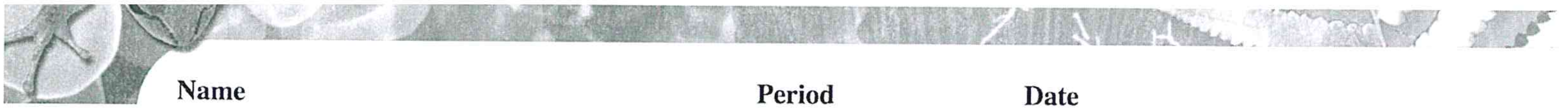


Name **Period** **Date**

SECTION
2.1

ATOMS, IONS, AND MOLECULES

Reinforcement

KEY CONCEPT All living things are based on atoms and their interactions.

All matter, whether living or nonliving, is made of the same tiny building blocks, called atoms. An **atom** is the smallest basic unit of matter. All atoms have the same basic structure, composed of three smaller particles.

- Protons: A proton is a positively charged particle in an atom's nucleus. The nucleus is the dense center of an atom.
- Neutrons: A neutron has no electrical charge, has about the same mass as a proton, and is also found in an atom's nucleus.
- Electrons: An electron is a negatively charged particle found outside the nucleus. Electrons are much smaller than either protons or neutrons.

Different types of atoms are called **elements,** which cannot be broken down by ordinary chemical means. Which element an atom is depends on the number of protons in the atom's nucleus. For example, all hydrogen atoms have one proton, and all oxygen atoms have 16 protons. Only about 25 different elements are found in organisms. Atoms of different elements can link, or bond, together to form **compounds.** Atoms form bonds in two ways.

- Ionic bonds: An **ion** is an atom that has gained or lost one or more electrons. Some atoms form positive ions, which happens when an atom loses electrons. Other atoms form negative ions, which happens when an atom gains electrons. An **ionic bond** forms through the electrical force between oppositely charged ions.
- Covalent bonds: A **covalent bond** forms when atoms share one or more pairs of electrons. A **molecule** is two or more atoms that are held together by covalent bonds.

1. What are the parts of an atom?

____

2. What makes atoms of one element different from the atoms of another element?

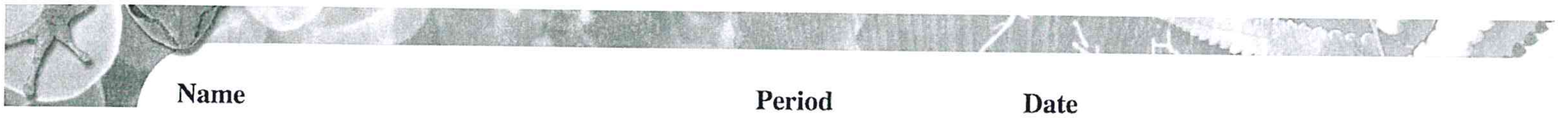
____

3. How are ionic bonds and covalent bonds different?

____

____

____



Name **Period** **Date**

SECTION
2.2

PROPERTIES OF WATER
Reinforcement

KEY CONCEPT Water's unique properties allow life to exist on Earth.

The structure of the water molecule gives water unique properties. Water is a polar molecule, which means that it has a region with a slight negative charge (the oxygen atom), and a region with a slight positive charge (the hydrogen atoms). The oppositely charged regions of water molecules interact to form hydrogen bonds. A **hydrogen bond** is an attraction between a slightly positive hydrogen atom and a slightly negative atom. Hydrogen bonds are responsible for several important properties of water.

- High specific heat: Water resists changes in temperature; it must absorb a large amount of heat energy to increase in temperature.
- Cohesion: The attraction among molecules of a substance is called **cohesion.** Cohesion due to hydrogen bonds makes water molecules "stick" together.
- Adhesion: The attraction among molecules of different substances is called **adhesion.** Water molecules "stick" to many other materials because of hydrogen bonds.

Many compounds that are important for life dissolve in water. Water is the largest component of cells' interiors, and chemical reactions in the cell take place in this water. When one substance dissolves in another, a **solution** is formed. The substance present in the greatest amount is called the **solvent.** Substances that are present in lower amounts and dissolve in the solvent are called **solutes.** Polar solvents, such as water, dissolve polar molecules and ions.

When some substances dissolve in water they break up into ions. A compound that releases a hydrogen ion (a proton) when it dissolves in water is an **acid. Bases** are compounds that remove, or accept, hydrogen ions. A solution's acidity, or its hydrogen ion concentration, is measured on the pH scale. An acid has a low pH (pH below 7) and a high hydrogen ion concentration. A base has a high pH (pH above 7) and a low hydrogen ion concentration. Organisms must maintain a stable pH. Even a small change in pH can disrupt many biological processes.

