

**CHAPTER 7**

# Ionic Compounds and Metals

## Section 7.1 Ion Formation

*In your textbook, read about chemical bonds and formation of ions.*

Use each of the terms below just once to complete the passage.

chemical bond	electrons	energy level	ions	noble gases
nucleus	octet	pseudo-noble gas formations	valence	

The force that holds two atoms together is called a(n) (1) \_\_\_\_\_.

Such an attachment may form by the attraction of the positively charged

(2) \_\_\_\_\_ of one atom for the negatively charged

(3) \_\_\_\_\_ of another atom, or by the attraction of charged atoms, which are called

(4) \_\_\_\_\_. The attractions may also involve

(5) \_\_\_\_\_ electrons, which are the electrons in the outermost

(6) \_\_\_\_\_. The (7) \_\_\_\_\_ are a family of elements that have very

little tendency to react. Most of these elements have a set of eight outermost electrons, which is called a

stable (8) \_\_\_\_\_. The relatively stable electron structures developed by loss of

electrons in certain elements of groups 3, 4, 13, and 14 are called (9) \_\_\_\_\_.

For each statement below, write *true* or *false*.

- \_\_\_\_\_ 10. A positively charged ion is called an anion.
- \_\_\_\_\_ 11. Elements in group 1 lose their one valence electron, forming an ion with a 1+ charge.
- \_\_\_\_\_ 12. Elements tend to react so that they acquire the electron structure of a halogen.
- \_\_\_\_\_ 13. A sodium atom tends to lose one electron when it reacts.
- \_\_\_\_\_ 14. The electron structure of a zinc ion ( $\text{Zn}^{2+}$ ) is an example of a pseudo-noble gas formation.
- \_\_\_\_\_ 15. A  $\text{Cl}^-$  ion is an example of a cation.
- \_\_\_\_\_ 16. The ending *-ide* is used to designate an anion.
- \_\_\_\_\_ 17. Nonmetals form a stable outer electron configuration by losing electrons and becoming anions.

## Section 7.2 Ionic Bonds and Ionic Compounds

*In your textbook, read about forming ionic bonds and the characteristics of ionic compounds.*

**Circle the letter of the choice that best completes the statement or answers the question.**

1. An ionic bond is
  - a. attraction of an atom for its electrons.
  - b. attraction of atoms for electrons they share.
  - c. a force that holds together atoms that are oppositely charged.
  - d. the movement of electrons from one atom to another.
2. The formula unit of an ionic compound shows the
  - a. total number of each kind of ion in a sample.
  - b. simplest ratio of the ions.
  - c. numbers of atoms within each molecule.
  - d. number of nearest neighboring ions surrounding each kind of ion.
3. The overall charge of a formula unit for an ionic compound
  - a. is always zero.
  - b. is always negative.
  - c. is always positive.
  - d. may have any value.
4. How many chloride ( $\text{Cl}^-$ ) ions are present in a formula unit of magnesium chloride, given that the charge on a Mg ion is 2+?
  - a. one-half
  - b. one
  - c. two
  - d. four
5. Ionic bonds generally occur between
  - a. metals.
  - b. nonmetals.
  - c. a metal and a nonmetal.
  - d. noble gases.
6. Salts are examples of
  - a. nonionic compounds.
  - b. metals.
  - c. nonmetals.
  - d. ionic compounds.
7. A three-dimensional arrangement of particles in an ionic solid is called a(n)
  - a. crystal lattice.
  - b. sea of electrons.
  - c. formula unit.
  - d. electrolyte.
8. In a crystal lattice of an ionic compound,
  - a. ions of a given charge are clustered together, far from ions of the opposite charge.
  - b. ions are surrounded by ions of the opposite charge.
  - c. a sea of electrons surrounds the ions.
  - d. neutral molecules are present.

**Section 7.2 continued**

9. What is the relationship between lattice energy and the strength of the attractive force holding ions in place?
- The more positive the lattice energy is, the greater the force.
  - The more negative the lattice energy is, the greater the force.
  - The closer the lattice energy is to zero, the greater the force.
  - There is no relationship between the two quantities.
10. The formation of a stable ionic compound from ions
- is always exothermic.
  - may be either exothermic or endothermic.
  - is always endothermic.
  - neither absorbs nor releases energy.
11. In electron transfer involving a metallic atom and a nonmetallic atom during ion formation, which of the following is correct?
- The metallic atom gains electrons from the nonmetallic atom.
  - The nonmetallic atom gains electrons from the metallic atom.
  - Both atoms gain electrons.
  - Neither atom gains electrons.

