2.1 Matter and Organic Compounds

Lesson 2.1: True or False

Name_____ **Class**_____ **Date**_____

Write true if the statement is true or false if the statement is false.

_____ 1. An atom is smaller than an element.

_____ 2. Organic compounds are found in living organisms.

_____ 3. Proteins are made out of amino acids.

_____ 4. Proteins speed up chemical reactions.

_____ 5. The DNA code carries instructions for the correct sequence of nucleic acids in a protein

_____ 6. Sugars and phosphate groups form the middle of a nucleic acid chain.

_____ 7. DNA (and RNA) is made out of nucleotides.

_____ 8. A protein consists of one or more polypeptide chains.

_____ 9. Lipids include fats, oils, and sugars.

_____ 10. Carbohydrates are the most common type of organic compound.

_____ 11. Peanut oil is an unsaturated fatty acid.

_____ 12. Cytosine and adenine are complementary bases in DNA.

_____ 13. A double helix is like a spiral staircase.

_____ 14. Phospholipids form cell membranes.

_____ 15. Carbohydrates are made out of monosaccharides.

Lesson 2.1: Critical Reading

Name_____ **Class**_____ **Date**_____

Read these passages from the text and answer the questions that follow.

The Significance of Carbon

A compound found mainly in living things is known as an **organic compound**. Organic compounds make up the cells and other structures of organisms and carry out life processes. Carbon is the main element in organic compounds, so carbon is essential to life on Earth. Without carbon, life as we know it could not exist. Why is carbon so basic to life? The reason is carbon's ability to form stable bonds with many elements, including itself. This property allows carbon to form a huge variety of very large and complex molecules. In fact, there are nearly 10 million carbon-based compounds in living things! However, the millions of organic compounds can be grouped into just four major types: carbohydrates, lipids, proteins, and nucleic acids. You can compare the four types in **Table** 2.1. Each type is also described below.

Table 2.1: **Types of Organic Compounds**

Type of Compound	Examples	Elements	Functions
Carbohydrates	sugars, starches	carbon, hydrogen, oxygen	provides energy to cells, stores energy, forms body structures
Lipids	fats, oils	carbon, hydrogen, oxygen	stores energy, forms cell membranes, carries messages
Proteins	enzymes, antibodies	carbon, hydrogen, oxygen, nitrogen, sulfur	helps cells keep their shape, makes up muscles, speeds up chemical reactions, carries messages and materials
Nucleic Acids	DNA, RNA	carbon, hydrogen, oxygen, nitrogen, phosphorus	contains instructions for proteins, passes instructions from parents to offspring, helps make proteins

Carbohydrates

Carbohydrates are the most common type of organic compound. A **carbohydrate** is an organic compound such as sugar or starch, and is used to store energy. Like most organic compounds, carbohydrates are built of small, repeating units that form bonds with each other to make a larger molecule. In the case of carbohydrates, the small, repeating units are called monosaccharides.

Lipids

A **lipid** is an organic compound such as fat or oil. Organisms use lipids to store energy, but lipids have other important roles as well. Lipids consist of repeating units called fatty acids. There are two types of fatty acids: saturated fatty acids and unsaturated fatty acids.

Proteins

A **protein** is an organic compound made up of small molecules called **amino acids**. There are 20 different amino acids commonly found in the proteins of living things. Small proteins may contain just a few hundred

amino acids, whereas large proteins may contain thousands of amino acids.

Nucleic Acids

A **nucleic acid** is an organic compound, such as DNA or RNA, that is built of small units called nucleotides. Many nucleotides bind together to form a chain called a **polynucleotide**. The nucleic acid **DNA** (deoxyribonucleic acid) consists of two polynucleotide chains. The nucleic acid **RNA** (ribonucleic acid) consists of just one polynucleotide chain.

Questions

1. List two functions of organic compounds.

2. Which two categories of organic compounds store energy? Which of these organic compounds is more common?

3. What is a main difference between DNA and RNA?

4. Describe a difference between large and small proteins.

5. Why is carbon considered the essential element of life?

Lesson 2.1: Multiple Choice

Name_____ **Class**_____ **Date**_____

Circle the letter of the correct choice.