1. How do hydrogen bonds form?

____

____

____

2. What are the two parts of a solution?

____

3. What does pH measure?

Name ______________________________ Date __________ Class __________

CHAPTER 7 THE CHEMISTRY OF LIFE

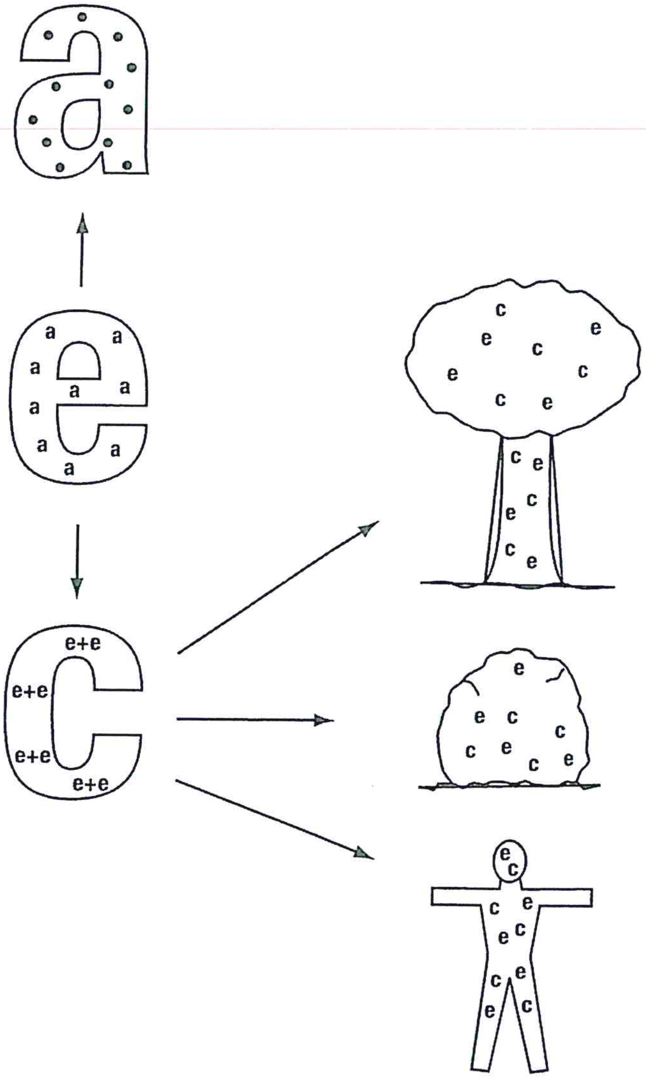
Get the Big Picture

Read what's in the boxes and study the pictures. Then fill in the blanks in the statements below.

Atom
- smallest particle of an element
- contains protons, neutrons, and electrons

Element
- made of atoms
- cannot be broken down into simpler substances
- hydrogen and oxygen are elements

Compound
- made up of chemically combined elements
- water is a compound, made up of hydrogen and oxygen



1. Elements are made up of ____________________.

2. Inside the atoms are ____________________, ____________________, and ____________________.

3. Elements combine to form ____________________.

4. All living and nonliving things are made up of ____________________ and ____________________.

Name ______________________________ Date ____________ Class ____________

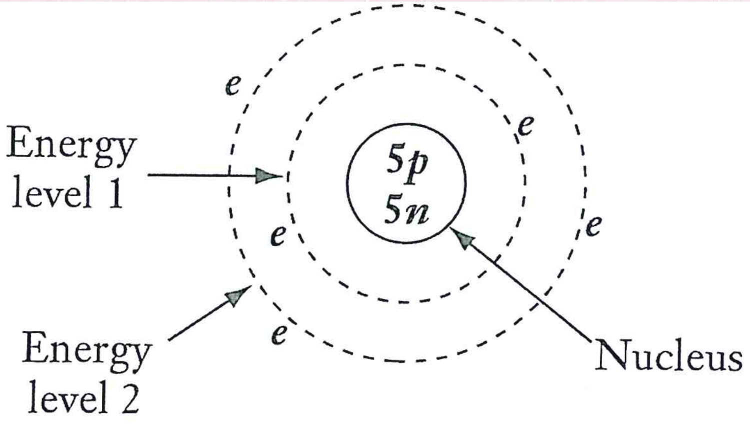
CHAPTER 7 THE CHEMISTRY OF LIFE

Section 7.1 Elements and Atoms
Section 7.2 Interactions of Matter
Section 7.3 Life Substances

Study the Diagram

Use the diagram to answer the questions.

Boron Atom



1. An atom of boron contains ____________ protons, ____________ neutrons, and ____________ electrons.

2. An oxygen atom contains 8 protons and 8 neutrons. It has 2 electrons in its first energy level. It has 6 electrons in its second energy level. In the space below, draw an atom of oxygen. Be sure to show the protons, neutrons, electron energy levels, and electrons.

Oxygen Atom