Unit 7 Test Review: Chemical Nomenclature

Section 7.3 Names and Formulas for 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. 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.

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

<table>
<thead>
<tr>
<th>anion</th>
<th>-ate</th>
<th>cation</th>
<th>electrons</th>
<th>zero</th>
<th>lower right</th>
</tr>
</thead>
<tbody>
<tr>
<td>monoatomic</td>
<td>-ite</td>
<td>one</td>
<td>oxidation number</td>
<td>oxyanion</td>
<td>polyatomic</td>
</tr>
<tr>
<td>subscript</td>
<td>superscript</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
A one-atom ion is called a(n) (1) __________________ ion. The charge of such an ion is equal to the atom's (2) __________________, which is the number of (3) __________________ transferred to or from the atom to form the ion. In ionic compounds, the sum of the charges of all the ions equals (4) __________________. Ions made up of more than one atom are called (5) __________________ ions. If such an ion is negatively charged and includes one or more oxygen atoms, it is called a(n) (6) __________________. 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) __________________. The name for the ion with fewer oxygen atoms ends with (8) __________________.

In the chemical formula for any ionic compound, the chemical symbol for the (9) __________________ is written first, followed by the chemical symbol for the (10) __________________. A(n) (11) __________________ 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)________________________ of the symbol for the element. If no number appears, the assumption is that the number equals (13) __________________.

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>14. ClO₂⁻</td>
<td>a. chlorate</td>
</tr>
<tr>
<td>15. ClO₄⁻</td>
<td>b. hypochlorite</td>
</tr>
<tr>
<td>16. ClO⁻</td>
<td>c. chloride</td>
</tr>
<tr>
<td>17. Cl⁻</td>
<td>d. perchlorate</td>
</tr>
<tr>
<td>18. ClO₃⁻</td>
<td>e. chlorite</td>
</tr>
</tbody>
</table>

19. When is it necessary to use roman numerals in the name of an ionic compound? Which elements require this special rule?

20. The -ate form of a polyatomic ion created from boron and oxygen is BO₃⁻³. The name of this polyatomic ion is borate ion.

   a. Based on the above information, what is the formula for a borite PAI?

   b. What name should be applied to a PAI with the formula BO₄⁻³?

   c. Name and write the formula for a compound using the BO⁻³ PAI and strontium ion.
21. Specifically, the metals ________________________________ do not require special distinguishing symbols like roman numerals or suffixes when writing their names in an ionic compound because they can only possibly form one type of cation.

22. The Stock System uses _______________________________ in the name of a compound to distinguish between possible cations used to make the ionic compound.

23. The Traditional System uses _______________________________ in the name of a compound to distinguish between possible cations used to make the ionic compound.

Answer using the Stock system.

Write the correct name for:

1) CuS
2) PbBr₄
3) Pb₃N₂
4) Fe₂O₃
5) FeI₂
6) Sn₃P₄
7) Cu₂S
8) SnCl₂
9) HgO
10) Hg₂F₂

Answer using the Traditional system.

Write the correct name for:

11) CuCl₂
12) CuBr
13) PbO
14) Fe₂S₃
15) PbCl₂
16) SnO
17) Cu₂O
18) PbO₂
19) FeO
20) SnO₂

Answer using either system.

Write the correct name for:

21) Hg₂O
22) Hg₂I₂
23) AuCl₃
24) MnO
25) CrCl₃
26) CoO
27) Mn₂O₃
28) Co₂S₃
29) AuF
30) CrBr₂
For each of the following chemical formulas, write the correct name of the ionic compound represented. You may refer to the periodic table on pages 156-157 and Table 8.7 for help.

21. NaI
22. CaCl₂
23. K₂S
24. MgO
25. LiHSO₄
26. NH₄Br
27. Ca₃N₂
28. Cs₃P

37. Circle any formula(s) from questions # 21-36 that require the Stock System for naming.

38. Place a star beside any formula(s) from questions # 21-36 that is/are binary ionic compounds.

For each of the following ionic compounds, write the correct formula for the compound. You may refer to the periodic table on pages 156-157 and Table 8.7 for help.

