Name _____ Class _____ Date _____

CHAPTER 1 The Scope of Biology

Summary of Key Concepts

Concept 1.1 Biology explores life from the global to the microscopic scale. (pp. 4–6)

Biology reaches from the scale of the entire planet down to the scale of cells and molecules. Biologists divide this huge range of scales into different levels of organization. At the global scale is the *biosphere*, which consists of all the parts of the planet that are inhabited by living things. Making up the biosphere are Earth's ecosystems. An *ecosystem* is the community of living things in an area, along with the nonliving features of the environment that support the living community. Examples of ecosystems range from a small backyard pond to a tropical rain forest covering millions of acres. The community of each ecosystem consists of individual living things, called *organisms*. All organisms are made up of one or more *cells*, which are life's basic units of structure and function. The nucleus of each cell contains molecules of *DNA*, the chemical responsible for inheritance. Each DNA molecule includes units of inherited information called *genes*.

1. What makes up the biosphere? _____

_____

2. Identify the components of an ecosystem. _____

_____

_____

3. How are genes related to DNA? _____

_____

Concept 1.2 Biology explores life in its diverse forms. (pp. 7–10)

A *species* is a distinct form of life. Zebras, monarch butterflies, and human beings are all examples of species. Biologists classify the more than 1.5 million known species by organizing similar species into larger categories. Many biologists call the broadest category a *domain*. There are three domains: Archaea, Bacteria, and Eukarya. Most organisms in the Archaea and Bacteria domains are *unicellular*, meaning that their entire bodies consist of just a single cell. All of the Archaea and Bacteria are *prokaryotic cells,* which are cells without nuclei. The Eukarya domain is divided into four subgroups, or kingdoms: protists, fungi, plants, and animals. All are organisms with *eukaryotic cells*, meaning they contain nuclei. Many protists and some fungi are unicellular. The rest of the Eukarya are *multicellular*, or made of many cells.

4. Which domains consist mainly of unicellular organisms? _____

_____

5. How do eukaryotic cells differ from prokaryotic cells? _____

_____

Name _____ Class _____ Date_____

6. In which domain should a biologist classify a single-celled organism containing a nucleus? _____

Concept 1.3 Ten themes unify the study of life. (pp. 11–19)
These ten basic ideas, or themes, can help you connect what you learn as you study biology. **Theme 1:** All levels of life, from the biosphere to the cell, are biological systems. A *system* is a complex organization formed from a combination of parts. **Theme 2:** Cells are the basis of life. All organisms are made of cells. Multicellular organisms depend on the interactions of their many cells. **Theme 3:** Form is related to function. For example, the structure of a bird's wing allows the bird to fly. **Theme 4:** Inherited information in the form of DNA enables organisms to reproduce their own kind. **Theme 5:** Organisms interact continuously with their environment. **Theme 6:** Life on Earth depends on energy from the sun. *Producers* such as plants use sunlight to make food in a process called *photosynthesis*. *Consumers* such as animals obtain food by eating producers or other consumers. **Theme 7:** Organisms can regulate their internal conditions and maintain *homeostasis*, or a "steady state." For example, mammals and birds can maintain a constant internal body temperature. **Theme 8:** *Evolution*, or changes in genes from generation to generation, leads to adaptations. *Adaptations* are inherited traits that help an organism survive and reproduce in its particular environment. Evolution occurs at the level of the *population,* which is a group of organisms in a certain area belonging to the same species. Adaptations come about through *natural selection*, the process by which individuals with a helpful inherited trait live longer and produce more offspring than those without the trait. **Theme 9:** Modern biology affects society by changing humans' everyday lives. **Theme 10:** Biology relies on certain processes of inquiry to find possible answers to questions about life.

7. Explain how a human being is a biological system. _____

_____

8. Give an example of form related to function in an organism. _____

_____

9. Explain how life on Earth depends on energy from the sun. _____

_____

_____

Reading Skills Practice

Writing definitions Write definitions for the following terms in your own words: *biosphere*, *organism*, and *cell*.

Vocabulary Review and Reinforcement

In 1–6, fill in the blanks with the appropriate terms from the chapter.

1. All the parts of the planet that are inhabited by living things make up the _____.

Name _____ Class _____ Date _____

2. The community of living things in an area, along with the nonliving features of the environment that support the living community, is called a(n) _____.

3. The term for an individual living thing is _____.

4. The basic unit of structure and function of organisms is the _____.

5. The chemical responsible for inheritance is _____.

6. A unit of inherited information along a DNA molecule is called a(n) _____.

In 7–11, write true *if the statement is true. If the statement is false, replace the underlined term with a term that makes the statement true.*

