

# Compounds

Textbook pages 76–83

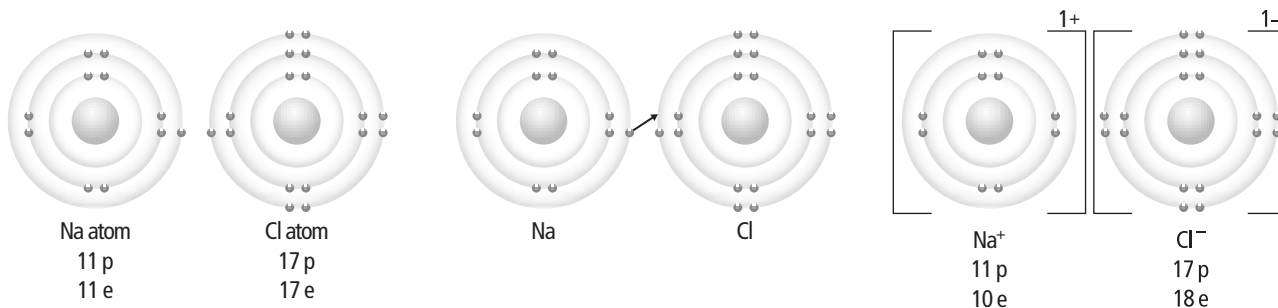
## Before You Read

What do you know about ions? Write your ideas on the lines below.

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Sodium (Na) loses an electron to chlorine (Cl) to form sodium chloride, an ionic compound. Sodium chloride is table salt.



### Mark the Text

#### Identify Definitions

Highlight the definition of each word that appears in bold type.



### Reading Check

- When is an ionic compound formed?

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### How do compounds form?

Recall that an element is a pure substance that is made up of one type of atom. A **compound** is a pure substance that is made up of two or more types of atoms that are joined together due to a chemical change. Water, sugar, and table salt are three examples of compounds.

Atoms are held together in compounds by chemical bonds. These chemical bonds are created by attractive forces between atoms. Chemical bonds are formed when atoms gain or lose electrons, or when they share electrons. Recall that an atom is electrically neutral. When an atom loses electrons it becomes positively charged. When an atom gains electrons it becomes negatively charged.

### What are ionic compounds?

If atoms gain electrons from other atoms or lose electrons to other atoms, they form **ionic compounds**. Ionic compounds usually form between metals and non-metals. Why? The atoms in metals tend to lose electrons. So metals have a positive charge when they form ions. The atoms in non-metals tend to gain electrons. So non-metals have a negative charge when they form ions. ✓

## How do ionic compounds form?

When atoms of a metal come near atoms of a non-metal, they may join together to form an ionic compound. Electrons from the metal atoms are transferred to the non-metal atoms to create oppositely charged ions that attract each other. For instance, think about what happens when a sodium atom (metal) comes near a chlorine atom (non-metal). The sodium atom loses an electron to form a positive ion, and the chlorine atom gains an electron to form a negative ion. The two oppositely-charged ions are attracted to each other.

Ionic compounds are made up of charged particles (ions), but the positive charges and the negative charges balance, so ionic compounds are neutral.

A repeating pattern of positive and negative ions in a compound is called an **ionic lattice**.

## How do covalent compounds form?

Sometimes atoms share electrons instead of losing and gaining them. If atoms share electrons, they form covalent compounds.

**Covalent compounds** form when non-metal atoms bond together by sharing their electrons. Since the electrons are shared, the particles that make up covalent compounds are neutral. They do not have a charge. A neutral particle that is made up of atoms that are joined together by covalent bonds is called a **molecule**. A water molecule is a covalent compound. Its molecules are made of hydrogen and oxygen. Carbon dioxide gas is also a covalent compound. Its molecules are made of carbon and oxygen. ✓

## What is a polyatomic ion?

Some ions contain more than one atom. For example, the nitrate ion ( $\text{NO}_3^-$ ) contains nitrogen and oxygen. The carbonate ion ( $\text{CO}_3^{2-}$ ) contains carbon and oxygen. In these many-atom ions, the atoms are held together with covalent bonds. But the many-atom unit has a charge, so it is considered an ion. An ion that is made up of two or more atoms that are held together with covalent bonds is called a **polyatomic ion**.

### ✓ Reading Check

2. When is a covalent compound formed?

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Use with textbook pages 76–80.

## Words to know about compounds

### Vocabulary

atom	ionic lattice
chemical bonds	lose
compound	molecule
covalent compounds	negatively
electrons	neutrons
element	polyatomic ion
gain	positively
ion	protons
ionic compounds	

Use the terms in the vocabulary box to fill in the blanks. Each term may be used more than once. You will not need to use every term.

