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CHAPTER 8 STUDY GUIDE FOR CONTENT MASTERY

Ionic Compounds

Section 8.1 Forming Chemical Bonds

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)** chemical bond. Such an attachment may form by the attraction of the positively charged **(2)** nucleus of one atom for the negatively charged **(3)** electrons of another atom, or by the attraction of charged atoms, which are called **(4)** ions. The attractions may also involve **(5)** valence electrons, which are the electrons in the outermost **(6)** energy level. The **(7)** noble gases 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)** octet. The relatively stable electron structures developed by loss of electrons in certain elements of groups 1B, 2B, 3A, and 4A are called **(9)** pseudo-noble gas formations.

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

false **10.** A positively charged ion is called an anion.

true **11.** Elements in group 1A lose their one valence electron, forming an ion with a 1+ charge.

false **12.** Elements tend to react so that they acquire the electron structure of a halogen.

true **13.** A sodium atom tends to lose one electron when it reacts.

true **14.** The electron structure of a zinc ion (Zn^{2+}) is an example of a pseudo-noble gas formation.

false **15.** A Cl^- ion is an example of a cation.

true **16.** The ending *-ide* is used to designate an anion.

false **17.** Nonmetals form a stable outer electron configuration by losing electrons and becoming anions.

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Section 8.2 What is an ionic bond?

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 (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.

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Section 8.2 ***continued***

9. What is the relationship between lattice energy and the strength of the attractive force holding ions in place?

a. The more positive the lattice energy is, the greater the force.
b. The more negative the lattice energy is, the greater the force.
c. The closer the lattice energy is to zero, the greater the force.
d. There is no relationship between the two quantities.

10. The formation of a stable ionic compound from ions

a. is always exothermic.
b. may be either exothermic or endothermic.
c. is always endothermic.
d. 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?

a. The metallic atom gains electrons from the nonmetallic atom.
b. The nonmetallic atom gains electrons from the metallic atom.
c. Both atoms gain electrons.
d. 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*.

true **19.** The crystal lattice of ionic compounds affects their melting and boiling points.

true **20.** The lattice energy is the energy required to separate the ions of an ionic compound.

false **21.** The energy of an ionic compound is higher than that of the separate elements that formed it.

false **22.** Large ions tend to produce a more negative value for lattice energy than smaller ions do.

true **23.** Ions that have larger charges tend to produce a more negative lattice energy than ions with smaller charges do.

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Section 8.3 Chemical Formulas and Their Names

In your textbook, read about communicating what is in a compound and naming ions and ionic compounds.

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

anion	*-ate*	cation	electrons	zero
lower right	monatomic	one	oxidation number	*-ite*
oxyanion	polyatomic	subscript		

A one-atom ion is called a(n) **(1)** monatomic ion. The charge of such an ion is equal to the atom's **(2)** oxidation number, which is the number of **(3)** electrons transferred to or from the atom to form the ion. In ionic compounds, the sum of the charges of all the ions equals **(4)** zero. Ions made up of more than one atom are called **(5)** polyatomic ions. If such an ion is negatively charged and includes one or more oxygen atoms, it is called a(n) **(6)** oxyanion. If two such ions can be formed that contain different numbers of oxygen atoms, the name for the ion with more oxygen atoms ends with the suffix **(7)** *-ate*. The name for the ion with fewer oxygen atoms ends with **(8)** *-ite*.

In the chemical formula for any ionic compound, the chemical symbol for the **(9)** cation is written first, followed by the chemical symbol for the **(10)** anion. A(n) **(11)** subscript is a small number used to represent the number of ions of a given element in a chemical formula. Such numbers are written to the **(12)** lower right of the symbol for the element. If no number appears, the assumption is that the number equals **(13)** one.

For each formula in Column A, write the letter of the matching name in Column B.

Column A		Column B
e	**14.** ClO_2^-	**a.** chlorate
d	**15.** ClO_4^-	**b.** hypochlorite
b	**16.** ClO^-	**c.** chloride
c	**17.** Cl^-	**d.** perchlorate
a	**18.** ClO_3^-	**e.** chlorite

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Section 8.3 *continued*

For each of the following chemical formulas, write the correct name of the ionic compound represented. You may refer to the periodic table and Table 8.7 for help.

19. NaI **sodium iodide**

20. $CaCl_2$ **calcium chloride**

21. K_2S **potassium sulfide**

22. MgO **magnesium oxide**

23. $LiHSO_4$ **lithium hydrogen sulfate**

24. NH_4Br **ammonium bromide**

25. Ca_3N_2 **calcium nitride**

26. Cs_3P **cesium phosphide**

27. $KBrO_3$ **potassium bromate**

28. $Mg(ClO)_2$ **magnesium hypochlorite**

29. Li_2O_2 **lithium peroxide**

30. $Be_3(PO_4)_2$ **beryllium phosphate**

31. $(NH_4)_2CO_3$ **ammonium carbonate**

32. $NaBrO_3$ **sodium bromate**

33. Fe_2O_3 **iron(III) oxide**

34. $Fe(IO_3)_2$ **iron(III) iodate**

For each of the following ionic compounds, write the correct formula for the compound. You may refer to the periodic table and Table 8.7 for help.

35. beryllium nitride **Be_3N_2**

36. nickel(II) chloride **$NiCl_2$**

37. potassium chlorite **$KClO_2$**

38. copper(I) oxide **Cu_2O**

39. magnesium sulfite **$MgSO_3$**

40. ammonium sulfide **$(NH_4)_2S$**

41. calcium iodate **$Ca(IO_3)_2$**

42. iron(III) perchlorate **$Fe(ClO_4)_3$**

43. sodium nitride **Na_3N**

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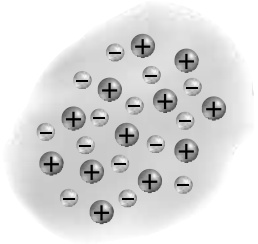
Section 8.4 Metallic Bonds and Properties of Metals

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?
electron sea model

2. Why are the electrons in a metallic solid described as delocalized?
They are free to move from one atom to another.

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

4. Are the metal atoms that are shown cations or anions? How can you tell?
Cations; they are positively charged.

5. How do the metallic ions differ from the ions that exist in ionic solids?
The electrons are not completely lost by the metal atoms, as they are in an ionic solid.

6. Explain what holds the metal atoms together in the solid.
They are bonded by the oppositely charged electron sea that surrounds them.

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 **Yes; when the metal is hammered, the delocalized electrons move, keeping the metallic bonds intact.**

8. Brittle **no**

9. Lustrous **Yes; the delocalized electrons absorb and release protons.**

10. High melting point **Yes; the metallic bonds are strong.**

11. Low boiling point **no**

12. Ductile **Yes; when the metal is pulled, the delocalized electrons move, keeping the metallic bonds intact.**

13. Poor conduction of heat **no**

14. Good conduction of electricity **Yes; the delocalized electrons are mobile.**