10 CHEMICAL QUANTITIES

Reviewing Content

47. Number, mass, or volume; examples will vary.

48. **a.** molecule
b. formula unit
c. molecule
d. atom

49. **a.** 3
b. 2
c. 9
d. 10

50. All contain 6.02×10^{23} molecules

51. mol C_2H_6

52. **a.** 1.81×10^{24} atoms Sn
b. 2.41×10^{23} formula units KCl
c. 4.52×10^{24} molecules SO_2
d. 2.89×10^{21} formula units NaI

53. **a.** 98.0 g/mol
b. 76.0 g/mol
c. 100.1 g/mol
d. 132.1 g/mol
e. 89.0 g/mol
f. 159.8 g/mol

54. **a.** 60.1 g/mol
b. 28.0 g/mol
c. 106.8 g/mol
d. 63.5 g/mol

55. Answers will vary but should include
1. Determine the moles of each atom from the formula.
2. Look up the atomic mass of each element.
3. Multiply the number of moles of each atom times its molar mass.
4. Sum these products.

56. 71.0 g/mol Cl_2

57. Answers will vary.

58. **a.** 0.258 mol SiO_2
b. 4.80×10^{-4} mol AgCl
c. 1.12 mol Cl_2
d. 0.106 mol KOH
e. 5.93 mol $Ca(C_2H_3O_2)_2$
f. 2.00×10^{-2} mol Ca

59. **a.** 108 g C_5H_{12}
b. 547 g F_2
c. 71.8 g $Ca(CN)_2$
d. 0238 g H_2O_2
e. 224 g NaOH
f. 1.88 g Ni

60. **a.** 1.7×10^2 L Ar
b. 9.9 L C_2H_6

61. **a.** 1.96 g/L
b. 0.902 g/L
c. 2.05 g/L

62. **a.** 234 L SO_3
b. 2.99×10^{-22} g $C_9H_8O_4$
c. 3.13×10^{25} atoms

63. **a.** 5.9% H, 94.1% S
b. 22.6% N, 6.5% H, 19.4% C, 51.6% O
c. 41.7% Mg, 54.9% O, 3.4% H
d. 42.1% Na, 18.9% P, 39.0% O

64. **a.** 3.33 g S
b. 5.65 g N
c. 40.6 g Mg
d. 152 g P

65. **d.** 77.7% Fe in FeO

66. H_2O_2

67. **a.** molecular
b. molecular
c. empirical

68. **a.** $C_3H_6O_3$
b. Hg_2Cl_2

69. **a.** H_2O_2
b. $C_6H_6O_4$

Understanding Concepts

70. You can measure the mass of 22.4 L of the compound at STP; this is the molar volume of the gas. The mass of the molar volume is the molar mass.

71. **a.** A, $C_2H_4O_2$; D, $C_5H_{10}O_5$; E, $C_6H_{12}O_6$
b. slope = 2.5/1, which is the ratio of the molar mass of the empirical formula to the mass of carbon in the empirical formula: 30/12 = 2.5/1.
c. mass of carbon = 36(x);
molar mass = 90(y)
mass of carbon = 48(x);
molar mass = 120(y)

72. **a.** A molecule is composed of two or more atoms.
b. There are 6.02×10^{23} molecules in 1 mol of a molecular substance.
c. A mole of CO_2 has 3 times Avogadro's number of atoms.

73. **b.** 0.842 mol C_2H_4

74. 24.5 g

75. **a.** CO
b. $C_2O_2NH_5$
c. Cl_2OC

76. **a.** 27 amu
b. aluminum

77. 3.01×10^{13} km

78. **a.** $CuBr_2$
b. CH_3

79. $C_3H_6O_3$

80. 3.34×10^{25} molecules H_2O

81. 2.73×10^{20} F atoms

82. 0.982 g He

Critical Thinking

83. C_2H_6O

84. A molecular formula is a whole number multiple of its empirical formula.

85. Sulfur atoms have a greater atomic mass. The most abundant sulfur atom has 16 protons, 16 electrons, and 16 neutrons; carbon is composed of 6 protons, 6 electrons, and 6 neutrons. Therefore, 6.02×10^{23} sulfur atoms will have a greater mass than the same number of carbon atoms.

86. Gas molecules are separated by so much empty space their own volumes are insignificant in determining how much space a certain quantity of gas molecules takes up.

87. **a.** $C_9H_{11}O_2N$ **b.** $C_9H_{11}O_2N$

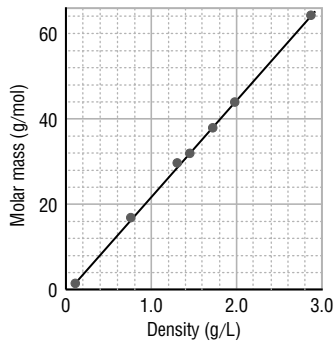
Concept Challenge

88. $C_3H_5O_9N_3$

89. 21.9 cm^3

90. 3.54×10^{23} O_2 molecules

91. **a.**



b. 22.4 L/mol
c. 24.6 g/mol
d. 2.5 g/L

92. 2.4×10^9 kg Au; 2×10^{11} L H_2O; not feasible

93. 6.025×10^{23} formula units/mol

Cumulative Review

94. chemical change: wax burning
physical change: wax melting
physical change: wax vaporizing

95. **a.** physical change **b.** chemical change
c. chemical change **d.** physical change
e. chemical change **f.** physical change

96. **a.** false **b.** true
c. true **d.** false

97. A molecule is composed of two or more atoms.

98. No; the student has ignored the units. The density of sugar is 1.59 g/mL; the density of carbon dioxide is much less, 1.83 g/L.

99. It will float. Its density, 0.848 g/mL, is less than the density of water.

100. **a.** 4.72×10^3 mg
b. 97 km/h
c. 4.4×10^{-2} dm

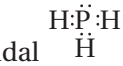
101. **a.** 40, 40, 50 **b.** 46, 46, 62
c. 35, 35, 46 **d.** 51, 51, 72

102. **a.** $1s^2 2s^2 2p^5$ **b.** $1s^2 2s^1$
c. [Kr] $5s^1$

103. Magnesium and barium are both in group 2A and have 2 valence electrons.

104. Cr, Cd, Cu, and Co

105. For group A elements, the group number equals the number of valence electrons.

106. **a.** pyramidal  **b.** linear 

c. linear  **d.** tetrahedral

107. For single bond a single line connects the atoms (X—X). Atoms are connected by two lines in a double bond (X=X), and three lines in a triple bond (X≡X).

108. Answers will vary.
- **a.** carbon monoxide (CO)
- **b.** ozone (O_3)
- **c.** nitrogen dioxide (NO_2)

109. Calculate the electronegativity difference between two atoms. If the difference is small (0.0 —0.4) the bond is nonpolar covalent. If the difference ≥ 2.0, the bond is most likely ionic. For values between 0.4 and 2.0, the bond is polar covalent.

110. **d.** CaS_2 **f.** Ba(OH)

111.
- **a.** iron(III) hydroxide
- **b.** ammonium iodide
- **c.** sodium carbonate
- **d.** carbon tetrachloride

112. **a.** KNO_3 **b.** CuO
c. Mg_3N_2 **d.** AgF