1. A pure substance that is made up of one type of atom is called a(n) \_\_\_\_\_.
2. A pure substance that is made up of two or more types of atoms that are joined together due to a chemical change is called a(n) \_\_\_\_\_.
3. Atoms in a molecule and ions in an ionic lattice are held together by \_\_\_\_\_.
4. Chemical bonds are formed when atoms gain or lose \_\_\_\_\_ or when they share \_\_\_\_\_.
5. When an atom loses electrons it becomes \_\_\_\_\_ charged.  
When an atom gains electrons it becomes \_\_\_\_\_ charged.
6. Metals and non-metals may form \_\_\_\_\_.
7. The atoms in non-metals tend to \_\_\_\_\_ electrons.
8. A(n) \_\_\_\_\_ is a repeating pattern of positive and negative ions.
9. \_\_\_\_\_ form when non-metal atoms bond together by sharing their electrons.
10. A neutral particle that is made up of atoms that are joined together by covalent bonds is called a(n) \_\_\_\_\_.
11. A(n) \_\_\_\_\_ is an ion that is made up of two or more atoms that are held together with covalent bonds.

Use with textbook pages 76–80.

## True or false?

Read the statements given below. If the statement is true, write “T” on the line in front of the statement. If it is false, write “F” and rewrite the statement to make it true.

1. \_\_\_\_\_ An element is a pure substance made of more than one kind of compound.

\_\_\_\_\_

2. \_\_\_\_\_ Compounds form through chemical bonds.

\_\_\_\_\_

3. \_\_\_\_\_ In covalent compounds, atoms gain or lose electrons to form molecules.

\_\_\_\_\_

4. \_\_\_\_\_ Water is a molecule formed by the sharing of electrons between the atoms of hydrogen and oxygen.

\_\_\_\_\_

\_\_\_\_\_

5. \_\_\_\_\_ Covalent compounds involve the sharing of electrons, while ionic compounds involve the transfer of electrons.

\_\_\_\_\_

\_\_\_\_\_

6. \_\_\_\_\_ Ions are formed when atoms lose or gain protons.

\_\_\_\_\_

7. \_\_\_\_\_ An ionic lattice is a repeating pattern of positive and negative ions.

\_\_\_\_\_

\_\_\_\_\_

8. \_\_\_\_\_ A polyatomic ion is electrically neutral.

\_\_\_\_\_

9. \_\_\_\_\_ Atoms are held together by covalent bonds in polyatomic ions.

\_\_\_\_\_

\_\_\_\_\_

Use with textbook pages 76–80.

## Comparing ionic and covalent compounds

Use the chart to help you compare ionic compounds and covalent compounds. On the left side, place the letters of the statements that are only true of ionic compounds. On the right side, place the letters of the statements that are only true of covalent compounds. In the middle, place the letters of the statements that are true of both compounds.

- A. atoms gain or lose electrons to form ions
- B. pure substance made up of two or more kinds of elements
- C. compound is made of a positive ion and a negative ion
- D. atoms join by sharing electrons
- E. atoms are joined to each other by chemical bonds
- F. exist as a solid in the form of an ionic lattice
- G. oppositely charged ions attract each other
- H. molecule made of uncharged atoms
- I. bond between atoms is due to electron transfer
- J. compound is made of a non-metal and a non-metal
- K. sodium chloride (NaCl) is an example
- L. water (H<sub>2</sub>O) is an example

Ionic compound	Both	Covalent compound

Use with textbook pages 76–80.

## Compounds

Match each Term on the left with the best Descriptor on the right. Each Descriptor may be used only once.

Term	Descriptor
1. _____ molecule	<b>A.</b> pure substance made of one type of atom
2. _____ ionic lattice	<b>B.</b> atoms combine by gaining or losing electrons
3. _____ polyatomic ion	<b>C.</b> repeating pattern of positive and negative ions
4. _____ ionic compound	<b>D.</b> atoms combine by sharing electrons to form molecules
5. _____ covalent compound	<b>E.</b> neutral particle that is made up of atoms that are joined together by covalent bonds
	<b>F.</b> ion made up of two or more atoms that are held together with covalent bonds

Circle the letter of the best answer.

6. Atoms in non-metals tend to gain

- A. molecules
- B. ions
- C. atoms
- D. electrons

7. Which of the following can be formed when there is electron transfer between metals and non-metals?

- A. molecule
- B. element
- C. ionic bond
- D. covalent bond

8. Which of the following is formed due to the sharing of electrons between two non-metals?

I.	a molecule
II.	a covalent bond
III.	a covalent compound

- A. I and II only
- B. I and III only
- C. II and III only
- D. I, II, and III

9. Water is a(n)

- A. element
- B. polyatomic ion
- C. ionic compound
- D. covalent compound

10. Sodium chloride is a(n)

- A. element
- B. polyatomic ion
- C. ionic compound
- D. covalent compound

11. Which of the following can be formed when a non-metal atom reacts with a non-metal atom?

- A. element
- B. polyatomic ion
- C. ionic compound
- D. covalent compound