_____ **7.** A distinct form of life is a(n) species.

_____ **8.** Prokaryotic cells contain nuclei.

_____ **9.** Multicellular organisms are made of many cells.

_____ **10.** The process by which plants use sunlight to make food is called homeostasis.

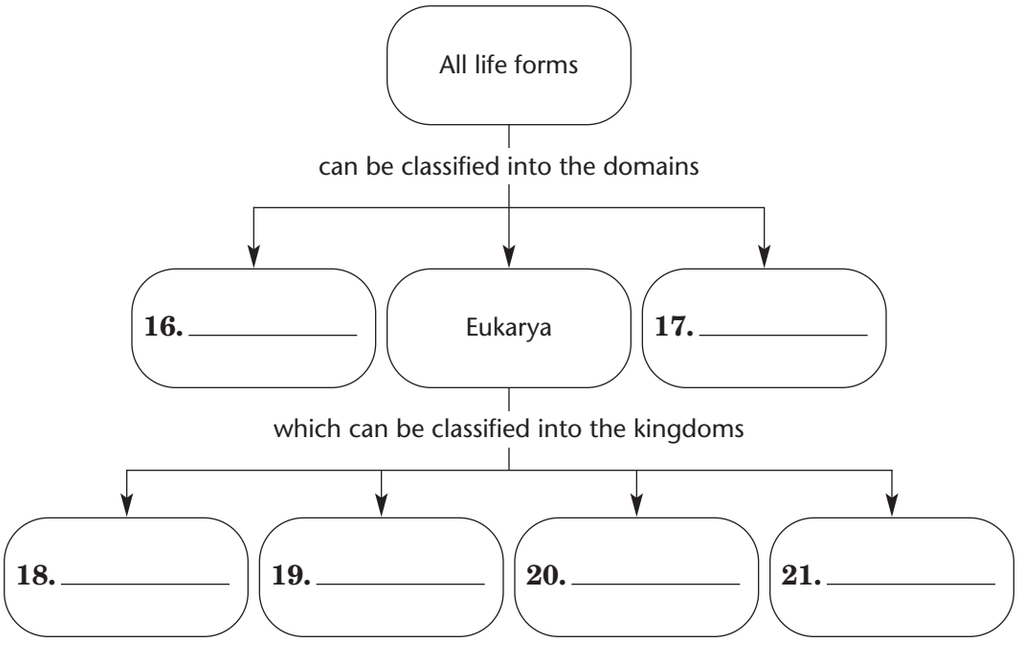
_____ **11.** Animals and other organisms that eat the food in an ecosystem are called producers.

In 12–15 write the letter of the correct definition on the line next to each term.

_____ **12.** eukaryotic cell
_____ **13.** unicellular
_____ **14.** system
_____ **15.** homeostasis

a. steady state
b. cell that contains a nucleus
c. complex organization formed from a combination of parts
d. consisting of a single cell

In 16–21, fill in the blanks with the appropriate terms from the chapter.



Name _____ Class _____ Date_____

WordWise

Answer the questions by writing the Key Terms in the blanks. Then put the numbered letters in order to find the hidden Key Term. Write a definition for the hidden Key Term.

1. What is life's basic unit of structure and function?

__ __ __ __
1

2. What term means "made of many cells"?

__ __ __ __ __ __ __ __ __ __ __ __ __
2

3. What is the broadest category used to classify life forms?

__ __ __ __ __ __
3

4. What term refers to a distinct form of life?

__ __ __ __ __ __ __
4

5. What is a complex organization formed from a combination of parts?

__ __ __ __ __ __
5

6. What eats the food made by producers?

__ __ __ __ __ __ __ __ __
6

7. What helps an organism's ability to survive and reproduce in its environment?

__ __ __ __ __ __ __ __ __ __
7

8. What word means "generation-to-generation change in the proportion of different inherited genes in a population"?

__ __ __ __ __ __ __ __ __
8

9. What term refers to an individual living thing?

__ __ __ __ __ __ __ __
9

Key Term: __ __ __ __ __ __ __ __ __
1 2 3 4 5 6 7 8 9

Definition: _____

_____

_____

Name _____ Class _____ Date _____

CHAPTER 2 The Science of Biology

Summary of Key Concepts

Concept 2.1 Discovery science emphasizes inquiry and observation. (pp. 24–29)

Biology is defined as the scientific study of life. Science is a way to answer questions about the natural world. At the heart of science is inquiry—people asking questions about what they observe in nature and actively seeking answers. The questions that drive scientific inquiry are based on *observation*, using the senses to gather information. Recorded observations are called *data*. Through careful observations and data, discovery science describes natural structures and processes. A logical conclusion based on observations is called an *inference*. Inferences are important in science because they help narrow down general questions into specific questions. These specific questions can then be explored further. Scientists put together many specific observations to reach a general conclusion, or *generalization*.

1. What is the difference between an observation and data? _____

_____

_____

2. Compare the terms *inference* and *generalization*. _____

_____

_____

_____

Concept 2.2 Hypothesis-based science is a search for explanations. (pp. 30–36)

Questions about nature usually arise from the observations of discovery science. Hypothesis-based science is a process for testing the possible answers to such questions. It uses the scientific method, which has five steps: observation, question, hypothesis, prediction, and test. The key element is the *hypothesis*, which is a suggested answer to a well-defined scientific question. A hypothesis allows scientists to make certain predictions, which are then tested by making additional observations or by designing experiments. Experiments that test hypotheses generally test the effect of one condition that can differ, called a *variable*. For example, a study of plant growth might test the effect of different amounts of sunlight. An experiment that tests the effect of a single variable is called a *controlled experiment*. To eliminate unwanted variables in a controlled experiment, researchers may divide the subjects into two groups: a control group and an experimental group. Both groups are the same except for the variable being investigated. For example, the plant study would include only a single type of plant, and each plant would receive the same soil, temperature, and amount of water. Organizing data in tables or graphs helps scientists interpret the results of their experiments.

