Chapter 8
STUDY GUIDE FOR CONTENT MASTERY

Ionic Compounds

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 (Zn2+) 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.

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.

STUDY GUIDE FOR CONTENT MASTERY
CHAPTER 8

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.

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 1B, 2B, 3A, and 4A are called (9).

For each statement below, write true or false.

10. A positively charged ion is called an anion.
11. Elements in group 1A 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 (Zn2+) is an example of a pseudo-noble gas formation.
15. A 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.

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   a. is always zero.  
   b. is always negative.  
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   a. one-half  
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5. Ionic bonds generally occur between
   a. metals.  
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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.
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.

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) **-ite**. The name for the ion with fewer oxygen atoms ends with 8) **-ate**.

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.

<table>
<thead>
<tr>
<th>Column A</th>
<th>Column B</th>
</tr>
</thead>
<tbody>
<tr>
<td>e</td>
<td>a. chlorate</td>
</tr>
<tr>
<td>d</td>
<td>b. hypochlorite</td>
</tr>
<tr>
<td>b</td>
<td>c. chloride</td>
</tr>
<tr>
<td>c</td>
<td>d. perchlorate</td>
</tr>
<tr>
<td>a</td>
<td>e. chlorite</td>
</tr>
</tbody>
</table>
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. CaCl₂  calcium chloride
21. K₂S  potassium sulfide
22. MgO  magnesium oxide
23. LiHSO₄  lithium hydrogen sulfate
24. NH₄Br  ammonium bromide
25. Ca₃N₂  calcium nitride
26. Cs₃P  cesium phosphide
27. KBrO₃  potassium bromate
28. Mg(ClO)₂  magnesium hypochlorite
29. Li₂O₂  lithium peroxide
30. Be₃(PO₄)₂  beryllium phosphate
31. (NH₄)₂CO₃  ammonium carbonate
32. NaBrO₃  sodium bromate
33. Fe₂O₃  iron(III) oxide
34. Fe(IO₃)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  Be₃N₂
36. nickel(II) chloride  NiCl₂
37. potassium chlorate  KClO₃
38. copper(II) oxide  Cu₂O
39. magnesium sulfite  MgSO₃
40. ammonium sulfide  (NH₄)₂S
41. calcium iodate  Ca(IO₃)₂
42. iron(III) perchlorate  Fe(ClO₄)₃
43. sodium nitride  Na₃N
Section 9.2 Naming Molecules

In your textbook, read about how binary compounds and acids are named from their formulas.

For each statement below, write true or false.

false 1. Binary molecular compounds are generally composed of a metal and a nonmetal.
false 2. The second element in the formula of a binary compound is named using the suffix -ite.
false 3. The prefix tetra- indicates three atoms.
true 4. The prefix hexa- indicates six atoms.
true 5. In naming the first element in a formula, the prefix mono- is not used.
false 6. For binary acids, the hydrogen part of the compound is named using the prefix hydro-.
false 7. An oxyacid contains only two elements.
false 8. If the name of the anion of an oxyacid ends in -ate, the acid name contains the suffix -ous.

In your textbook, read about naming molecular compounds and oxyacids.

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

<table>
<thead>
<tr>
<th>Column A</th>
<th>Column B</th>
</tr>
</thead>
<tbody>
<tr>
<td>c 9. CO</td>
<td>a. hydrobromic acid</td>
</tr>
<tr>
<td>i 10. CO₂</td>
<td>b. dinitrogen tetroxide</td>
</tr>
<tr>
<td>g 11. H₂CO₃</td>
<td>c. carbon monoxide</td>
</tr>
<tr>
<td>e 12. NH₃</td>
<td>d. nitrous acid</td>
</tr>
<tr>
<td>b 13. N₂O₄</td>
<td>e. ammonia</td>
</tr>
<tr>
<td>d 14. HNO₂</td>
<td>f. nitric acid</td>
</tr>
<tr>
<td>f 15. HNO₃</td>
<td>g. carbonic acid</td>
</tr>
<tr>
<td>a 16. HBr</td>
<td>h. bromic acid</td>
</tr>
<tr>
<td>h 17. HBrO₃</td>
<td>i. carbon dioxide</td>
</tr>
</tbody>
</table>
Section 9.3 Molecular Structures
In your textbook, read about Lewis structures.

For each statement below, write true or false.

true 1. A structural formula shows the arrangement of the atoms in a molecule.
false 2. The central atom in a molecule is the one with the highest electron affinity.
true 3. In molecules, hydrogen is always a terminal atom.
false 4. The number of bonding pairs in a molecule is equal to the number of electrons.
false 5. To find the total number of electrons available for bonding in a positive ion, you should add the ion charge to the total number of valence electrons of the atoms present.
false 6. The electrons in a coordinate covalent bond are donated by both the bonded atoms.
true 7. Resonance occurs when more than one valid Lewis structure can be written for a molecule.
true 8. Nitrate is an example of an ion that forms resonance structures.
false 9. The carbon dioxide molecule contains two double bonds.
true 10. All electrons in an atom are available for bonding.
false 11. In the sulfate ion (SO₄²⁻), 32 electrons are available for bonding.
false 12. When carbon and oxygen bond, the molecule contains ten pairs of bonding electrons.

In your textbook, read about resonance structures and exceptions to the octet rule.