1. Water (H_2O) is a(n)
   (a) element.
   (b) atom.
   (c) compound.
   (d) carbohydrate.
2. A process that changes some chemical substances into others is a
   (a) chemical bond.
   (b) chemical reaction.
   (c) chemical equation.
   (d) chemical formula.
3. The main difference between saturated and unsaturated fatty acids is
   (a) the amount of energy found in the fatty acid.
   (b) saturated fatty acids are liquids.
   (c) unsaturated fatty acids can be packed together very tightly.
   (d) the number of hydrogen atoms bonded to the carbon atoms.
4. The function of proteins can include
   (a) helping cells keep their shape.
   (b) helping to destroy foreign substances.
   (c) speeding up biochemical reactions.
   (d) all of the above
5. The characteristics of DNA includes which of the following?
   (a) DNA is made of nucleotides consisting of a sugar, a phosphate group, and a carbon base.
   (b) DNA is made of a single polynucleotide chain, which winds into a double helix.
   (c) DNA is how inherited characteristics are passed from one generation to the next.
   (d) all of the above
6. Which category of organic compound is the major component of cell membranes?
   (a) carbohydrate
   (b) lipid
   (c) protein
   (d) nucleic acid
7. The cell wall of plants is made out of
   (a) starch.
   (b) glycogen.
   (c) cellulose.
   (d) chitin.
8. The main element of organic compounds is
   (a) hydrogen.
   (b) oxygen.
   (c) nitrogen.
   (d) carbon.

Lesson 2.1: Vocabulary I

Name_____ **Class**_____ **Date**_____

Match the vocabulary word with the proper definition.

Definitions

_____ 1. an organic compound that stores energy, forms cell membranes, carries messages

_____ 2. an organic compound that contains instructions for proteins

_____ 3. an organic compound that provides energy to cells, stores energy, forms body structures

_____ 4. an organic compound that helps cells keep their shape

_____ 5. a pure substance, like carbon

_____ 6. may contain just a few simple sugars or thousands

_____ 7. subunit that make up proteins

_____ 8. subunit used to make nucleic acids

_____ 9. lipid in which carbon atoms are bonded to as many hydrogen atoms as possible

_____ 10. lipid in which carbon atoms are bonded to groups of atoms other then hydrogen

_____ 11. the major component of cell membranes

_____ 12. anything that takes up space and has mass

Terms

a. amino acid

b. carbohydrate

c. DNA

d. element

e. lipid

f. matter

g. nucleotide

h. phospholipid

i. polysaccharide

j. protein

k. saturated fatty acid

l. unsaturated fatty acid

2.2 Biochemical Reactions

Lesson 2.2: True or False

Name_____ **Class**_____ **Date**_____

Write true if the statement is true or false if the statement is false.

_____ 1. A substance that forms as a result of a chemical reaction is called a reactant.

_____ 2. Only some chemical reactions need energy to get started.

_____ 3. Biochemical reactions take place inside the cells.

_____ 4. A chemical reaction that releases heat is an exothermic reaction.

_____ 5. Most biochemical reactions need help to get started.

_____ 6. Anabolic reactions give off energy.

_____ 7. Metabolism is the sum of all the biochemical reactions in an organism.

_____ 8. In a chemical reaction, the quantity of an element may change.

_____ 9. During a chemical reaction, some bonds break and new bonds form.

_____ 10. Activation energy is the energy needed to start a chemical reaction.

_____ 11. An enzyme speeds up the reaction by lowering the activation energy.

_____ 12. In a chemical reaction, the number of atoms on one side of the arrow may differ from the number of atoms on the other side.

_____ 13. Matter is always conserved.

_____ 14. Understanding chemistry is needed to understand fully the processes within the cell.

_____ 15. In a chemical reaction, the quantity of each element does not change.

2.3 Water, Acids, and Bases

Lesson 2.3: True or False

Name_____ **Class**_____ **Date**_____

Write true if the statement is true or false if the statement is false.