Name _____ Class _____ Date_____

3. How is hypothesis-based science related to discovery science? _____

_____

_____

4. What is the scientific method? _____

_____

5. What is a hypothesis? _____

_____

6. What is the purpose of the control group in a controlled experiment?

_____

_____

Concept 2.3 Understanding science will help you evaluate many issues. (pp. 37–41)

Did you ever see an advertisement for a product and wonder if you should believe the claims it makes and buy the product? Making everyday decisions such as this requires you to judge the quality of evidence. *Evidence* consists of a collected body of data from observations and experiments. Scientific evidence should be repeatable. Repeating the observations and experiments of others should lead to similar evidence.

Scientific hypotheses should lead to predictions that can be tested. There must be some observation or experiment that could reveal if the hypotheses are false. Even hypotheses that stand up to repeated testing may later be revised or even rejected. Science is limited in the kinds of questions it can help answer. It can only search for natural causes for natural phenomena. Supernatural explanations of natural events are outside the bounds of science, because there is no way to show that they are false.

Theories lead to major scientific advances. A *theory* is a well-tested explanation that makes sense of a great variety of scientific observations. Compared to a hypothesis, a theory is much broader in scope. Theories only become widely accepted in science when they are supported by a large body of evidence. If new evidence that contradicts a theory is uncovered, scientists need to modify or discard the theory.

Models are physical, mental, or mathematical representations of how people understand a process or an idea. They help people explain and evaluate ideas about the natural world.

Communicating findings is important in science. Communication allows scientists to check one another's claims by attempting to repeat experiments. *Technology* and science are related, but their goals and methods are different. The goal of science is to understand nature. The goal of technology is to apply scientific understanding for some specific purpose.

7. What is evidence? _____

_____

8. How does a theory differ from a hypothesis? _____

_____

_____

Name _____ Class _____ Date _____

9. Give an example of a model. _____

_____

10. Contrast the goals of science and technology. _____

_____

_____

Reading Skills Practice

Summarizing information in a graph Use the information provided in the graph in Figure 2-16 on page 35 to describe the effect of snake coloration on attacks by predators.

Vocabulary Review and Reinforcement

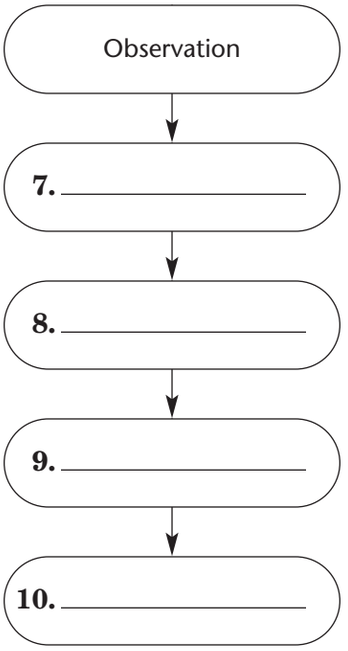
In 1–6, write the letter of the correct definition on the line next to each term.

_____ **1.** observation
_____ **2.** data
_____ **3.** generalization
_____ **4.** hypothesis
_____ **5.** variable
_____ **6.** controlled experiment

a. recorded observations
b. condition that can differ within an experiment
c. use of the senses to gather information
d. experiment that tests the effect of a single variable
e. general conclusion
f. suggested answer to a well-defined scientific question

In 7–10, fill in the blanks with the appropriate terms from the chapter.

Scientific Method



Name _____ Class _____ Date_____

In 11–20, write true *if the statement is true. If the statement is false, replace the underlined term with a term that makes the statement true.*

_____ **11.** In science, <u>evidence</u> consists of a collected body of data from observations and experiments.

_____ **12.** A(n) <u>hypothesis</u> is a well-tested explanation that makes sense of a great variety of scientific observations.

_____ **13.** <u>Theories</u> are physical, mental, or mathematical representations of how people understand a process or an idea.

_____ **14.** The goal of <u>observation</u> is to apply scientific understanding for some specific purpose.

_____ **15.** <u>Hypothesis-based</u> science is a search for explanations.

_____ **16.** Observations recorded as measurements are called <u>qualitative</u> data.

_____ **17.** <u>Discovery</u> science emphasizes inquiry and observation.

_____ **18.** When they use the scientific method, scientists test <u>questions</u>.

_____ **19.** A controlled experiment helps to eliminate the effects of unwanted <u>predictions</u>.

_____ **20.** The statement, "All living things are made of cells," is an example of a(n) <u>model</u>.

WordWise

Find and circle nine Key Terms from the chapter in the puzzle below. Words may appear horizontally, vertically, or diagonally. Then write each term and its definition on a separate sheet of paper.

