ The atomic number is determined by the number of _____.
13. _____ These atomic particles are represented by the planets encircling the sun in Figure 2-2.
14. _____ This particle is added or removed in making an isotope of an atom.
15. _____, _____ These particles are represented by the sun in Figure 2-2.

MATCHING

Bonds

Directions: Match the following words to the most appropriate definition by writing the correct letter in the space provided. Some words may be used more than once. See text, pp. 18-19.

A. ionic bond
B. covalent bond
C. hydrogen bond

1. _____ Type of bond formed when electrons are shared by atoms
2. _____ Type of bond that forms between water molecules
3. _____ Type of bond that forms water, H_2O
4. _____ Type of bond between sodium and chloride in table salt, NaCl
5. _____ Intermolecular bond
6. _____ Type of bond formed when one atom donates an electron to another atom
7. _____ Type of bond usually formed when carbon interacts with another atom

MATCHING

Cations, Anions, and Electrolytes

Directions: Match the following words to the most appropriate definition by writing the correct letter in the space provided. Some words may be used more than once. See text, p. 20.

A. cation(s)
B. anion(s)
C. electrolyte(s)
D. ion(s)
E. ionization

1. _____ Atom that carries an electrical charge
2. _____ Sodium ion
3. _____ Chloride ion
4. _____ Formed as electrons are lost or gained
5. _____ Classification of NaCl
6. _____ Positively charged ion
7. _____ Negatively charged ion
8. _____ Ions represented as Na^+, K^+, and Ca^{2+}

9. _____ Dissociation of NaCl into Na^+ and Cl^-

10. _____ Substance that can ionize

11. _____ Cl^-, Na^+, K^+, and Ca^{2+}

MATCHING

Molecules and Compounds

Directions: Match the following words to the most appropriate definition by writing the correct letter in the space provided. Some words may be used more than once. See text, pp. 20-22.

A. water
B. oxygen
C. carbon dioxide
D. chemical reaction
E. catalyst
F. molecule(s)
G. compound(s)

1. _____ Classification of O_2 and N_2

2. _____ Substances that contain molecules formed by two or more different atoms

3. _____ Classification of H_2O, in addition to molecule

4. _____ Most abundant compound in the body

5. _____ Molecule that exists in nature as a gas and plays an essential metabolic role in supplying the cells of the body with energy

6. _____ Compound is a waste product that is formed when food is chemically broken down for energy

7. _____ This molecule is the reason why cardiopulmonary resuscitation (CPR) must be started immediately.

8. _____ Compound that is considered to be the universal solvent

9. _____ Compound that has the ability to absorb large amounts of heat without itself increasing dramatically in temperature

10. _____ Describes, for example, glucose + $O_2 \rightarrow CO_2 + H_2O$ + energy

11. _____ Describes the role of an enzyme that increases the rate of a chemical reaction

MATCHING

Acids and Bases

Directions: Match the following words and symbols to the most appropriate definition by writing the correct letter in the space provided. Some words and symbols may be used more than once. See text, pp. 22-24.

A. acid or acidic
B. base or basic
C. buffer
D. pH

1. _____ A scale ranging from 0 to 14 that measures how many H^+ (hydrogen ions) are in solution

2. _____ Electrolyte that dissociates into H^+ and an anion

3. _____ Substance that removes H^+ from solution

4. _____ Describes a pH of 7.6

5. _____ Describes the effect of an antacid on stomach H^+

6. _____ Describes grapefruit juice, vinegar, and lemon juice

7. _____ Also referred to as *alkaline*

8. _____ Chemical substance that prevents large changes in pH

9. _____ Describes normal pH of urine

10. _____ Describes normal pH of blood

11. _____ Describes normal pH of gastric (stomach) juice

12. _____ Substance that can either donate or remove H^+ from solution

13. _____ Turns litmus paper pink

14. _____ Turns litmus paper blue

READ THE DIAGRAM

pH Scale

Directions: Referring to Figure 2-6 in the textbook, write the numbers from the pH scale in the spaces below. See text, pp. 23-24.