_____ 1. Water is a chemical.

_____ 2. The hydrogen atoms in a water molecule attract electrons more strongly than the oxygen atom does.

_____ 3. Hydrogen bonds are very strong bonds.

_____ 4. Water is a reactant in photosynthesis.

_____ 5. Enzymes in the small intestine need an acidic environment in order to work.

_____ 6. Pure water has a pH of 7.

_____ 7. Lemon juice is a stronger acid than orange juice.

_____ 8. An ion is an electrically charged atom or molecule.

_____ 9. The stomach is a very acidic environment.

_____ 10. Water is released during cellular respiration.

_____ 11. Soap is very acidic.

_____ 12. Hydrogen bonds cause water to have a relatively high boiling point of 100°F.

_____ 13. Acids have a pH lower than 7.

_____ 14. Bases have a pH lower than 7.

_____ 15. A water molecule has positive and negative parts to it.

NAME DATE CLASS

Chapter 1

STUDY GUIDE

Text Pages 12–18

Solving Problems

In the blank, write the letter of the term or phrase that best completes each statement.

_____ **1.** The first step in any problem-solving strategy is to _____ .
a. collect information about the problem **b.** identify the problem

_____ **2.** The method used by scientists for solving problems is known as the _____ .
a. control **b.** scientific method

_____ **3.** A prediction about a problem that can be tested is a _____ .
a. hypothesis **b.** conclusion

_____ **4.** A _____ is a standard for comparison in an experiment.
a. variable **b.** control

_____ **5.** An explanation backed by results obtained from repeated tests or experiments is a _____ .
a. theory **b.** variable

_____ **6.** A process that uses certain skills to solve problems is called _____ .
a. theory **b.** critical thinking

_____ **7.** A _____ is a changeable factor in an experiment.
a. variable **b.** control

_____ **8.** The best experiments test only one _____ at a time.
a. variable **b.** control

_____ **9.** If a conclusion does not support a hypothesis, the _____ .
a. experiment did not work properly **b.** hypothesis should be revised

_____ **10.** If a hypothesis is supported by new data gathered over a period of time, it may become a _____ .
a. control **b.** theory

_____ **11.** Making lists, drawing graphs, making a model, and eliminating possibilities are all _____ for solving problems.
a. strategies **b.** variables

_____ **12.** If a hypothesis has been backed by results from repeated tests or experiments, it becomes a _____ .
a. variable **b.** theory

Chapter 2

STUDY GUIDE

Text Pages 32–37

• Atoms

Circle the term in parentheses that makes each statement correct.

1. Protons are particles (outside, in) the nucleus of an atom.
2. Electrons are atomic particles with a (positive, negative) charge.
3. An example of matter is (air, heat).
4. The building blocks of matter are (atoms, compounds).
5. (Neutrons, Protons) are particles in the atom's nucleus that have no electric charge.
6. The atomic particles outside of the atom's nucleus are (electrons, protons).
7. Substances made up of only one kind of atom are called (isotopes, elements).
8. Isotopes are atoms of the same element that have different numbers of (neutrons. protons).
9. Negatively charged particles that move around the atom's nucleus are (neutrons, electrons).
10. Two atoms of the same element that have different (mass numbers, atomic numbers) are isotopes of the element.
11. A difference in the (mass number, atomic number) of atoms means the atoms are of different elements.
12. The nucleus of an atom has a (positive, negative) charge.
13. Carbon-14 is an (isotope. element) of carbon.
14. The mass number of an atom with 12 protons and 12 neutrons is (12, 24).
15. The atomic number of an atom is equal to the number of (protons. neutrons) in its nucleus.
16. In atoms with equal numbers of electrons and protons, there is (a positive, no) electric charge.
17. Anything that takes up space and has mass is (matter, an element).
18. A model of an atom is (larger, smaller) than the actual atom.
19. The nucleus of an atom is made up of neutrons and (electrons, protons).
20. Isotopes enable scientists to determine the (age, size) of ancient objects.

NAME DATE CLASS

Chapter 2

STUDY GUIDE

Text Pages 38–43

Combinations of Atoms

Use the words in the box to complete the statements. You will use the words more than once.

molecule	compound	chemical properties	ions	mixture

1. The components of a _____ can be separated by physical means.

2. The _____ of an element determine how the element will change when it reacts with another element.

3. A _____ is a substance that has different properties from the elements in it.

4. Combined atoms form a _____ .

5. Electrically charged atoms are _____ .

6. Table salt is an example of a _____ .

7. An example of a _____ is salt water.

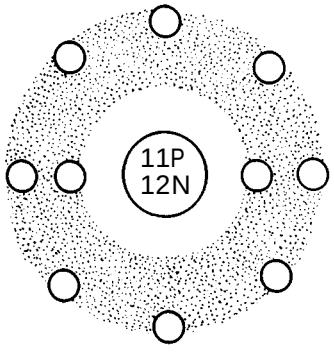
8. Table salt is formed when the _____ of sodium and chlorine combine.