39. beryllium nitride
40. nickel(II) fluoride
41. potassium arsenite
42. copper(I) oxide
43. magnesium hyposulfite
44. ammonium sulfide
45. calcium iodate
46. iron(III) perchlorate
47. sodium carbide
48. iron(II) chloride
49. copper(I) sulfide
50. lead(IV) iodide
51. tin(II) fluoride
52. mercury(I) bromide
53. tin(II) oxide
54. chromium(III) oxide
55. gold(I) iodide
56. manganese(II) nitride
57. cobalt(III) phosphide
58. iron(III) chloride
59. copper(II) sulfide
60. lead(II) bromide
61. tin(IV) iodide
62. mercury(II) fluoride
63. tin(IV) oxide
64. manganese(III) chloride
65. chromium(II) nitride
66. gold(III) oxide
67. cobalt(II) phosphide
68. tin(II) sulfide
69. mercury(I) sulfide
70. gold(III) bromide
71. manganese(II) oxide
72. chromium(II) chloride
73. lead(IV) nitride
74. cobalt(III) oxide
75. copper(II) iodide
76. tin(IV) fluoride
77. iron(II) phosphide
Section 10.5 The Formula for a Hydrate

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

- anhydrous
- crystal structure
- desiccants
- formula unit
- hydrate
- hydration
- water molecules
- water of hydration

A(n) (1) ______________________ is a compound that has a specific number of water molecules bound to its atoms. Molecules of water that become part of a hydrate are called waters of (2) ____________________. In the formula for a hydrate, the number of (3) ______________________ associated with each (4) ______________________ of the compound is written following a dot.

The substance remaining after a hydrate has been heated and its waters of hydration released is called (5) ______________________. The ratio of the number of moles of (6) ______________________ to one mole of the anhydrous compound indicates the coefficient of H₂O that follows the dot in the formula of the hydrate. Because the anhydrous form of the hydrate can absorb water into its (7) ______________________, hydrates are used as (8) ______________________, which are drying agents.

Complete the table of hydrates.

<table>
<thead>
<tr>
<th>Chemical Formula</th>
<th>Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>CdSO₄</td>
<td>Cadmium sulfate, anhydrous</td>
</tr>
<tr>
<td>CdSO₄·H₂O</td>
<td>9. __________________________</td>
</tr>
<tr>
<td><strong>10. ______________</strong></td>
<td>Ammonium sulfate tetrahydrate</td>
</tr>
<tr>
<td>Mg(C₂H₃O₂)₂·4H₂O</td>
<td>11. __________________________</td>
</tr>
<tr>
<td><strong>12. NiCl₂·____H₂O</strong></td>
<td>13. __________________________ hexahydrate</td>
</tr>
<tr>
<td><strong>14. __________·3H₂O</strong></td>
<td>15. cupric nitrate ___________________</td>
</tr>
</tbody>
</table>
In the space at the left, write true if the statement is true; if the statement is false, change the italicized term to make it true.

___________________  1. The overall charge of a formula unit for a compound is never zero.
___________________  2. A sulfate ion contains fewer oxygen atoms than a sulfite ion does.
___________________  3. In naming ionic compounds, the cation is named first.
___________________  4. When a metal reacts with a nonmetal, the metal tends to gain electrons.
___________________  5. In naming a monatomic anion, the suffix -ide is used.
___________________  6. The prefix per- is used in naming the anion with the most oxygen atoms.
___________________  7. Benzene (C_6H_6) and acetylene (C_2H_2) have the same empirical formula but different molecular formulas.
___________________  8. The empirical formula of a compound can always be used to determine the compound’s molecular formula.

Reviewing Vocabulary

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

<table>
<thead>
<tr>
<th>Column A</th>
<th>Column B</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. For a monatomic ion, is equal to the charge</td>
<td>a. anion</td>
</tr>
<tr>
<td>2. A charged particle containing more than one atom</td>
<td>b. cation</td>
</tr>
<tr>
<td>3. A positively charged ion</td>
<td>c. chemical bond</td>
</tr>
<tr>
<td>4. A negatively charged ion</td>
<td>d. formula unit</td>
</tr>
<tr>
<td>5. The name for most ionic compounds other than oxides</td>
<td>e. ionic bond</td>
</tr>
<tr>
<td>6. A charged particle containing only one atom</td>
<td>f. monatomic ion</td>
</tr>
<tr>
<td>7. The electrostatic force that holds oppositely charged particles</td>
<td>g. oxidation</td>
</tr>
<tr>
<td>together</td>
<td>number</td>
</tr>
<tr>
<td>8. A polyatomic ion composed of an element bonded to at least one</td>
<td>h. oxyanion</td>
</tr>
<tr>
<td>oxygen atom</td>
<td>i. polyatomic ion</td>
</tr>
<tr>
<td>9. Shows the simplest ratio of ions in an ionic compound</td>
<td>j. salts</td>
</tr>
<tr>
<td>10. Compound that has a specific number of water molecules bound to its</td>
<td>k. empirical</td>
</tr>
<tr>
<td>atoms</td>
<td>formula</td>
</tr>
<tr>
<td>11. Formula of a compound with the smallest whole-number mole ratio of</td>
<td>l. molecular</td>
</tr>
<tr>
<td>the elements</td>
<td>formula</td>
</tr>
<tr>
<td>12. Specifies the actual number of atoms of each element in one</td>
<td>m. hydrate</td>
</tr>
<tr>
<td>molecule of a compound</td>
<td>n. molecular</td>
</tr>
</tbody>
</table>
Circle the letter of the word or phrase that best completes the statement or answers the question.