g	e	n	e	r	l	d	o	n	s	i
o	b	s	e	r	v	a	t	i	o	n
v	o	m	c	e	t	t	g	o	t	f
a	a	u	o	v	a	a	f	n	h	e
r	d	r	m	d	b	d	a	l	e	r
i	e	v	i	d	e	n	c	e	o	e
a	n	c	l	a	p	l	t	s	r	n
n	t	h	a	t	b	i	n	s	y	c
l	p	e	c	j	r	l	j	y	r	e
e	c	a	t	o	p	l	e	c	a	n
t	e	c	h	n	o	l	o	g	y	t
z	h	y	p	o	t	h	e	s	i	s

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CHAPTER 3 The Process of Science: Studying Animal Behavior

Summary of Key Concepts

Concept 3.1 Biologists study behavior through observations and experiments. (pp. 48–52)

Animal behavior refers to what an animal does as it interacts with its environment. Biologists observe animal behavior and ask questions about it. For example, a biologist might ask whether an animal is born knowing how to perform a particular behavior or whether the behavior must be learned. Scientists usually cannot use controlled experiments when they study animals in the wild. Instead, scientists can test their hypotheses through further observation, such as Jane Goodall's studies of chimpanzees. In other cases, scientists can conduct controlled experiments in an animal's natural environment, such as Niko Tinbergen's studies of digger wasps.

Biologists study both immediate causes and ultimate causes of animal behavior. The *immediate cause* of an animal's behavior usually answers "how" questions. For example, the immediate cause of a wasp finding its nest is the wasp's ability to recognize landmarks. The *ultimate cause* of a behavior usually answers "why" questions. The ultimate cause of the nest-finding behavior might be that it helps the wasp survive and reproduce.

1. What is animal behavior? _____

_____

2. Give examples of an immediate cause and an ultimate cause of an animal behavior. _____

_____

_____

Concept 3.2 Experiments show that both genes and environment affect behavior. (pp. 53–56)

All of an animal's behaviors depend on some combination of genes and environment. Some behaviors are controlled mainly by genes. They are performed correctly by all individuals of a species, even if they have no previous experience with the behavior. Such a behavior is called an *innate behavior*. One type of innate behavior is a *fixed action pattern (FAP)*. A FAP is a behavior that occurs as an unchangeable sequence of actions. Once the sequence begins, it is always carried through in the same order until the end of the sequence is reached. Many innate behaviors coordinate with rhythmic changes in the environment. For example, flying squirrels are active at night and sleep from dawn to dusk. This type of innate rhythm with a cycle of about 24 hours is called a *circadian rhythm*. Other behaviors have seasonal rhythms, such as migration.

3. What is innate behavior? _____

_____

_____

Name _____ Class _____ Date_____

4. Give an example of a behavior with a circadian rhythm. _____

_____

_____

Concept 3.3 Learning is behavior based on experience. (pp. 57–61)

A change in an animal's behavior resulting from experience is called *learning*. *Habituation* is a simple form of learning in which an animal learns not to respond to a repeated stimulus. An example of habituation is the way you eventually stop paying attention to the ticking of a clock. Many behaviors have both learned and unlearned parts. An example is imprinting. *Imprinting* is learning that is limited to a critical time period in an animal's life and that is usually irreversible. Learning that a particular stimulus or response is linked to a reward or punishment is called *conditioning*. For example, a cat may learn to associate the sound of a can opener with mealtime. At a level above conditioning is insight. *Insight* is the ability to respond appropriately to a new situation without previous experience. Insight involves the ability to analyze problems and to test possible solutions.

Many young animals engage in play behavior. Some researchers think that play allows young animals to practice behaviors required for survival. Others think that play behavior provides exercise for the young animals.

5. How are learning and habituation related? _____

_____

_____

6. When does imprinting occur and how long does it last? _____

_____

_____

7. Give an example of conditioning. _____

_____

8. What are two possible functions of play behavior in young animals?

_____

_____

Concept 3.4 Social behaviors are important adaptations in many species. (pp. 62–65)

Interactions between two or more individuals of the same species are called social behaviors. An example is competitive behavior. Animals that live in social groups must sometimes compete for resources such as food. Actual physical struggles or threatening behaviors are classified as *aggressive behavior*. Aggressive behaviors may lead to a ranking of animals in the group, from most dominant to most submissive. This ranking is called a *dominance hierarchy*. Many animals try to defend an area called a *territory* from other members of the species. In some species, animals perform *courtship rituals*, elaborate behaviors that take place before mating. Some courtship rituals help an animal attract a mate. An example is a male peacock displaying its tail feathers. All social behaviors depend on some form of signaling, or *communication*, among animals. Animals communicate using sounds, odors,

visual displays, and touches. When animals in a group work together in a way that is good for the group, the behavior is called *cooperation*. An example is a pack of wolves together capturing a large prey animal.

9. What are two types of social behavior in animals? _____

_____

10. List ways animals communicate. _____

_____

11. What is cooperation? _____

_____

Reading Skills Practice

Outlining Make an outline of the information on competitive behaviors on pages 62–63. In your outline, include a definition of each of the bold-faced Key Terms.

Vocabulary Review and Reinforcement

In 1–6, fill in the blanks with the appropriate terms from the chapter.

