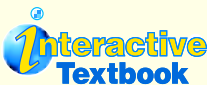


Study Tip

Identifying the Main Idea As you review each section, write down the key concepts that are found in bold print in each major division. Then add details and extensions until you have a complete outline of the topic.



If your class subscribes to the Interactive Textbook with ChemASAP, your students can go online to access an interactive version of the Student Edition and a self-test.

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Key Concepts**9.1 Naming Ions**

- When the metals in Groups 1A, 2A, and 3A lose electrons, they form cations with positive charges equal to their group number.
- The charge of any ion of a Group A nonmetal is determined by subtracting 8 from the group number.
- The charges of cations of many transition metal ions must be determined from the number of electrons lost. When a cation can have more than one ionic charge, a Roman numeral is used in the name to indicate the charge.
- The names of most polyatomic anions end in *-ite* or *-ate*.

9.2 Naming and Writing Formulas for Ionic Compounds

- The name of a binary ionic compound is the cation name followed by the anion name.
- To write the formula for a binary ionic compound, write the symbol for the cation and then the anion. Then balance the charges.
- To write formulas for compounds containing polyatomic ions, write the symbol for the metal ion followed by the formula for the polyatomic ion and balance the charges.
- To name a compound containing a polyatomic ion, state the cation first and then the anion.

9.3 Naming and Writing Formulas for Molecular Compounds

- Prefixes show how many atoms of each element are present in a molecule of a binary compound.
- To write the formula for a binary molecular compound, write the symbols for the elements and use the prefixes to determine the subscripts. Omit *mono-* for a single atom.

9.4 Naming and Writing Formulas for Acids and Bases

- An acid is a combination of a monatomic or polyatomic anion with sufficient hydrogen atoms to make the compound electrically neutral. Acids are named as shown in Table 9.5.
- A base is a combination of a cation with as many hydroxide ions as are needed to make the compound electrically neutral. Bases are named in the same way as other ionic compounds.

9.5 The Laws Governing Formulas and Names

- The ways that compounds form are summed up in two laws: the law of definite proportions and the law of multiple proportions.
- To name a compound or write its formula, follow the flowcharts in Figures 9.20 and 9.22 to the correct name or formula.

Vocabulary

- acid (p. 271)
- base (p. 273)
- binary compound (p. 261)
- law of definite proportions (p. 274)
- law of multiple proportions (p. 275)
- monatomic ion (p. 253)
- polyatomic ion (p. 257)

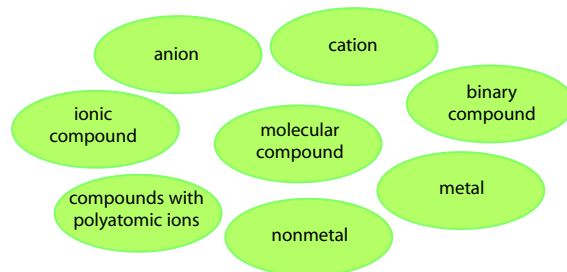
Organizing Information

Use these terms to construct a concept map that organizes the major ideas of this chapter.



Concept Map 9 Solve the Concept Map with the help of an interactive guided tutorial.

with **ChemASAP**

**Chapter Resources****Print**

- **Core Teaching Resources**, Chapter 9, Practice Problems, Vocabulary Review, Quiz, Chapter Test A, Chapter Test B

Technology

- **Computer Test Bank**, Chapter 9 Test
- **Interactive Textbook with ChemASAP**, Chapter 9
- **Virtual Chem Labs**, Lab 10

Reviewing Content

9.1 Naming Ions

42. Give the expected charges on the ions of elements of these groups of the periodic table.
 a. Group 6A b. Group 1A
 c. Group 7A d. Group 3A
43. Give the expected charge of the cations of these elements.
 a. Sr b. Ca c. Al d. Cs
44. Name the following ions. Use Table 9.2 if necessary.
 a. Ba^{2+} b. I^- c. Ag^+ d. Hg^{2+}
45. Write the names and formulas of the two polyatomic anions in Table 9.3 with names that do not end in *-ite* or *-ate*.
46. Name the following ions.
 a. OH^- b. Pb^{4+} c. SO_4^{2-} d. O^{2-}