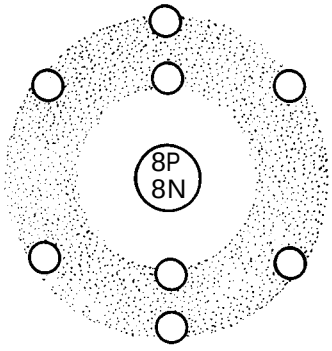
9. Iron rusts when it comes in contact with water because of its _____ .

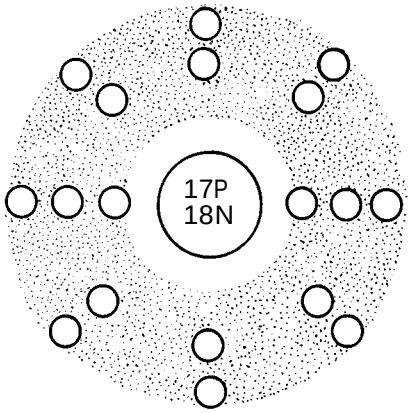
10. The atoms of hydrogen and oxygen combine to form a _____ of the compound water.

Identify the two atoms that are ions. Label the negatively charged ion with a minus sign. Label the positively charged ion with a plus sign.

11 protons 12 neutrons 10 electrons	8 protons 8 neutrons 8 electrons	17 protons 18 neutrons 18 electrons
_____	_____	_____







Name _____ Class _____ Date _____

SECTION 2-1 REVIEW

COMPOSITION OF MATTER

VOCABULARY REVIEW Define the following terms.

1. atom _____

_____

2. neutron _____

_____

3. compound _____

_____

4. covalent bond _____

_____

5. ion _____

_____

MULTIPLE CHOICE Write the correct letter in the blank.

_____ **1.** The atomic number of carbon is 6. Therefore, the number of protons in a carbon atom equals

a. 3. **b.** 6. **c.** 7. **d.** 12.

_____ **2.** One of the kinds of particles found in the nucleus of an atom is the

a. proton. **b.** electron. **c.** ion. **d.** boron.

_____ **3.** The maximum number of electrons that can be held in an atom's second energy level is

a. 2. **b.** 4. **c.** 6. **d.** 8.

_____ **4.** Of the following elements, the one that is most likely to form ionic bonds is

a. hydrogen. **b.** carbon. **c.** sodium. **d.** oxygen.

_____ **5.** An example of a compound is

a. water. **b.** hydrogen gas. **c.** oxygen gas. **d.** chloride ion.

Name _____ Class _____ Date _____

SHORT ANSWER **Answer the questions in the space provided.**

1. What is the difference between mass and weight? _____

_____

_____

2. Identify the elements and the number of atoms of each element in each of the following compounds:

BO_2 _____ KCl _____

$C_6H_{12}O_6$ _____ NH_3 _____

3. How many pairs of electrons do the two oxygen atoms in an oxygen molecule share with each other? Explain your answer. _____

_____

_____

4. **Critical Thinking** The atomic number of argon is 18. Will argon tend to form bonds with other elements? Explain your answer. _____

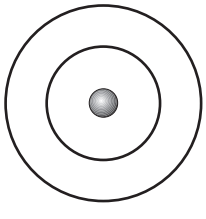
_____

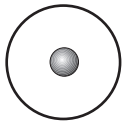
_____

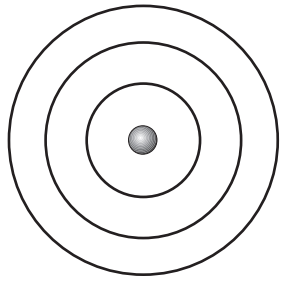
_____

STRUCTURES AND FUNCTIONS **Label each atom in the spaces provided, and complete the models by drawing the correct number of electrons at each energy level.**

The diagrams below represent incomplete models of the atoms helium (atomic number 2), carbon (atomic number 6), and sulfur (atomic number 16). Note: The third energy level can contain up to eight electrons.







a _____ **b** _____ **c** _____

Name _____ Class _____ Date _____

Skills Worksheet

Scientific Methods

SEQUENCING/RELATING INFORMATION

Scientists at a major university became concerned by recent reports of severe insomnia in a number of people with previously normal sleep patterns. These scientists decided to undertake a scientific investigation to try to determine the cause of this behavior. This scientific investigation had six stages. The paragraphs below, labeled *A–F*, describe the stages of this investigation, but the sequence of the stages is incorrect.