A digger wasp is born "knowing" how to build a nest. This is an example of **1.** _____ behavior. Some animals change their behavior as a result of experience. When this happens, it is called **2.** _____. Newly hatched graylag geese formed an irreversible bond with a man named Karl Lorenz. The learning process that led to this bond is called **3.** _____. Interactions between two or more members of the same species are called **4.** _____ behavior. This type of behavior depends on some form of signaling, or **5.** _____, such as odors or visual displays. A group of musk oxen forming a protective ring around their young is an example of **6.** _____.

In 7–13, write the letter of the correct definition on the line next to each term.

_____ **7.** ultimate cause
_____ **8.** circadian rhythm
_____ **9.** immediate cause
_____ **10.** aggressive behavior
_____ **11.** insight
_____ **12.** courtship ritual
_____ **13.** territory

a. cause that explains the current reasons for a behavior
b. innate rhythm with a cycle of about 24 hours
c. ability to respond appropriately to a new situation without previous experience
d. cause that explains how a behavior helps an organism survive and reproduce
e. physical struggles or threatening behaviors between animals
f. area that individuals defend and from which other members of the same species are usually excluded
g. elaborate behaviors performed before mating

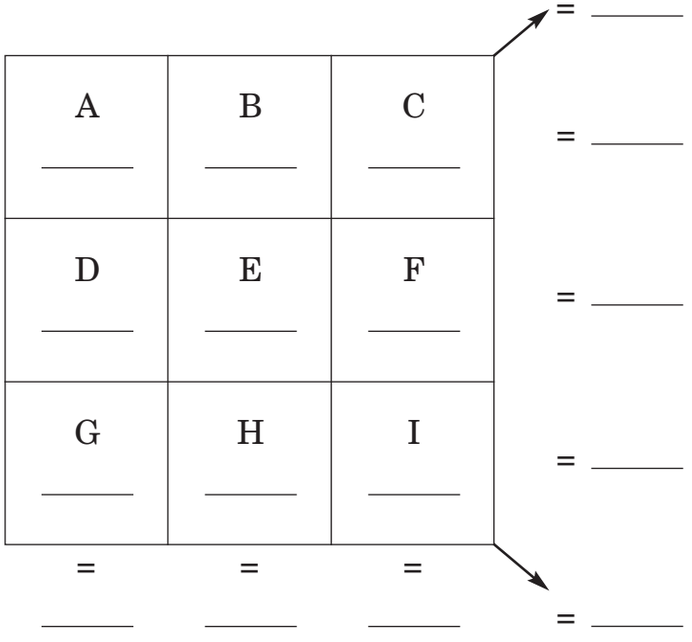
Name _____ Class _____ Date_____

WordWise

Match each definition in the left column with the correct Key Term in the right column. Then write the number of each term in the appropriate box below. When you have filled in all the boxes, add up the numbers in the columns, rows, and two diagonals. All the sums should be the same.

A. what an animal does as it interacts with its environment
B. behavior that is performed correctly by all individuals of a species, even if they have no previous experience with the behavior
C. innate behavior that occurs as an unchangeable sequence of actions
D. change in an animal's behavior resulting from experience
E. learning that is limited to a specific time period in an animal's life and that is usually irreversible
F. learning that a particular stimulus or response is linked to a reward or punishment
G. behavior in which individuals work together in a way that is beneficial to the group
H. simple form of learning in which an animal learns not to respond to a repeated stimulus
I. ranking of the most dominant to most submissive individuals within a group

1. innate behavior
2. cooperation
3. conditioning
4. dominance hierarchy
5. imprinting
6. animal behavior
7. learning
8. fixed action pattern
9. habituation



Name _____ Class _____ Date _____

CHAPTER 4 The Chemical Basis of Life

Summary of Key Concepts

Concept 4.1 Life requires about 25 chemical elements. (pp. 72–73)
Matter is anything that takes up space and has mass. The different types of matter are made up of one or more chemical elements. An *element* is a pure substance that cannot be broken down into other substances by chemical means. About 25 elements are essential to life. Four elements—oxygen, carbon, hydrogen, and nitrogen—make up about 96 percent of the living matter in your body. *Trace elements* make up less than 0.01 percent of your body mass. Most elements can combine chemically with other elements, forming *compounds*. Water (H_2O) is an example of a compound. It always contains the same ratio of hydrogen (H) combined with oxygen (O).

1. What are the four most common elements in living things? _____

_____

2. What is a difference between an element and a compound? _____

_____

_____

Concept 4.2 Chemical properties are based on the structure of atoms. (pp. 74–77)
An *atom* is the smallest possible particle of an element. Atoms are made up of three even smaller parts. *Protons* have a single unit of positive electrical charge (+). *Electrons* have a single unit of negative electrical charge (–). *Neutrons* have no electrical charge. Protons and neutrons are tightly packed together in the center of the atom, forming the *nucleus*. Electrons move around the outside of the nucleus at great speed. The physical and chemical properties of an element depend on the number and arrangement of protons, electrons, and neutrons. All atoms of a particular element have the same number of protons, known as the element's *atomic number*. Some elements have different forms called *isotopes*, which differ in their numbers of neutrons. The nucleus of a *radioactive isotope* is unstable and breaks down over time, giving off matter and energy.