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

<table>
<thead>
<tr>
<th>Column A</th>
<th>Column B</th>
</tr>
</thead>
<tbody>
<tr>
<td>c 13. Odd number of valence electrons</td>
<td>a. O₂</td>
</tr>
<tr>
<td>b 14. Fewer than 8 electrons around an atom</td>
<td>b. BF₃</td>
</tr>
<tr>
<td>d 15. More than 8 electrons around central atom</td>
<td>c. NO</td>
</tr>
<tr>
<td>a 16. More than one valid Lewis structure</td>
<td>d. SF₆</td>
</tr>
</tbody>
</table>

Section 9.4 Molecular Shape
In your textbook, read about the VSEPR model.

Circle the letter of the choice that best completes the statement.

1. The VSEPR model is used mainly to
   a. determine molecular shape.
   b. write resonance structures.
   c. determine ionic charge.
   d. measure intermolecular distances.

2. The bond angle is the angle between
   a. the sigma and pi bonds in a double bond.
   b. the nucleus and the bonding electrons.
   c. two terminal atoms and the central atom.
   d. the orbitals of a bonding atom.

3. The VSEPR model is based on the idea that
   a. there is always an octet of electrons around an atom in a molecule.
   b. electrons are attracted to the nucleus.
   c. molecules repel one another.
   d. shared and unshared electron pairs repel each other as much as possible.

4. The shape of a molecule whose central atom has four pairs of bonding electrons is
   a. tetrahedral.
   b. trigonal planar.
   c. trigonal pyramidal.
   d. linear.

5. The shape of a molecule that has two covalent single bonds and no lone pairs on the central atom is
   a. tetrahedral.
   b. trigonal planar.
   c. trigonal pyramidal.
   d. linear.

6. The shape of a molecule that has three single covalent bonds and one lone pair on the central atom is
   a. tetrahedral.
   b. trigonal planar.
   c. trigonal pyramidal.
   d. linear.

In your textbook, read about hybridization.

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

<table>
<thead>
<tr>
<th>carbon</th>
<th>carbon dioxide</th>
<th>hybridization</th>
<th>sp³</th>
<th>identical</th>
<th>methane</th>
<th>sp</th>
<th>phosphorus trihydride</th>
</tr>
</thead>
</table>

The formation of new orbitals from a combination or rearrangement of valence electrons is called (7) hybridization. The orbitals that are produced in this way are (8) identical to one another. An example of an element that commonly undergoes such formation is (9) carbon. When this atom combines its three p orbitals and its one s orbital, the orbitals that result are called (10) sp³ orbitals. An example of a molecule that has this type of orbital is (11) methane.
Section 9.5 Electronegativity and Polarity

In your textbook, read about electronegativity.

Use the table of electronegativities below to answer the following questions.

**Electronegativities of Some Elements**

<table>
<thead>
<tr>
<th>(1)</th>
<th>(2)</th>
<th>(3)</th>
<th>(4)</th>
<th>(5)</th>
<th>(6)</th>
<th>(7)</th>
<th>(8)</th>
<th>(9)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clo</td>
<td>3.5</td>
<td>3.1</td>
<td>2.0</td>
<td>2.1</td>
<td>2.8</td>
<td>2.2</td>
<td>2.1</td>
<td>2.9</td>
</tr>
<tr>
<td>Ca</td>
<td>2.1</td>
<td>1.9</td>
<td>1.8</td>
<td>1.6</td>
<td>1.9</td>
<td>1.7</td>
<td>1.8</td>
<td>1.6</td>
</tr>
<tr>
<td>Na</td>
<td>1.6</td>
<td>1.5</td>
<td>1.4</td>
<td>1.3</td>
<td>1.4</td>
<td>1.3</td>
<td>1.5</td>
<td>1.3</td>
</tr>
<tr>
<td>Mg</td>
<td>1.2</td>
<td>1.1</td>
<td>1.0</td>
<td>0.9</td>
<td>1.0</td>
<td>0.9</td>
<td>1.1</td>
<td>0.9</td>
</tr>
<tr>
<td>Al</td>
<td>0.9</td>
<td>0.9</td>
<td>0.8</td>
<td>0.7</td>
<td>0.8</td>
<td>0.7</td>
<td>0.9</td>
<td>0.7</td>
</tr>
<tr>
<td>Si</td>
<td>0.6</td>
<td>0.6</td>
<td>0.5</td>
<td>0.4</td>
<td>0.5</td>
<td>0.4</td>
<td>0.6</td>
<td>0.4</td>
</tr>
<tr>
<td>P</td>
<td>0.3</td>
<td>0.3</td>
<td>0.2</td>
<td>0.1</td>
<td>0.2</td>
<td>0.1</td>
<td>0.3</td>
<td>0.1</td>
</tr>
<tr>
<td>Cl</td>
<td>3.0</td>
<td>2.9</td>
<td>2.8</td>
<td>2.7</td>
<td>2.8</td>
<td>2.7</td>
<td>2.9</td>
<td>2.7</td>
</tr>
</tbody>
</table>

1. What is the meaning of the term electronegativity?
   - The tendency of an atom to attract electrons.

2. Which element has the highest electronegativity? What is the numerical value? What are the name and group number of the chemical family that has the highest overall electronegativities?
   - Fluorine; 3.98; halogens; group 7A.

3. Which element has the lowest electronegativity? What is the numerical value? What are the name and group number of the chemical family that has the lowest overall electronegativities?
   - Francium; 0.7; alkali metals; group 1A.

4. What general trend in electronegativity do you note going down a group? Across a period? Electronegativity tends to decrease. Electronegativity tends to increase.

5. How are the electronegativity values used to determine the type of bond that exists between two atoms? The values are subtracted.

6. In your textbook, read about the properties of covalent compounds.
   - For each statement below, write true or false.
     - True 6. Ionic compounds are usually soluble in polar substances.
     - False 7. In a covalent molecular compound, the attraction between molecules tends to be strong.

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