9 CHEMICAL NAME AND FORMULAS

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;

$(NH_4)_2CO_3$, ammonium carbonate;

NH_4CN, ammonium cyanide;

$(NH_4)_3PO_4$, ammonium phosphate;

$Sn(NO_3)_4$, tin(IV) nitrate; $Sn(CO_3)_2$, tin(IV) carbonate; $Sn(CN)_4$, tin(IV) cyanide;

$Sn_3(PO_4)_4$, tin(IV) phosphate; $Fe(NO_3)_3$, iron(III) nitrate; $Fe_2(CO_3)_3$, iron(III) carbonate; $Fe(CN)_3$, iron(III) cyanide; $FePO_4$, iron(III) phosphate; $Mg(NO_3)_2$, magnesium nitrate; $MgCO_3$, magnesium carbonate; $Mg(CN)_2$, magnesium cyanide; $Mg_3(PO_4)_2$, 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.** $HC_2H_3O_2$

59. No, to be an acid the compound must produce H^+ ions in water solution.

60. **a.** HNO_2 **b.** $Al(OH)_3$
c. H_2Se **d.** $Sr(OH)_2$
e. H_3PO_4

61. **a.** $Fe(OH)_2$ **b.** lead(II) hydroxide
c. $Cu(OH)_2$ **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 the 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.** $Ca(HCO_3)_2$
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. $Ba(OH)_2$ **d.** $Cu(NO_2)_2$
e. K_2SO_3 **f.** $CaCO_3$
g. NaBr **h.** $Fe_2(SO_4)_3$

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. $Sn(CN)_4$ **f.** LiH
g. $Sr(C_2H_3O_2)_2$ **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

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 $Fe_2(SO_4)_3$, 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*

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

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.** 7.75×105 µL **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 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^-

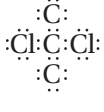
102. b and c; Molecular compounds formed by two nonmetals have covalent bonds.

103. b., d., and f.

104. **a.** :Cl:Cl: **b.** :C:::O:

c. :O::C::O: **d.**

e.



f. H:Ö:H

g.

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

106. ionic bond: electrons are transferred

$Na\cdot + \cdot\ddot{F}: \rightarrow Na\cdot^{+}\ :\ddot{F}:^{-}$

covalent bond: electrons are shared

$H\cdot + \cdot H \rightarrow H:H$