Chemists describe an atom's electrons as belonging to certain energy levels. For example, the lowest energy level, nearest the nucleus, can hold 2 electrons, and the second energy level can hold 8 electrons. Usually, it is the electrons in the highest occupied energy level of an atom that determine how an atom reacts with other atoms. Atoms with partly filled energy levels tend to react with other atoms, filling their highest energy levels.

3. Describe the three types of small particles within an atom and explain how they are arranged. _____

_____

_____

Name _____ Class _____ Date_____

4. How do an isotope and a radioactive isotope differ? _____

_____

_____

5. Which atom is likely to be more chemically reactive, an atom with a partly filled energy level or an atom with all energy levels completely filled? Explain. _____

_____

_____

Concept 4.3 Chemical bonds join atoms to one another. (pp. 78–80)
When atoms share or transfer electrons, an attraction, or chemical bond, forms that holds the atoms together. An *ionic bond* is a chemical bond that occurs when an atom transfers an electron to another atom. The two atoms are now electrically charged and are called *ions*. The attraction between two oppositely charged ions holds the two ions together in an ionic bond. In contrast, a *covalent bond* forms when two atoms share electrons. The number of covalent bonds an atom can form usually equals the number of electrons needed to fill its highest occupied energy level. Two or more atoms held together by covalent bonds form a *molecule*. A *chemical reaction* occurs when chemical bonds break and new bonds form, producing one or more new substances. A chemical equation describes a chemical reaction. The equation shows the starting materials for the reaction, or *reactants*, and the ending materials, or *products*.

6. Contrast an ionic bond and a covalent bond. _____

_____

_____

7. What is a molecule? _____

_____

8. What happens during a chemical reaction? _____

_____

Concept 4.4 Life depends on the unique properties of water. (pp. 81–87)
A water molecule is made up of two hydrogen atoms each joined to one oxygen atom by a single covalent bond. Oxygen pulls electrons much more strongly than hydrogen, causing the oxygen atom to be slightly negative and the hydrogen atoms to be slightly positive. Water is a *polar molecule* because the opposite ends of the molecules have opposite electric charges. Being polar, water molecules have a weak attraction to each other and form hydrogen bonds with each other. A *hydrogen bond* is a chemical bond between two molecules formed by the attraction of a slightly positive hydrogen atom to a slightly negative atom.

Water has many unusual properties because of its polar nature and ability to form hydrogen bonds. Water has strong *cohesion*, which is the tendency of molecules of the same kind to stick together. Water molecules are also attracted to other molecules, which is called *adhesion*. Cohesion and adhesion help move water up from the roots of a plant. Water can also absorb more *thermal energy,* the energy of the motion of particles in a substance, without a large increase in temperature. *Temperature* is the measure of the average thermal energy in a substance. Unlike other substances, solid water is less dense than liquid water,

Name _____ Class _____ Date _____

causing ice to float. Water is an important *solvent*—a substance that dissolves other substances—and forms many *solutions*. When water is the solvent, a solution is called an *aqueous solution*. In some aqueous solutions, the substance that is dissolved, called the *solute*, breaks apart into ions. A compound that adds hydrogen ions (H^+) to a solution is an *acid*. A compound that removes H^+ ions from a solution is a *base*. The *pH scale* describes how acidic or basic a solution is. Many cells are sensitive to slight changes in pH. Many biological fluids contain *buffers,* substances that resist changes in pH.

9. What causes water to be a polar molecule? _____

_____

_____

10. What properties of water help move it upward from the roots of a plant?

_____

11. How does a base differ from an acid? _____

_____

Reading Skills Practice

Writing an outline Write an outline of Concept 4.4 on pages 81–86. Use the blue headings in the concept as the headings in your outline. Include the most important facts and main ideas in your outline. Be sure to include the Key Terms.

Vocabulary Review and Reinforcement

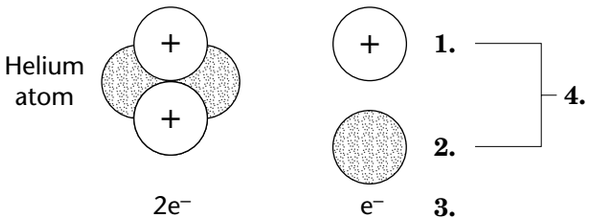
In 1–6, study the diagram. Then fill in the blanks with the appropriate terms from the chapter.

1. _____

2. _____

3. _____

4. _____



5. This diagram shows a(n) _____, the smallest possible particle of an element.

6. The number of protons in the atom of an element is known as the element's _____.

In 7–13, write the letter of the correct definition on the line next to each term.

_____ **7.** solution

_____ **8.** ion

_____ **9.** buffer

_____ **10.** solvent

_____ **11.** matter

_____ **12.** pH scale

_____ **13.** solute

a. substance that causes a solution to resist changes in pH
b. substance that dissolves another substance
c. electrically charged atom or group of atoms
d. range of numbers that is used to describe how acidic or basic a solution is
e. anything that takes up space and has mass
f. uniform mixture of two or more substances
g. substance that is dissolved in a solution

Name _____ Class _____ Date_____

In 14–17, write true *if the statement is true. If the statement is false, replace the underlined term with a term that makes the statement true.*

_____ **14.** A(n) covalent bond is a weak attraction between a hydrogen atom of one molecule and a slightly negative atom of another molecule.