9.2 Naming and Writing Formulas for Ionic Compounds

47. What is the net ionic charge of every ionic compound? Explain.
48. How are formulas written for binary ionic compounds, given their names? How is the reverse done?
49. How do you determine the charge of a transition metal cation from the formula of an ionic compound containing that cation?
50. How are formulas written for ionic compounds with polyatomic ions, given their names? How is the reverse done?
51. Identify these binary ionic compounds.
 a. KBr b. sodium nitride
 c. K_3PO_4 d. calcium sulfate
52. When must parentheses be used in a formula?
53. Complete the table by writing correct formulas for the compounds formed by combining positive and negative ions. Then name each compound.

| | NO_3^- | CO_3^{2-} | CN^- | PO_4^{3-} |
|------------------|-----------------|--------------------|---------------|--------------------|
| NH_4^+ | a. _____ | b. _____ | c. _____ | d. _____ |
| Sn^{4+} | e. _____ | f. _____ | g. _____ | h. _____ |
| Fe^{3+} | i. _____ | j. _____ | k. _____ | l. _____ |
| Mg^{2+} | m. _____ | n. _____ | o. _____ | p. _____ |

9.3 Naming and Writing Formulas for Molecular Compounds

54. What are the components of a binary molecular compound?
55. What prefix indicates each of the following numbers of atoms in the formula of a molecular compound?
 a. 3 b. 1 c. 2 d. 6 e. 5 f. 4
56. How are formulas for binary molecular compounds written, given their names? How is the reverse done?
57. Write the formula or name for these compounds.
 a. boron trichloride b. N_2O_5
 c. dinitrogen tetrahydride d. CCl_4

9.4 Naming and Writing Formulas for Acids and Bases

58. Give the name or the formula for these acids.
 a. HCl b. sulfuric acid
 c. HNO_3 d. acetic acid
59. Is every molecular compound that contains hydrogen an acid? Explain.
60. Write formulas for these compounds.
 a. nitrous acid
 b. aluminum hydroxide
 c. hydroselenic acid
 d. strontium hydroxide
 e. phosphoric acid
61. Write names or formulas for these compounds.
 a. iron(II) hydroxide b. $\text{Pb}(\text{OH})_2$
 c. copper(II) hydroxide d. $\text{Co}(\text{OH})_2$

9.5 The Laws Governing Formulas and Names

62. What is the law of definite proportions?
63. Describe the law of multiple proportions.
64. Nitrous oxide is known as laughing gas and is used as an anesthetic in dentistry. The mass ratio of nitrogen to oxygen is 7:4. A 68-g sample of a compound composed of nitrogen and oxygen contains 42 g of nitrogen. Is the sample nitrous oxide? Explain.

