

Elements and the Periodic Table ▪ *Section Summary*

Nonmetals and Metalloids

Guide for Reading

- What are the properties of nonmetals?
- How are metalloids useful?

Nonmetals are elements that lack most of the properties of metals. **Most nonmetals are poor conductors of electricity and heat and are reactive with other elements. Solid nonmetals are dull and brittle.** Nonmetals usually have lower densities than metals, and are poor conductors of heat and electricity.

Except for Group 18, most nonmetals readily form compounds with other elements. Many metals and nonmetals react with each other. Because atoms of nonmetals usually gain electrons, electrons move from metal atoms to nonmetal atoms. Nonmetals can also form compounds with other nonmetals by sharing electrons.

The elements in Group 14, the carbon family, can gain, lose, or share four electrons when reacting with other elements. Carbon is the only nonmetal element in the group. Carbon plays an important role in the chemistry of life.

Group 15 is also known as the nitrogen family. The two nonmetals in the group are nitrogen and phosphorus. These nonmetals usually gain or share three electrons when reacting with other elements. Nitrogen is an element that occurs in nature as a molecule formed from two nitrogen atoms bonded together. A molecule that is made up of two identical atoms is a **diatomic molecule**.

The elements in Group 16, the oxygen family, have three nonmetals—oxygen, sulfur, and selenium. These atoms typically gain or share two electrons in a reaction. The oxygen we breathe is O_2 . Ozone is O_3 .

The elements in Group 17 are known as the **halogens**. All but one of the halogens are nonmetals. A halogen atom typically gains or shares one electron when it reacts. In their elemental form, all of the halogens are very reactive.

The elements in Group 18, the **noble gases**, do not ordinarily form compounds. That is because the atoms of these elements do not gain, lose, or share electrons.

Hydrogen is the simplest element. Its atoms contain one proton and one electron. Because hydrogen's chemical properties are so different from the other elements, it cannot be grouped into a family.

On the border between the metals and the nonmetals are seven elements called metalloids. The **metalloids** have some of the characteristics of metals and some of the characteristics of nonmetals. **The most useful property of the metalloids is their varying ability to conduct electricity.** Some metalloids are used to make semiconductors. **Semiconductors** are substances that under some conditions can carry electricity, and under other conditions cannot carry electricity. Semiconductors are used to make computer chips, transistors, and lasers.