_____ **15.** The starting materials for a chemical reaction are products.

_____ **16.** A(n) aqueous solution is a uniform mixture of water and another substance.

_____ **17.** Trace elements make up less than 0.01 percent of your body mass.

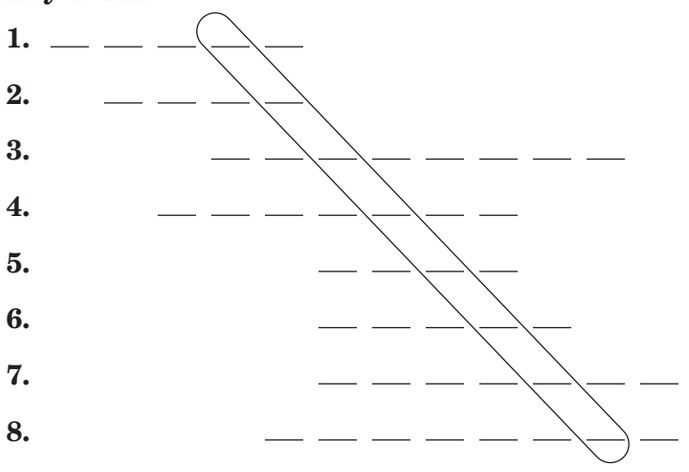
WordWise

Use the clues to identify Key Terms from the chapter. Write the terms on the lines, putting one letter in each blank. When you finish, the word enclosed in the diagonal lines will reveal the type of attraction that occurs between unlike molecules.

Clues

1. a molecule in which opposite ends have opposite electric charges
2. a compound that adds H^+ ions to a solution
3. the tendency of molecules of the same kind to stick to one another
4. a pure substance that cannot be broken down into other substances by chemical means
5. a compound that removes H^+ ions from a solution
6. a chemical bond that occurs when an atom transfers electrons
7. a different form of an element that has a different number of neutrons
8. a substance containing two or more elements that are chemically combined in a fixed ratio

Key Terms



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CHAPTER 5 The Molecules of Life

Summary of Key Concepts

Concept 5.1 Carbon is the main ingredient of organic molecules. (pp. 92–94)

Other than water, most molecules in a cell include a skeleton of carbon atoms. These carbon-based molecules are called *organic molecules*. In contrast, molecules that do not contain carbon skeletons, like water, are called *inorganic molecules*. *Hydrocarbons* are organic molecules composed of only carbon and hydrogen. Different arrangements of atoms bonded to a carbon skeleton can form *functional groups,* which give specific properties to molecules. For example, hydroxyl groups (–OH) are *hydrophilic*, meaning they attract water.

Molecules in cells are often made up of many similar, smaller molecular units called *monomers*. Long chains of monomers linked together form *polymers*. Each time a monomer is added to a growing polymer chain, a water molecule is released in a dehydration reaction. In a hydrolysis reaction, the addition of water breaks down a polymer.

1. What is the relationship between carbon skeletons and functional groups?

_____

_____

2. How are polymers made and how are they broken down? _____

_____

Concept 5.2 Carbohydrates provide fuel and building material. (pp. 95–97)

Carbohydrates are organic molecules made up of sugar molecules. Sugars consist of carbon (C), hydrogen (H), and oxygen (O) in a ratio of 1 C: 2 H: 1 O. Almost all carbohydrates are hydrophilic. Simple sugars that contain just one sugar molecule are *monosaccharides*. Sugar molecules are the main energy supply for the cell. Cells store extra sugar as larger carbohydrates. Sugars constructed from two monosaccharides are *disaccharides*. Cells break down disaccharides for energy or store them for later use. Long polymer chains made up of simple sugar monomers are called *polysaccharides*, or complex carbohydrates. *Starch* is a polysaccharide found in plant cells. Plants and animals that eat plants break down starch for energy and building materials. In animal cells, excess sugar is stored as *glycogen*. When energy is needed, the cells break down glycogen. Another polysaccharide in plants, *cellulose*, protects and stiffens plant cells.

3. How do cells use simple sugar molecules? _____

_____

4. Contrast a disaccharide and a polysaccharide. _____

_____

_____

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Concept 5.3 Lipids include fats and steroids. (pp. 98–99)

Lipids are organic molecules that are *hydrophobic*, or unable to dissolve in water. A *fat* is a lipid made up of a three-carbon backbone attached to three fatty acid chains. Fats store energy for later use, cushion internal organs, and insulate the body. A *saturated fat* is a fat in which all three fatty acid chains contain the maximum possible number of hydrogen atoms. These fats are solids at room temperature. An *unsaturated fat* contains less than the maximum number of hydrogen atoms. These fats are liquid oils at room temperature.