Assessment 281

Reviewing Content

42. a. 2- b. 1+ c. 1- d. 3+
43. a. 2+ b. 2+ c. 3+ d. 1+
44. a. barium ion b. iodide ion
 c. silver ion d. mercury(II) ion
45. cyanide, CN^- and hydroxide, OH^-
46. a. hydroxide ion b. lead(IV) ion
 c. sulfate ion d. oxide ion
47. zero; A compound is electrically neutral.
48. The symbols for the cation and anion are written and the charges are balanced with subscripts. The name of the cation is followed by the name of the anion.
49. Determine the charge of the anion then work the formula backwards to find the charge of the transition metal cation needed to give a net charge of zero for the formula unit.
50. The symbols for the cation and anion are written and the charges are balanced with subscripts. Parentheses are used around the polyatomic ion if a subscript is needed. The name of the cation is followed by the name of the anion.
51. a and b
52. When more than a single polyatomic ion is needed to balance the formula
53. NH_4NO_3 , ammonium nitrate; $(\text{NH}_4)_2\text{CO}_3$, ammonium carbonate; NH_4CN , ammonium cyanide; $(\text{NH}_4)_3\text{PO}_4$, ammonium phosphate; $\text{Sn}(\text{NO}_3)_4$, tin(IV) nitrate; $\text{Sn}(\text{CO}_3)_2$, tin(IV) carbonate; $\text{Sn}(\text{CN})_4$, tin(IV) cyanide; $\text{Sn}_3(\text{PO}_4)_4$, tin(IV) phosphate; $\text{Fe}(\text{NO}_3)_3$, iron(III) nitrate; $\text{Fe}_2(\text{CO}_3)_3$, iron(III) carbonate; $\text{Fe}(\text{CN})_3$, iron(III) cyanide; FePO_4 , iron(III) phosphate; $\text{Mg}(\text{NO}_3)_2$, magnesium nitrate; MgCO_3 , magnesium carbonate; $\text{Mg}(\text{CN})_2$, magnesium cyanide; $\text{Mg}_3(\text{PO}_4)_2$, magnesium phosphate
54. two nonmetals
55. a. tri- b. mono- c. di- d. hexa-
 e. penta- f. tetra-
56. For formulas, write the correct symbols for each element with a subscript corresponding to the prefix before each element in the

name. For naming, name each element in the order given. Use the subscript to determine the prefixes before each element in the name. The name ends in *-ide*.

57. a. BCl_3 b. dinitrogen pentoxide
 c. N_2H_4 d. carbon tetrachloride
58. a. hydrochloric acid b. H_2SO_4 c. nitric acid d. $\text{HC}_2\text{H}_3\text{O}_2$
59. No, to be an acid the compound must produce H^+ ions in water solution.
60. a. HNO_2 b. $\text{Al}(\text{OH})_3$ c. H_2Se
 d. $\text{Sr}(\text{OH})_2$ e. H_3PO_4

61. a. $\text{Fe}(\text{OH})_2$ b. lead(II) hydroxide
 c. $\text{Cu}(\text{OH})_2$ d. cobalt(II) hydroxide
62. In all samples of the same chemical compound, the masses of the elements are always in the same proportions.
63. Whenever two elements form more than one compound, the different masses of one element that combine with the same mass of the other element are in a ratio of small whole numbers.
64. no; The ratio of nitrogen to oxygen is 42:26, which is not a 7:4 ratio.

Understanding Concepts

65. a. KMnO_4 b. $\text{Ca}(\text{HCO}_3)_2$
c. Cl_2O_7 d. Si_3N_4 e. NaH_2PO_4
f. PBr_5 g. CCl_4
66. a. MgS b. Na_3PO_3 c. $\text{Ba}(\text{OH})_2$
d. $\text{Cu}(\text{NO}_2)_2$ e. K_2SO_3 f. CaCO_3
g. NaBr h. $\text{Fe}_2(\text{SO}_4)_3$
67. a. sodium chlorate
b. mercury(I) bromide
c. potassium chromate
d. perchloric acid
e. tin(IV) oxide
f. iron(III) acetate
g. potassium hydrogen sulfate
h. calcium hydroxide
i. barium sulfide
68. a. lithium perchlorate
b. dichlorine monoxide
c. mercury(II) fluoride
d. calcium oxide
e. barium phosphate
f. iodine
g. strontium sulfate
h. copper(I) acetate
i. silicon tetrachloride
69. a. magnesium permanganate
b. beryllium nitrate
c. potassium carbonate
d. dinitrogen tetrahydride
e. lithium hydroxide
f. barium fluoride
g. phosphorus triiodide
h. zinc oxide
i. phosphorous acid
70. a. CaBr_2 b. AgCl c. Al_4C_3
d. NO_2 e. $\text{Sn}(\text{CN})_4$ f. LiH
g. $\text{Sr}(\text{C}_2\text{H}_3\text{O}_2)_2$ h. Na_2SiO_3
71. binary molecular compound
72. lithium carbonate, Li_2CO_3
73. SnCl_4
74. a. 2:1 b. PbI_2 , lead(II) iodide and PbI_4 , lead(IV) iodide
75. a. 9.85% b. nitrogen, oxygen, and chlorine; 54.9 billions of kg
c. 34.7% d. H_2SO_4 , N_2 , O_2 , NH_3 , CaO , H_3PO_4 , NaOH , Cl_2 , Na_2CO_3 , HNO_3