1. _____ Which number indicates a neutral pH?
2. _____ What is the acidic range?
3. _____ What is the basic range?
4. _____ What is the alkaline range?
5. _____ Relative to pH 7, which numbers indicate a higher concentration of H^+?
6. _____ Relative to pH 7, which numbers indicate a lower concentration of H^+?
7. _____ Range for blood pH
8. _____ Range for intestinal contents
9. _____ Range for stomach contents
10. _____ Range for urine

MATCHING

Energy

Directions: Match the following words and symbols to the most appropriate definition by writing the correct letter in the space provided. Some words and symbols may be used more than once. See text, pp. 24-25.

A. mechanical
B. thermal
C. nuclear
D. chemical
E. electrical
F. radiant
G. ATP

1. _____ A log is burned, providing light as chemical energy is converted into this type of energy.
2. _____ Walking is an expression of this type of energy.
3. _____ A log is burned, warming everyone around the campfire as chemical energy is converted into this type of energy.
4. _____ The heart pushes blood into large blood vessels as chemical energy is converted into this type of energy.
5. _____ Type of energy that holds atoms together
6. _____ Type of energy that is released from the movement of ions across cell membranes
7. _____ Energy transfer substance
8. _____ The unstable nucleus of an isotope spontaneously decays, thereby emitting this type of energy.
9. _____ Responsible for body temperature as chemical energy is converted to this type of energy
10. _____ Example: sugar $\rightarrow CO_2 + H_2O +$ energy (ATP)

MATCHING

Mixtures, Solutions, Suspensions, and Precipitates

Directions: Match the following words to the most appropriate definition by writing the correct letter in the space provided. Some words may be used more than once. See text, pp. 25-27.

A. mixture
B. solution
C. suspension(s)
D. aqueous
E. colloidal suspension
F. tincture
G. precipitate

1. _____ An example is blood plasma because the proteins remain suspended within the plasma.
2. _____ Solution in which water is the solvent
3. _____ Solution in which alcohol is the solvent
4. _____ Combinations of two or more substances that can be separated by ordinary physical means
5. _____ Examples include mayonnaise, egg white, and jellies.
6. _____ Mixture that contains a solvent and solute; there is an even distribution of the solute with the solution
7. _____ Combination of sugar and little bits of iron
8. _____ Example: the white flakes that form when you add a drug to an IV salt solution

9. _____ Mixture that must be shaken to prevent settling of particles

10. _____ Suspension in which the particles are so small that they do not need to be shaken to keep them evenly distributed

11. _____ The solid formed in a solution during a chemical reaction

12. _____ Example is sea or salt water

SIMILARS AND DISSIMILARS

Directions: Circle the word in each group that is least similar to the others. Indicate the similarity of the three words on the line below each question.

1. molecules protons electrons neutrons

_____

2. Na ion K ion Cl ion H ion

_____

3. ionic covalent pH intermolecular

_____

4. anion neutron ion cation

_____

5. H^+ acidic pH < 6.8 alkalosis

_____

6. basic pH > 7.6 potassium alkaline

_____

7. Mg N H_2O Zn

_____

8. chemical pH mechanical thermal

_____

9. aqueous water tincture ideal solvent

_____

Part II: Putting It All Together

MULTIPLE CHOICE

Directions: Choose the correct answer.

1. Which of the following describes activities such as chewing food and chopping a log?
   a. chemical change
   b. neutralization reaction
   c. ionization reaction
   d. physical change

2. Which of the following is a strong acid?
   a. vinegar
   b. lemon juice
   c. blood
   d. HCl

3. Which of the following is/are classified as thermal, chemical, or radiant?
   a. cations
   b. anions
   c. energy
   d. electrolytes

4. Which of the following words best describes a radioisotope?
   a. acidic
   b. alkaline
   c. unstable
   d. ionization

5. Which of the following describes the chlorine atom when its outer electron shell gains one electron?
   a. +1 positive charge
   b. no electrical charge
   c. −2 negative charge
   d. −1 negative charge

6. Hydrogen has one proton, zero neutrons, and one electron. Which statement is true?
   a. The atomic number is 2.
   b. The atomic mass is 2.
   c. The atomic number is 1.
   d. This is an isotope of helium because it has no neutrons.

