ANSWERS TO CHAPTER 2

CONTENT LEARNING ACTIVITY

Basic Chemistry
A. 1. Matter; 2. Mass; 3. Weight; 4. Kilogram
B. 1. Element; 2. Atom; 3. Neutron; 4. Electron; 5. Electron cloud
C. 1. Atom; 2. Electron cloud; 3. Nucleus; 4. Proton; 5. Neutron

Electrons and Chemical Bonding
1. Electrons; 2. Ions; 3. Ionic; 4. Covalent; 5. Double; 6. Polar; 7. Hydrogen

Molecules and Compounds
1. Molecule; 2. Compound; 3. Molecule; 4. Compound; 5. Molecule; 6. Dissociate

Chemical Reactions
1. Reactants; 2. Products; 3. Synthesis; 4. Decomposition; 5. Exchange; 6. Reversible; 7. Equilibrium; 8. Potential; 9. Released; 10. Heat; 11. ATP

Rate of Chemical Reactions
1. Increases; 2. Decreases; 3. Catalyst; 4. Enzymes

Acids and Bases
A. 1. Acids; 2. Bases; 3. Salts; 4. Buffers
B. 1. Neutral solution; 2. Acidic solution; 3. Alkaline (basic) solution

Inorganic Chemistry
A. 1. Oxygen (O_2); 2. Carbon dioxide (CO_2)
B. 1. Heat; 2. Lubricant; 3. Digestion; 4. Transport; 5. Dissociate; 6. React

Organic Chemistry
1. Organic molecules; 2. Inorganic molecules

Carbohydrates
1. Monosaccharides; 2. Disaccharides; 3. Polysaccharides

Lipids
1. Lipids; 2. Glycerol, Fatty Acids; 3. Triacylglycerol; 4. Saturated; 5. Unsaturated

Proteins
1. Amino acid; 2. Essential; 3. Shape; 4. Denaturation; 5. Enzymes; 6. Structural; 7. Contraction; 8. Activation energy; 9. Lock and key model

Nucleic Acids
1. Nucleotide; 2. DNA; 3. Chromatin; 4. Chromosomes; 5. RNA; 6. DNA

QUICK RECALL

1. Electrons—negative charge, protons—positive charge, and neutrons—no charge
2. Ionic, covalent, and hydrogen bonding
3. Decomposition, synthesis, and exchange reactions
4. Nature of reacting substances, concentration of reacting substances, temperature, and catalysts (enzymes)
5. Carbohydrates—monosaccharides, fats—glycerol and fatty acids, proteins—amino acids, and nucleic acids—nucleotides
6. Monosaccharides, disaccharides, and polysaccharides
7. Energy, structure, and regulation
8. Regulation, structure, energy, contraction, transport, and protection
9. Heredity, Controlling cell activities, and protein synthesis

WORD PARTS

1. neutron, neutral
2. isotope
3. synthesis
4. polysaccharide
5. monosaccharide
6. monosaccharide, disaccharide, polysaccharide

MASTERY LEARNING ACTIVITY

1. E. An element consists of atoms of only one kind. An atom of an element is that smallest particle of an element that has the chemical characteristics of that element. A molecule is composed of two or more atoms chemically joined to form an independent unit, and electrons, protons, and neutrons are parts of atoms.
2. D. The atomic number of an element is equal to the number of protons in each atom. Because the number of electrons is equal to the number of protons, the number of electrons is also equal to the atomic number. The number of neutrons in an atom is not necessarily equal to the number of electrons.

3. A. A polar covalent bond occurs because of unequal sharing of electrons; one end of the molecule is more negative than the other end. Nonpolar covalent bonds share electrons equally between atoms, whereas ionic bonds involve complete transfer of electrons between atoms.

4. B. Synthesis reactions occur when atoms, ions, or molecules combine to form larger, more complex molecules. Polysaccharides are made up of many monosaccharides bonded together. The breakdown of fat is a decomposition reaction. Hydrochloric acid and sodium hydroxide reacting to form sodium chloride and water is an exchange reaction.

5. B. Decomposition reactions involve the breakdown of molecules. Atoms or molecules are transferred in exchange reactions, and synthesis reactions produce larger molecules from smaller molecules.

6. D. Chemical reaction rates are increased by increasing concentration of the reactions, increasing temperature, and the presence of enzymes.

7. C. On the pH scale, numbers below 7 denote an acid. Because acids donate hydrogen ions to a solution, the more acidic the solution (i.e., lower pH), the more hydrogen ions will be present.

8. D. Buffers resist a change in pH. Enzymes speed up reactions they catalyze.

9. C. Because water molecules are polar, ionic substances tend to separate, or dissociate in water. Water is composed of two hydrogen atoms, and one oxygen atom. Water absorbs large amounts of heat when it changes from the liquid form (evaporates), and is very important for cooling the body. Water is involved in many chemical reactions in the body.

10. A. Glycogen is a polysaccharide composed of many glucose (a monosaccharide) molecules. Phospholipids and steroids are lipids, and DNA is a nucleic acid.

11. D. Glycerol and fatty acids combine to form a fat. The most common fats, which have three fatty acids attached to a glycerol molecule, are triacylglycerols. Monosaccharides and disaccharides are building blocks for carbohydrates, and amino acids are building blocks for proteins.

12. D. Hydrogen bonds cause the amino acid chain to be folded or coiled. There are 20 basic types of amino acids; eight of these are essential amino acids and cannot be produced by the body. Different proteins contain different numbers and arrangement of amino acids. The shape of proteins is the determining factor for their function.

13. D. Enzymes are protein molecules that act as catalysts and can be used again after a reaction. However, they function by lowering the activation energy required for reactions.

14. E. All of the concepts determine, or are dependent upon, protein shape. Enzyme shape produces the lock and key model of enzyme activity; this makes enzymes very specific for the reaction they catalyze. Hydrogen bonds between amino acids produce folding or coiling of the amino acid chain. Denaturation is the loss of shape of a protein that results when these hydrogen bonds are broken.

15. A. DNA has a double strand of nucleotides (double helix), and contains the sugar deoxyribose. There are three types of RNA.

FINAL CHALLENGES

1. Salt (NaCl) dissociates into sodium and chloride ions in water. These ions are not visible in water, so the salt has "disappeared". When the water evaporates, the sodium and chloride ions are no longer held apart by the polar water molecules, so once again sodium chloride molecules appear.

2. A. Substances A and B require activation energy for the reaction to proceed, and this activation energy is provided by the heat.
   B. Substance D is a catalyst that lowers the activation energy requirement, but it is not used up or altered in the reaction.

3. Holding one's breath causes an increase in blood carbon dioxide levels because carbon dioxide is not eliminated by the respiratory system. As a result, more carbonic acid (H_2CO_3) forms and then dissociates into hydrogen ions (H^+) and bicarbonate ions (HCO_3^-). The increased number of hydrogen ions cause a decrease in blood pH.

4. Carbohydrates are usually polar molecules that dissolve in water, whereas lipids usually do not dissolve in water but do dissolve in organic solvents such as alcohol (medicinal supply) or acetone (fingernail polish remover). Because many carbohydrates are sugars, one could also taste each substance (but tasting is really not a safe way to test unknown substances!)