Understanding Concepts

65. Write formulas for these compounds.
a. potassium permanganate
b. calcium hydrogen carbonate
c. dichlorine heptoxide
d. trisilicon tetranitride
e. sodium dihydrogen phosphate
f. phosphorus pentabromide
g. carbon tetrachloride
66. Write formulas for these compounds.
a. magnesium sulfide b. sodium phosphite
c. barium hydroxide d. copper(II) nitrite
e. potassium sulfite f. calcium carbonate
g. sodium bromide h. ferric sulfate
67. Name these compounds.
a. NaClO_3 b. Hg_2Br_2 c. K_2CrO_4
d. HClO_4 e. SnO_2 f. $\text{Fe}(\text{C}_2\text{H}_3\text{O}_2)_3$
g. KHSO_4 h. $\text{Ca}(\text{OH})_2$ i. BaS
68. Name each substance.
a. LiClO_4 b. Cl_2O c. HgF_2
d. CaO e. $\text{Ba}_3(\text{PO}_4)_2$ f. I_2
g. SrSO_4 h. $\text{CuC}_2\text{H}_3\text{O}_2$ i. SiCl_4
69. Name each compound.
a. $\text{Mg}(\text{MnO}_4)_2$ b. $\text{Be}(\text{NO}_3)_2$ c. K_2CO_3
d. N_2H_4 e. LiOH f. BaF_2
g. PI_3 h. ZnO i. H_3PO_3
70. Write formulas for these compounds.
a. calcium bromide b. silver chloride
c. aluminum carbide d. nitrogen dioxide
e. tin(IV) cyanide f. lithium hydride
g. strontium acetate h. sodium silicate
71. A compound of general formula Q_xR_y contains no hydrogen, and Q and R are both elements. Neither Q nor R is a metal. Is Q_xR_y an acid, a binary ionic compound, an ionic compound containing a polyatomic anion, or a binary molecular compound?
72. A compound of general formula Q_xR_y contains no hydrogen, Q is the alkali metal of lowest atomic mass, and R contains the elements oxygen and carbon in a 3:1 ratio. Write the name and the formula of the compound.
73. Two compounds contain only tin and chlorine. The ratio of the masses of chlorine combined with 1.00 g of tin in the two compounds is 2:1. If one compound has the formula SnCl_2 , what is the formula for the other compound?
74. Analysis of two compounds shows that they contain only lead and iodine in the following amounts:
Compound I: 22.48 g Pb and 27.52 g I
Compound II: 5.80 g Pb and 14.20 g I
a. Determine the ratio of lead contained in the two compounds for every 1 g of iodine.
b. Use your ratio and your knowledge of ionic charges to write the formulas and the names of the two compounds.
75. The United States produces thousands of different kinds of inorganic chemicals. Inorganic chemicals, for the most part, do not contain carbon. The table shows the amounts (in billions of kg) of the top ten inorganic chemicals produced in a recent year.