7. What type of bond is formed when two hydrogen atoms and one oxygen atom unite to form water?
   a. ionic
   b. hydrogen
   c. intermolecular
   d. covalent

8. What type of reaction occurs when HCl is mixed with a NaOH solution to form a salt (NaCl) and water?
   a. neutralization
   b. agglutination
   c. differentiation
   d. catabolism

9. What is the pH range of blood?
   a. 4.75 to 5.50
   b. 8.45 to 8.95
   c. 7.35 to 7.45
   d. 7.00 to 7.35

10. Which of the following is an electrolyte?
    a. potassium chloride
    b. glucose
    c. water
    d. mayonnaise

11. Which of the following is most acidic?
    a. intestinal contents
    b. blood
    c. pH 7.2
    d. pH 6.6

12. The sodium ion is a(n)
    a. electrolyte.
    b. anion.
    c. compound.
    d. cation.

13. A blood pH of 7.2
    a. has fewer H^+ ions than normal blood pH.
    b. is acidosis.
    c. is within normal limits.
    d. is alkalosis.

14. A blood pH of 7.55
    a. has fewer H^+ ions than normal blood pH.
    b. is within normal limits.
    c. is considered acidotic.
    d. can be lowered by the removal of H^+.

15. When placed in water, sodium chloride
    a. lowers the pH of the solution.
    b. forms a NaCl precipitate.
    c. ionizes into Na^+ and Cl^-.
    d. forms a strong acid.

Part III: Challenge Yourself!

GROUPS AND PUZZLE

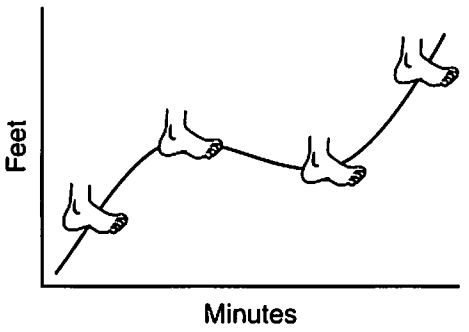
1. Which group is incorrect?
   a. parts of an atom: proton, neutron, electron
   b. electrolytes: NaCl, $CaCl_2$, KCl
   c. chemical bonds: ionic, covalent, intermolecular
   d. cations: sodium ion, potassium ion, chloride ion

2. Which group is incorrect?
   a. parts of an atom: proton, neutron, electron
   b. cations: sodium ion, potassium ion, calcium ion
   c. states of matter: solid, liquid, gas
   d. trace elements: copper, calcium, hydrogen

3. Which group is incorrect?
   a. chemical bonds: ionic, covalent, intermolecular
   b. ions: cations, anions
   c. parts of an atom: protons, neutrons, electrons
   d. carriers of a negative charge: electrons, anions, neutrons

BODY TOON

Hint: Spray Painting the Town



Answer: graph-feetie (graffiti)

Student Name _____

PUZZLE

Hint: YUM...

Directions: Perform the following functions on the Sequence of Words that follows. When all the functions have been performed, you are left with a word or words related to the hint. Record your answer in the space provided.

Functions: Remove the following:

1. Clinical condition characterized by pH < 7.35
2. Clinical condition characterized by pH > 7.45
3. Parts (three) of an atom
4. Color of an acid on the pH scale
5. Color of a base on the pH scale
6. Another word for basic
7. Types of bonds (two): sharing and donating
8. Most common compound in the body
9. Energy transfer molecule
10. Name of a water solution and an alcohol solution

Sequence of Words

WATERSODIUMATPALKALINECOVA
LENTCARBONALKALOSISELECTONSPIN
KPROTONSHYDROGENNEUTRON
SAQUEOUSOXYGENIONICBLUEACIDO
SISSULFURTINCTURENACHOS

Answer: _____