**Underline the word that correctly describes each property in ionic compounds.**

12. Melting point	Low	High
13. Boiling point	Low	High
14. Hardness	Hard	Soft
15. Brittleness	Flexible	Brittle
16. Electrical conductivity in the solid state	Good	Poor
17. Electrical conductivity in the liquid state	Good	Poor
18. Electrical conductivity when dissolved in water	Good	Poor

**For each statement below, write *true* or *false*.**

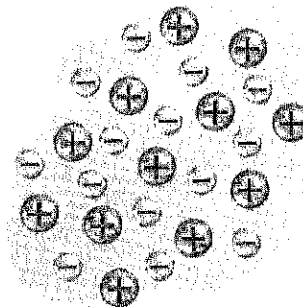
- \_\_\_\_\_ 19. The crystal lattice of ionic compounds affects their melting and boiling points.
- \_\_\_\_\_ 20. The lattice energy is the energy required to separate the ions of an ionic compound.
- \_\_\_\_\_ 21. The energy of an ionic compound is higher than that of the separate elements that formed it.
- \_\_\_\_\_ 22. Large ions tend to produce a more negative value for lattice energy than smaller ions do.
- \_\_\_\_\_ 23. Ions that have larger charges tend to produce a more negative lattice energy than ions with smaller charges do.

**CHAPTER 7****Section 7.4 Metallic Bonds and the Properties of Metals**

*In your textbook, read about metallic bonds.*

**Use the diagram of metallic bonding to answer the following questions.**

1. What is the name of the model of metallic bonding that is illustrated?



2. Why are the electrons in a metallic solid described as delocalized?

3. Which electrons from the metal make up the delocalized electrons?

4. Are the metal atoms that are shown cations or anions? How can you tell?

5. How do the metallic ions differ from the ions that exist in ionic solids?

6. Explain what holds the metal atoms together in the solid.

*In your textbook, read about the properties of metals.*

**For each property, write *yes* if the property is characteristic of most metals, or *no* if it is not. If the property is a characteristic of metals, explain how metallic bonding accounts for the property.**

7. Malleable \_\_\_\_\_
8. Brittle \_\_\_\_\_
9. Lustrous \_\_\_\_\_
10. High melting point \_\_\_\_\_
11. Low boiling point \_\_\_\_\_
12. Ductile \_\_\_\_\_
13. Poor conduction of heat \_\_\_\_\_
14. Good conduction of electricity \_\_\_\_\_

## CHAPTER 7

## CHAPTER ASSESSMENT

# Ionic Compounds and Metals

## Reviewing Vocabulary

Match the definition in Column A with the term in Column B.

## Column A

## Column B

- |  |                          |
|--|--------------------------|
| _____ 1. Electrons that are free to move in metals                                   | a. alloy                 |
| _____ 2. For a monatomic ion, is equal to the charge                                 | b. anion                 |
| _____ 3. The force that holds two atoms together                                     | c. cation                |
| _____ 4. A charged particle containing more than one atom                            | d. chemical bond         |
| _____ 5. A positively charged ion  | e. delocalized electrons |
| _____ 6. A negatively charged ion  | f. electrolyte           |
| _____ 7. An ionic compound whose aqueous solution conducts electricity               | g. electron sea model    |
| _____ 8. The name for most ionic compounds other than oxides                         | h. formula unit          |
| _____ 9. Represents the way electrons exist in metals                                | i. interstitial alloy    |
| _____ 10. A charged particle containing only one atom                                | j. ionic bond            |
| _____ 11. The energy needed to separate the ions of an ionic compound                | k. lattice energy        |
| _____ 12. The electrostatic force that holds oppositely charged particles together   | l. metallic bond         |
| _____ 13. A mixture of elements that has metallic properties                         | m. monatomic ion         |
| _____ 14. A mixture formed when small atoms fill holes in a metallic crystal         | n. oxidation number      |
| _____ 15. A polyatomic ion composed of an element bonded to at least one oxygen atom | o. oxyanion              |
| _____ 16. Shows the simplest ratio of ions in an ionic compound                      | p. polyatomic ion        |
| _____ 17. The attraction of a metallic cation for delocalized electrons              | q. salts                 |