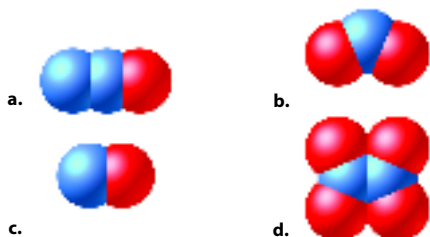


| Chemical | Amount produced (billions of kg) |
|------------------|----------------------------------|
| Sulfuric acid | 39.4 |
| Nitrogen | 26.9 |
| Oxygen | 17.7 |
| Ammonia | 16.5 |
| Lime | 16.3 |
| Phosphoric acid | 11.2 |
| Sodium hydroxide | 11.0 |
| Chlorine | 10.3 |
| Sodium carbonate | 9.3 |
| Nitric acid | 6.8 |

- a. What percentage of the total production of the top ten is lime (calcium oxide)?
- b. Three diatomic gases are on the list. What are their names? What was the combined production of these gases in billions of kilograms?
- c. What percentage of the total production of the top ten is the three acids?
- d. Write formulas for the top ten inorganic chemicals.

Critical Thinking

76. Compare and contrast the information conveyed by a molecular formula with that given by a formula unit of a compound.
77. Where on the periodic table will you find the two elements in a binary molecular compound?
78. Why is it important for chemists to have a system of writing chemical names and formulas?
79. Criticize this statement: "The ionic charge of any metal can be determined from the position of the element in the periodic table."
80. Summarize the rules that chemists use for naming ionic compounds. What is the purpose for each rule?
81. Nitrogen and oxygen form a number of stable chemical compounds. In the models below, nitrogen is blue; oxygen is red. Write the chemical formula and name of each.



82. Examine the following names for ionic compounds. Show, by writing all possible formulas for the compounds, that the names are incomplete. Then, write each complete name.
- a. copper sulfide b. iron sulfate c. lead oxide
83. Explain what is wrong with each formula.
- a. CsCl_2 b. ZnO_2 c. LiNe d. Ba_2S_2
84. Separate the following compounds into five categories: binary ionic compounds, binary molecular compounds, compounds with polyatomic ions, acids, and bases. Some compounds may fit in more than one category.
- a. CBr_4 b. HCN c. NH_4OH
 d. MgS_2 e. H_2SiO_3 f. ClBr
 g. Al_2O_3 h. Na_2HPO_4 i. KMnO_4

Concept Challenge

85. *CRC Handbook of Chemistry and Physics* is a reference book that contains a wealth of information about elements and compounds. Two sections of this book you might use are "Physical Constants of Inorganic Compounds" and "Physical Constants of Organic Compounds." To familiarize yourself with this work, make a table with these headings: Name, Formula, Crystalline Form or Color, Density, Melting Point ($^{\circ}\text{C}$), Boiling Point ($^{\circ}\text{C}$), and Solubility in Water. Enter these substances in the body of the table: ammonium chloride, barium, barium sulfate, bromine, calcium carbonate, chlorine, copper(II) sulfate pentahydrate, iodine, iron(II) sulfate pentahydrate, mercury, potassium carbonate, and sulfur. Use the handbook to complete the table.
86. Use the table you prepared for Problem 85 to answer the following questions.
- a. You have two unlabeled bottles, each containing a white powder. One of the substances is calcium carbonate, and the other is potassium carbonate. Describe a simple physical test you could carry out to distinguish between these two compounds.
- b. How would you distinguish between samples of copper(II) sulfate pentahydrate and iron(II) sulfate pentahydrate?
- c. A bottle contains a mixture of ammonium chloride and barium sulfate. How could you separate these two compounds?
- d. List the elements in the table in order of increasing density. Identify the elements as metals or nonmetals.
- e. List the compounds in the table in order of decreasing density.
- f. Calculate the mass of 47.0 cm^3 of mercury.
- g. Calculate the volume of 16.6 g of sulfur.
- h. How would you distinguish among the Group 7A elements (halogens) listed in the table?