Steroids are lipids in which the carbon skeleton forms four rings that are joined together. Steroids are classified as lipids because they are hydrophobic, but they are very different from fats. Some steroids act as chemical signals. Another steroid, *cholesterol*, is a key molecule found in cellular membranes.

5. What property do all lipids share? _____

_____

6. Contrast the structures of fats and steroids. _____

_____

_____

Concept 5.4 Proteins perform most functions in cells. (pp. 100–102)

A *protein* is a polymer made from a set of 20 kinds of monomers called amino acids. An *amino acid* has a central carbon atom bonded to a hydrogen atom, a carboxyl group, an amino group, and a side group. The side group is different for each amino acid and causes its particular chemical properties. Proteins form cell structures, store nutrients, act as chemical messengers, defend the body from disease, and control chemical reactions. The structure of each protein determines its particular function.

Cells build proteins by linking amino acids together into a chain called a *polypeptide*. Proteins are made up of one or more polypeptide chains. A working protein is twisted, folded, and coiled into a specific shape. A protein's shape is determined by its amino acid sequence and its environment. Changes in pH, temperature, or other environmental quality can cause a protein to lose its normal shape in a process called *denaturation*. Since a protein's function depends on its shape, a denatured protein loses its function.

7. List three functions of proteins. _____

_____

8. How are amino acids, polypeptides, and proteins related? _____

_____

_____

9. What determines the shape of a protein? _____

_____

Concept 5.5 Enzymes are proteins that speed up specific reactions in cells. (pp. 103–105)

Many different chemical reactions occur in cells. To get started, most chemical reactions require *activation energy.* This energy weakens the chemical bonds of the reactants. Compounds called *catalysts* speed up chemical reactions.

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Catalysts in cells are proteins called *enzymes*. Enzymes reduce the amount of energy required for activation. Each enzyme acts as a catalyst for a specific kind of chemical reaction.

The shape of each enzyme fits the shape of a specific reactant molecule, or *substrate*. The substrate bonds to the enzyme at the *active site*. The enzyme weakens the bonds of the substrate. Another way enzymes lower activation energy is by holding two substrates in neighboring sites, enabling them to react more easily.

10. What role do enzymes have in the cell? _____

_____

11. What happens at the active site of an enzyme? _____

_____

_____

Reading Skills Practice

Interpreting a diagram Study the diagram in Figure 5-16 on page 104 that illustrates the action of the enzyme sucrase. Identify the substrate for sucrase. Then, explain how sucrase catalyzes the chemical reaction. What happens to sucrase when the reaction is completed?

Vocabulary Review and Reinforcement

In 1–7, write true *if the statement is true. If the statement is false, replace the underlined term with a term that makes the statement true.*

_____ **1.** Sugars that contain just one sugar molecule are <u>monosaccharides</u>.

_____ **2.** Molecules that avoid water are <u>hydrophobic</u>.

_____ **3.** <u>Inorganic</u> molecules are carbon-based.

_____ **4.** A(n) <u>unsaturated</u> fat has the maximum possible number of hydrogen atoms.

_____ **5.** A(n) <u>carbohydrate</u> is made up of amino acids.

_____ **6.** <u>Polymers</u> are small molecular units joined together in large molecules.

_____ **7.** In <u>denaturation</u>, a protein unravels and loses its normal shape.

In 8–13, write the letter of the correct definition on the line next to each term.

_____ **8.** cholesterol
_____ **9.** glycogen
_____ **10.** cellulose
_____ **11.** hydrocarbon
_____ **12.** functional group
_____ **13.** starch

a. polysaccharide in animals that stores energy
b. organic molecule made up of only carbon and hydrogen
c. polysaccharide in plants that stores energy
d. lipid found in the membranes of cells
e. polysaccharide that stiffens plants
f. group of atoms that gives specific properties to a molecule

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In 14–18, complete the paragraph with the appropriate Key Terms from the chapter.

To start a chemical reaction, it is first necessary to reduce the **14.** _____, or start-up energy. Compounds that speed up chemical reactions, called **15.** _____, help reduce start-up energy. In cells, these compounds are specialized proteins called **16.** _____. The reactants that are acted upon by a specialized protein are known as **17.** _____. These reactant molecules bind to a particular region of the specialized protein, called the **18.** _____, and the reactants are changed to products.

WordWise

Find and circle nine Key Terms from the chapter in the puzzle below. Words may appear horizontally, vertically, or diagonally. Then write a definition for each term on a separate sheet of paper.

d	o	c	m	y	r	t	l	o	c	p	y	h	b
p	h	y	b	e	f	s	y	t	i	p	l	y	n
p	o	l	y	s	a	c	c	h	a	r	i	d	e
m	g	l	u	r	w	s	k	o	l	o	i	r	a
e	t	i	y	b	e	f	l	u	k	t	f	o	c
l	p	p	r	m	b	t	a	y	l	e	a	p	k
a	c	i	v	t	e	p	j	t	d	i	g	h	w
s	u	d	s	t	e	r	o	i	d	n	l	i	c
e	n	z	p	k	r	w	t	e	i	p	k	l	y
b	t	a	m	i	n	o	a	c	i	d	p	i	r
p	o	l	y	p	e	p	t	i	d	e	e	c	a