Sequence the stages properly by listing the letters of the paragraphs below in the correct order in the chart on the next page. Then decide which step in the scientific process each paragraph describes. In the space provided in the chart, write the step next to the number.

A. The scientists gathered 35 volunteers who agreed to eat 3 meals a day while living at the university research center for 30 days. These volunteers had no previous history of insomnia. They were aware that the meals would be made up of some foods containing the fat substitute, and they had been informed of the potential risks involved. Within 14 days, 17 of the volunteers were having trouble sleeping at night, and within 21 days, the entire group was showing signs of insomnia.

B. The scientists stated that if the chemical in the fat substitute was reacting with chemicals in the brain to cause the insomnia in the subjects being investigated, it should have a similar effect on other people.

C. The scientists gathered 80 volunteers who agreed to eat 3 meals a day while living at the university research center for 60 days. These volunteers had no previous history of insomnia. They were aware that the meals would be made up of some foods containing the fat substitute, and they had been informed of the potential risks involved. The scientists divided the volunteers into two groups. Group A consisted of 40 volunteers who were fed meals with foods containing the fat substitute. Group B consisted of 40 volunteers who were fed meals that did not contain the fat substitute. At the end of 60 days, the 40 volunteers in Group A were suffering from insomnia; the 40 volunteers in Group B were sleeping normally. Moreover, within 7 days of discontinuing the diet containing the fat substitute, the sleep patterns of the members of Group A returned to normal.

D. Because the fat substitute contained a chemical not typically found in the human diet, the scientists thought that this chemical caused the insomnia by reacting with other chemicals in the brain.

E. The scientists agreed that the chemical in the fat substitute was causing insomnia in people who ate foods containing this additive.

F. The scientists began to track the personal habits of 127 people who had recently reported the onset of insomnia, hoping to find a clue to the cause of this sleep disorder. Information about previous and current sleep patterns, exercise routines, stress at home and work, eating habits, and other criteria was gathered over a 6-month period. The only common element in the lives of all of the subjects was the consumption of foods containing a new fat substitute.

Correct order	Step in the scientific investigation
1. _____	_____
2. _____	_____
3. _____	_____
4. _____	_____
5. _____	_____
6. _____	_____

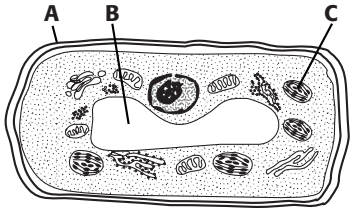
Name _____ Class _____ Date _____

Skills Worksheet

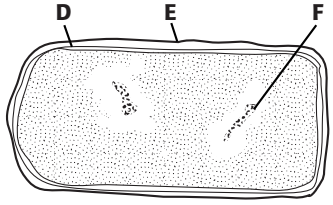
Cell Structure

INTERPRETING DIAGRAMS

Biology students were working on a class project. They prepared copies of transmission electron micrographs of a bacterium, a plant cell, and an animal cell for display in their classroom. Unfortunately, the pictures were not labeled and got mixed up. Help these students correctly identify the cells and cell structures. Use the figures below to answer questions 1–5.



Cell 1



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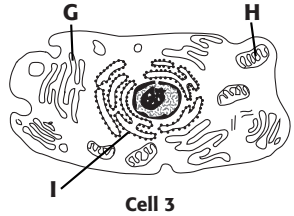

Cell 3

In the space provided, write the names of each cell's labeled structures (A–I). Using this information, write the identity of each cell—bacterium, plant cell, or animal cell.

1. Cell 1 identity _____

A. _____

B. _____

C. _____

2. Cell 2 identity _____

D. _____

E. _____

F. _____

3. Cell 3 identity _____

G. _____

H. _____

I. _____

Read each question, and write your answer in the space provided.

4. Are these cells prokaryotic or eukaryotic?

5. What are the primary differences between the three cells? What characteristics do they share?