Assessment 283

Concept Challenge

85. See *Solutions Manual* for answers.
86. a. Potassium carbonate has greater water solubility than CaCO_3 .
 b. The copper compound is blue; the iron compound is white.
 c. Add water to dissolve the NH_4Cl ; then filter out the insoluble BaSO_4 .
 d. chlorine (nonmetal), sulfur (nonmetal), bromine (nonmetal), barium (metal), iodine (nonmetal), mercury (metal)
 e. barium sulfate, calcium carbonate, potassium carbonate, copper(II) sulfate pentahydrate, iron(II) sulfate pentahydrate, ammonium chloride
 f. 639 g g. 7.54 cm^3 h. color, density, melting point, or boiling point

Critical Thinking

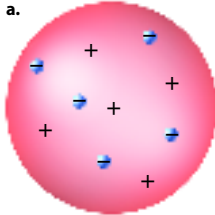
76. A molecular formula shows the number of each kind of atom in a molecule of the compound. The formula unit shows the lowest whole-number ratio of ions in a compound.
77. on the right side
78. Common names vary in different languages and are difficult to remember and convert to formulas.
79. The statement is true for the representative metals but not for the transition metals, which often have multiple charges.
80. Possible answers include: cations always come before anions; when a cation has more than one ionic charge, the charge is indicated by a Roman numeral; monatomic anions use an *-ide* ending. Each rule has a specific purpose; for example, an ionic charge is necessary information because it determines how many ions are in the formula unit of the compound.
81. a. N_2O , dinitrogen monoxide
 b. NO_2 , nitrogen dioxide
 c. NO , nitrogen monoxide
 d. N_2O_4 , dinitrogen tetroxide
82. a. Cu_2S , copper(I) sulfide and CuS , copper(II) sulfide
 b. FeSO_4 , iron(II) sulfate and $\text{Fe}_2(\text{SO}_4)_3$, iron(III) sulfate
 c. PbO , lead(II) oxide and PbO_2 , lead(IV) oxide
83. a. The charges do not balance, CsCl .
 b. The charges do not balance, ZnO .
 c. Neon does not form compounds.
 d. The subscripts are not the lowest whole-number ratio, BaS .
84. binary ionic compounds: *d* and *g*;
 binary molecular compounds: *a* and *f*;
 compounds with polyatomic ions: *b*, *c*, *e*, *h*, and *i*;
 acids: *b* and *e*;
 base: *c*

Cumulative Review

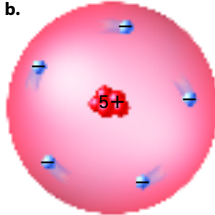
Cumulative Review

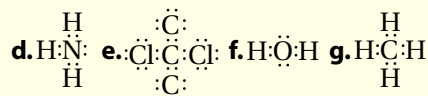
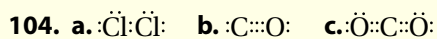
87. Answers may include: color (physical), solid (physical), magnetic (physical), conducts electricity (physical), burns (chemical).
88. a. 4 b. 2 c. 2 d. 4 e. 2 f. 1
89. 5.2 cm
90. a. $7.75 \times 10^5 \mu\text{L}$ b. 208 K
c. 0.832 cg
91. 0.538 g/cm^3
92. a. b b. protons c. electrons
d. neutrons
93. Both are in the nucleus and have a mass of about 1 amu. A proton is positively charged; a neutron has no charge.
94. a. neon b. carbon c. boron
d. helium
95. a. 1 b. 6 c. 5 d. 2 e. 7 f. 8
96. The metalloids border a line separating the metals from the nonmetals. Their properties are intermediate between those of metals and nonmetals.
97. a. cesium, potassium, sodium, lithium b. lithium, boron, carbon, fluorine, neon
98. a. Li b. I c. S d. O e. N f. F
99. When metallic elements of Group 1A and 2A form ions, they lose all their outer shell electrons. This increases the attraction by the nucleus for the fewer remaining electrons and results in ions that are smaller than the neutral atoms. The electron that a Group 7A element gains in forming an ion enters the outer shell, resulting in a decrease in the effective nuclear attraction of the increased number of electrons. The anion is larger than the neutral atom.
100. $1s^2 2s^2 2p^6$; Possible answers are N^{3-} , O^{2-} , F^- , Na^+ , Mg^{2+} , and Al^{3+} .
101. a. 12 p^+ and 10 e^- b. 35 p^+ and 36 e^- c. 38 p^+ and 36 e^-
d. 16 p^+ and 18 e^-
102. b and c; Molecular compounds formed by two nonmetals have covalent bonds.
103. b, d, and f