9. The anion that has the formula ClO\(^{-}\) is called the
   a. chloride ion.  
   b. chlorate ion.  
   c. hypochlorite ion.  
   d. perchlorate ion.

10. Where does a subscript that indicates the number of atoms appear, relative to a chemical symbol in a formula?
   a. to the upper left  
   b. to the lower left  
   c. to the upper right  
   d. to the lower right

11. What is the formula of calcium phosphate, which is made up of the ions Ca\(^{2+}\) and PO\(_4\)^{3-}?
   a. Ca\(_3\)PO\(_4\)  
   b. Ca\(_6\)PO\(_4\)  
   c. Ca\(_3\)(PO\(_4\))\(_2\)  
   d. Ca\(_2\)(PO\(_4\))\(_3\)

The diagram on the right represents a lithium atom (group 1 of the periodic table) and a fluorine atom (group 17). Use the diagram to answer the questions that follow.

1. What kind of compound is formed in the reaction? ________________________________

2. What are the formula and name of the product in this reaction? ______________________

Section 8.2 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.

_______________ 1. Binary molecular compounds are generally composed of a metal and a nonmetal.

_______________ 2. The second element in the formula of a binary compound is named using the suffix -ite.

_______________ 3. The prefix tetra- indicates three atoms.

_______________ 4. The prefix hexa- indicates six atoms.

_______________ 5. In naming the first element in a formula, the prefix mono- is not used.

_______________ 6. For binary acids, the hydrogen part of the compound is named using the prefix hydro-.

_______________ 7. An oxyacid contains only two elements.
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>9. CO</td>
<td>a. hydrobromic acid</td>
</tr>
<tr>
<td>10. CO₂</td>
<td>b. dinitrogen tetroxide</td>
</tr>
<tr>
<td>11. H₂CO₃</td>
<td>c. carbon monoxide</td>
</tr>
<tr>
<td>12. NH₃</td>
<td>d. nitrous acid</td>
</tr>
<tr>
<td>13. N₂O₄</td>
<td>e. ammonia</td>
</tr>
<tr>
<td>14. HNO₂</td>
<td>f. nitric acid</td>
</tr>
<tr>
<td>15. HNO₃</td>
<td>g. carbonic acid</td>
</tr>
<tr>
<td>16. HBr</td>
<td>h. bromic acid</td>
</tr>
<tr>
<td>17. HBrO₃</td>
<td>i. carbon dioxide</td>
</tr>
</tbody>
</table>

In the space at the left, write true if the statement is true; if the statement is false, change the italicized term to make it true.

18. In a chemical name, the prefix used to indicate the presence of two atoms of a given kind is bi-.

19. The prefix hydro- is used in naming binary acids.

20. The oxyacid suffix for an acid that contains an anion ending in -ate is -ic.

Write the correct formula for:

1) chlorine monoxide     8) carbon dioxide
2) oxygen difluoride     9) diphosphorous pentoxide
3) boron phosphide       10) phosphorous trichloride
4) dinitrogen monoxide    11) sulfur dioxide
5) nitrogen trifluoride  12) bromine pentafluoride
6) sulfur tetrachloride  13) disulfur dichloride
7) xenon trioxide        14) boron trifluoride
15) tetraarsenic decoxide
16) silicon tetrachloride
17) krypton difluoride
18) chlorine monoxide
19) silicon dioxide
20) boron trichloride
21) dinitrogen pentasulfide
22) carbon monoxide

Write the correct formula for:

1) As$_4$O$_{10}$
2) BrO$_3$
3) BN
4) N$_2$O$_3$
5) N$_3$
6) SF$_6$
7) XeF$_4$
8) PCl$_3$
9) CO
10) PCl$_5$
11) P$_2$O$_5$
12) S$_2$Cl$_2$
13) ICl$_2$
14) SO$_2$
15) P$_4$O$_{10}$
16) UF$_6$
17) OF$_2$
18) ClO$_2$
19) SiO$_2$
20) BF$_3$
21) N$_2$S$_5$
22) CO$_2$
23) SO$_3$
24) XeF$_6$
25) KrF$_2$
26) BrCl$_5$
27) SCl$_4$
28) PF$_3$
29) XeO$_3$
30) Si$_2$O$_4$
Name the following acids:

1) H$_3$PO$_4$
2) H$_2$CO$_3$
3) H$_2$SO$_4$
4) HIO$_3$
5) HF
6) HNO$_2$

Write the formula for these acids:

7) hydrobromic acid
8) hydrocyanic acid [this has a twist in it]
9) nitric acid
10) sulfurous acid
11) phosphorous acid
12) acetic acid