

Chapter 6

Teacher Guide and Answers

Page 22 • Section 2

1. activation energy
2. A substrate binds to an enzyme at the active site, which has a complementary shape, and the substrate is converted to product.
3. reactants: PbO_2 and HCl , products: PbCl_2 , Cl_2 , H_2O
4. In an endothermic reaction, the energy of the products is higher than the energy of the reactants. The reaction absorbs energy. In an exothermic reaction, the energy of the products is lower than the energy of the reactants, and the reaction releases energy.
5. $4\text{H}_2\text{O}$; 3O_2

Page 23 • Section 3

1. A solution is made by dissolving a solute in a solvent.
2. Buffers keep the pH within a particular range, and most biological processes require that the pH be between 6.5 and 7.5.
3. Oxygen has a stronger attraction for the shared electrons than hydrogen does, so the electrons spend more time near the oxygen nuclei. The bent shape of the molecule also contributes to its polarity.
4. OH^-
5. salad dressing: heterogeneous mixture, carbonated water: solution. The oil and vinegar separate, but the carbon dioxide and water do not.

Page 24 • Section 4

1. Polymers are molecules made from repeating units of identical or nearly identical organic compounds that are linked together by a series of covalent bonds.
2. Carbon has four electrons in its outermost energy level, so it can form four bonds with other atoms or with itself to make compounds. These compounds can be in the shape of chains, branches, and rings.
3. Students answers will vary. Nucleic acids store genetic information and are used to make copies of proteins, which are involved in almost every function of the body.

4. Both saturated fats and unsaturated fats have fatty acid tails. Saturated fats have only single bonds between all the carbons, and no more hydrogen atoms can bond to the tail. Unsaturated fats have at least one double bond between carbon atoms, and at least one more hydrogen can be added to the tail.
5. Student answers will vary. Proteins are involved in almost every function of the body, and they are all made from a combination of only 20 amino acids. The four different levels of structure allow the amino acids to be combined in a multitude of different orders and shapes to form all of the different types of proteins with different functions.

Chapter Test A

Page 25 • Part A: Multiple Choice

1. B
2. C
3. A

Page 25 • Part B: Matching

Matching Set 1

1. proton
2. electron
3. electron
4. neutron

Matching Set 2

5. B
6. C
7. A

Page 26 • Part C: Interpreting Graphs

1. Hydrogen, carbon, and oxygen are the three most abundant elements in living things.
2. 5730 years

Page 26 • Part D: Short Answer

1. An element is a pure substance that cannot be broken down into other substances by physical or chemical means.
2. Enzymes are catalysts that speed up the rate of chemical reactions in cells.

3. Macromolecules include carbohydrates, lipids, proteins, and nucleic acids.

Page 27 • Part E: Concept Application

1. The cells of living things need many nutrients, such as vitamins and minerals. Water dissolves these nutrients so they can be transported into cells. Cells use the nutrients to perform basic life functions. Without the nutrients, cells would die, eventually resulting in the death of the organism.
2. Fats contain lipids, and lipids store energy. Lipids are also a component of membranes and other vital molecules used in the body. Small amounts of fats provide the lipids necessary for repairing and growing new cell membranes.

Chapter Test B

Page 28 • Part A: Multiple Choice

1. D
2. D
3. A
4. B
5. A

Page 28 • Part B: Matching and Completion

Matching

1. A
2. B
3. C

Completion

4. atoms
5. compound
6. ion
7. product
8. hydrogen ions

Page 29 • Part C: Interpreting Graphs

1. A: hydrogen; B: carbon; C: oxygen
2. 25 percent

Page 29 • Part D: Short Answer

1. All three particles make up an atom. Protons and neutrons are located in the nucleus of the atom, while electrons are constantly moving outside the nucleus. Protons have a positive charge, electrons have a negative charge, and neutrons have no charge.
2. Both types of bonds involve the electrons of atoms. A covalent bond forms when atoms share electrons, while an ionic bond is formed by the attraction of two oppositely charged atoms or groups of atoms.
3. The activation energy of a chemical reaction is the minimum amount of energy needed for the reactants involved in the reaction to form the products. A catalyst, such as an enzyme, is a substance that lowers the activation energy needed to start the reaction.

Page 30 • Part E: Concept Application

1. The periodic table of the elements lists all the elements in periods and columns, called groups, based on their chemical and physical properties. Elements in the same column have similar chemical and physical properties, and chemists can use this information to determine how elements can be combined into new compounds. Scientists can analyze the elements in natural compounds and choose elements with similar properties to form synthetic compounds with predictable properties.
2. The chemical and physical properties of elements change when they combine to form a compound. When sodium and chlorine combine to form the compound table salt, their properties change. Sodium no longer reacts violently with water, and chlorine is no longer toxic to living things.
3. Lipids do not dissolve in water. Similarly, water cannot easily cross layers of lipid. The lipids in human skin serve to keep water in our bodies and prevent dehydration as well as preventing skin from absorbing harmful chemicals which might come in contact with our skin.

Chapter Test C

Page 31 • Part A: Multiple Choice

1. B
2. D
3. A
4. C
5. D
6. B

Page 31 • Part B: Completion

1. protons
2. isotopes
3. BF_3
4. covalent bonds
5. base
6. organic chemistry

Page 32 • Part C: Interpreting Graphs

1. A: hydrogen; B: carbon; C: oxygen; D: nitrogen
2. A 5000-year-old seed can be more accurately dated because there is a greater quantity of carbon-14 remaining. A 100,000-year-old bone has little carbon-14 remaining in it, which greatly reduces the possibility of calculating an accurate age for the artifact. Too many half-lives have passed for the 100,000-year-old bone to be accurately dated using carbon-14 with a half-life of only 5730 years.

Page 32 • Part D: Short Answer

1. The box on the periodic table of the elements that contains gold provides the element's name, chemical symbol, and average atomic mass. The chart also reveals the number of protons and electrons in gold atoms. The location of gold on the periodic table reveals other elements that have similar physical and chemical properties as gold.
2. Without slight positive and negative charges around each molecule, there would be no van der Waals forces to hold the molecules close together. The molecules would more easily separate from each other to form water vapor and most common ionic substances would no longer be soluble in water.

3. Blood is a heterogeneous mixture called a suspension. A suspension has undissolved particles that do not settle out of the liquid. Sugar water is a homogenous mixture called a solution because the sugar completely dissolves in the water. The soil-water mixture is a heterogeneous mixture because it forms two distinct layers of substances.

Page 33 • Part E: Concept Application

1. Hydrogen peroxide and water are different compounds with different chemical formulas. The different molecular structure of hydrogen peroxide completely changes its physical and chemical properties, and these different properties make hydrogen peroxide toxic to living things.
2. The fibers of meat will break down naturally causing the meat to become tender, but the enzyme papain acts as a catalyst to speed up the chemical reactions involved with breaking down the meat fibers to make the meat more tender.
3. During the summer when temperatures are high, water absorbs great quantities of heat without becoming too hot because it has a high specific heat index. This property of water protects aquatic creatures from extreme heat. During the winter, ice freezes on the surface of the pond because solid water is less dense than liquid water. The ice insulates aquatic creatures from extreme cold temperatures. If ice were denser than water, an ice layer would form on the bottom of the pond and freeze the aquatic creatures hibernating in the pond's muddy bottom.