87. List five properties of the chair you are sitting on. Classify each as physical or chemical. (Chapter 2)
88. How many significant figures are in the following measurements? (Chapter 3)
a. 15.05 g b. 0.31 cm c. 890 mL
d. 300.0 cm^3 e. $3.0 \times 10^5 \text{ kg}$ f. 0.001 mm
89. Determine the sum of the following measurements to the correct number of significant figures. (Chapter 3)
 $1.55 \text{ cm} + 0.235 \text{ cm} + 3.4 \text{ cm}$
90. Make the following conversions. (Chapter 3)
a. 775 mL to microliters (μL)
b. -65°C to K
c. 8.32 mg Ag to centigrams of silver (cg Ag)
91. A student finds that 6.62 g of a substance occupies a volume of 12.3 cm^3 . What is the density of the substance? (Chapter 3)
92. The diagrams show two early models of the atom. (Chapter 4)
a. Which is the more accurate?
b. What do the positively charged particles represent?
c. What do the negatively charged particles represent?
d. What major subatomic particle is missing in both of these models?
- a.



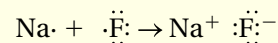
b.


93. Compare and contrast neutrons and protons with respect to their charge, mass, and position in the atom. (Chapter 4)
94. What elements have these electron configurations? (Chapter 5)
a. $1s^2 2s^2 2p^6$ b. $1s^2 2s^2 2p^2$
c. $1s^2 2s^2 2p^1$ d. $1s^2$
95. How many valence electrons do atoms of the following elements have? (Chapter 5)
a. lithium b. sulfur c. phosphorus
d. calcium e. bromine f. neon
96. Where are the metalloids found on the periodic table? Compare the properties of the metalloids to metals and nonmetals. (Chapter 6)
97. Arrange the following groups of elements in order of increasing ionization energy. (Chapter 6)
a. potassium, cesium, lithium, sodium
b. fluorine, boron, lithium, carbon, neon
98. From the positions of the elements in the periodic table, choose the element in each pair with the higher electronegativity. (Chapter 6)
a. Cs and Li b. Sr and I c. S and Mg
d. O and Se e. Te and N f. C and F
99. The ions of the elements of Groups 1A and 2A have smaller radii than their neutral atoms, whereas the ions of Group 7A have larger radii than their neutral atoms. Explain. (Chapter 6)
100. Write the electron configuration for the element neon, then identify three ions that have the same electron configuration. (Chapter 7)
101. How many protons and electrons are in each ion? (Chapter 7)
a. magnesium ion b. bromide ion
c. strontium ion d. sulfide ion
102. Which of these compounds would you expect to contain covalent bonds? Why? (Chapter 8)
a. KCl b. PBr_3 c. ClBr d. NaI
103. Which of these substances would you expect to be polar? (Chapter 8)
a. Cl_2 b. CO c. CO_2 d. NH_3
e. CCl_4 f. H_2O g. CH_4
104. Draw electron dot structures for the substances in Question 103. (Chapter 8)
105. Explain what a hydrogen bond is and under what conditions a hydrogen bond will form. (Chapter 8)
106. Explain the difference between an ionic bond and a covalent bond. Use electron dot structures to illustrate your explanation. (Chapter 8)

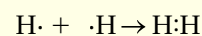


105. A hydrogen bond is an intermolecular force between a hydrogen atom covalently bonded to a very electronegative atom and an unshared pair of electrons on another electronegative atom.

106. ionic bond: electrons are transferred



covalent bond: electrons are shared



Standardized Test Prep

Test-Taking Tip

Eliminate Wrong Answers If you don't know which response is correct, start by eliminating those you know are wrong. If you can rule out some choices, you'll have fewer left to consider and you'll increase your chances of choosing the correct answer.

Select the choice that best answers each question or completes each statement.

- Identify the pair in which the formula does not match the name.
 - sulfite, SO_3^{2-}
 - dichromate, $\text{Cr}_2\text{O}_7^{2-}$
 - hydroxide, OH^-
 - nitrite, NO_3^-
 - perchlorate, ClO_4^-
- Which of these compounds are ionic?
 - CaSO_4
 - N_2O_4
 - NH_4NO_3
 - CaS
 - I and II only
 - II and III only
 - III and IV only
 - I, III, and IV only
 - I, II, III, and IV
- What is the name of AlCl_3 ?
 - aluminum trichloride
 - aluminum(III) chloride
 - aluminum chlorite
 - aluminum chlorate
 - aluminum chloride
- The Roman numeral in manganese(IV) sulfide indicates the
 - group number on the periodic table.
 - positive charge on the manganese ion.
 - number of manganese ions in the formula.
 - number of sulfide ions needed in the formula.
- Which of these statements does not describe every binary molecular compound?
 - Molecules of binary molecular compounds are composed of two atoms.
 - The names of binary molecular compounds contain prefixes.
 - The names of binary molecular compounds end in the suffix *-ide*.
 - Binary molecular compounds are composed of two nonmetals.
- What is the formula of ammonium carbonate?
 - NH_4CO_3
 - NH_4C
 - $(\text{NH}_4)_2\text{CO}_3$
 - NH_3CO_4
 - $(\text{NH}_3)_2\text{CO}_4$
 - NH_4CO_2

The lettered choices below refer to Questions 7–11. A lettered choice may be used once, more than once, or not at all.

(A) QR (B) QR_2 (C) Q_2R (D) Q_2R_3

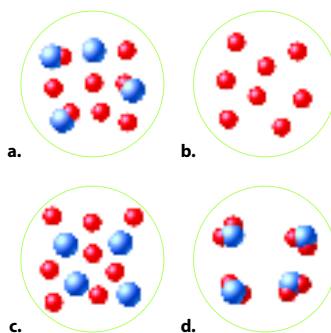
Which formula shows the correct ratio of ions in the compound formed by each pair of elements?

| Element Q | Element R |
|---------------|-----------|
| 7. aluminum | sulfur |
| 8. potassium | oxygen |
| 9. lithium | chlorine |
| 10. strontium | bromine |
| 11. sodium | sulfur |

Use the data table to answer Questions 12–13. The table gives formulas for some of the ionic compounds formed when cations (M, N, P) combine with anions (A, B, C, D).

| Cation | Anion | | | |
|--------|---------------|----------------------|-------------|--------------------------|
| | A | B | C | D |
| M | MA_2 | (1) | (2) | MD |
| N | (3) | N_2B | (4) | (5) |
| P | PA_3 | (6) | PC | $\text{P}_2(\text{D})_3$ |

- Use the given formulas to determine the ionic charge of each cation and anion.
 - Write formulas for compounds (1) through (6).
- Use the atomic windows to answer Questions 14–15.
- Identify the contents of each atomic window as a substance or a mixture.
 - Classify the contents as elements only, compounds only, or elements and compounds.



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- d
- d
- e
- b
- a
- c
- D
- C
- A
- B
- C
- cations: M^{2+} , N^+ , P^{3+} ;
anions: A^- , B^{2-} , C^{3-} , D^{2-}
- (1) MB, (2) M_3C_2 , (3) NA, (4) N_3C , (5) N_2D , (6) P_2B_3
- b** and **d** are substances; **a** and **c** are mixtures.
- a** contains elements and compounds, **b** and **c** contain only elements, and **d** contains only a compound.