Chapter 1

Answers to Additional Exercises

44 A strong bone has more bone mineral than a weaker one.

46 The woman has osteopenia.

48 Yes, she should be screened for osteoporosis.

50 The three physical states of matter are solid, liquid, and gas.

52 Solids and liquids have fixed volumes compared to the container.

54 Work is involved in moving an object.

56 a. temperature (measuring the kinetic energy of molecules in the body)
b. heat (energy is moving from the compress to the body)

58 A rock rolling down hill has kinetic energy.

60 a. Kinetic energy (The biker is moving.) b. Potential energy (The hiker is at the top of a hill.) c. Kinetic energy (Tthe helium atoms are moving within the balloon.) d. Potential energy (Energy is stored in the bonds of the molecules that make up candle wax.)

62 The heavier molecules will have more kinetic energy.

64 c. Molecules in the gas phase have the most amount of kinetic energy.

66 a. Physical change (Water is undergoing a phase change from a solid to a liquid.) b. Chemical change (The composition of matter changes, as observed by the color change.) c. Chemical change (The composition of food changes, as observed by the color and texture change.) d. Physical change (The blades of grass are shorter but the composition of the blades of grass is the same.)

68 a. A hospital is on the macroscopic scale. (You can see it.) b. A skin cell is on the microscopic scale. (You need a microscope to see it.) c. DNA is on the atomic scale. (DNA is too small to be seen.) d. A red blood cell is on the microscopic scale (You need a microscope to see it.)

70 *pico* (there are 10^{12} in a base unit), *nano* (there are 10^{9} in a base unit), *micro* (there are 10^{6} in a base unit), and *kilo* (there are 10^{-3} in a base unit)

72 a. 1×10^{18} b. 2.305×10^{9} c. 1.5×10^{-12} d. 2.08×10^{-2}

74 a. 100,000 b. 0.0024 c. 165

76 4.5×10^{2} is the larger number

78 a. 10^{4} b. 10^{-6} c. 3.7×10^{-4} d. the same number e. 5.4×10^{3}

80 a. 10 mm b. the same length c. 1 cm d. 1 dm

82 a. 1 ng b. 100 mg c. the same mass d. 50 mcg

84 c. 1000 mm is equivalent to 1 m.

86 V_{lead} = 16.5 mL – 15.0 mL = 1.5 mL

88 a. the same volume b. the same volume c. 250 cm^3 d. the same volume

90 Volume = 24 cm × 24 cm ×24 cm = 14,000 cm^3

92 There are 1000 “small c” calories in one “capital C” calorie. The “capital C” calories are reported on nutritional labels.

94 a. False b. True c. True. d. True

96 The balance is not accurate; the values are far away from the “true” value. The balance is precise because the measurements are close to each other.

98 a. two b. three c. two d. seven

100 a. exact number b. not exact c. exact number

102 a. 2.31 b. 9,310 c. 1.56

104 c. 0.63

106 a. 3.2 × 8.54 = 27 There are two significant figures. b. 3.2 + 8.54 = 11.7 There are three significant figures.

108 a. 56.33 cm × 2.5 cm = 140 cm^2

b. 3.4 cm + 2.2 cm + 5.11 cm + 8.777 cm = 19.5 cm

c. $\frac{34.22\ g}{39.0\ mL}$ = 0.877 g/mL

110 a. $50{,}000.\ \cancel{m} \times \frac{1\ \text{km}}{1000\ \cancel{m}} = 50.000\ km$

b. $0.66\ \cancel{g} \times \frac{10^6 \mu g}{1\ \cancel{g}} = 6.6 \times 10^5\ \mu g$

112 10^3 mm = 1 m and 10^{15} pm = 1 m

114 $75.6\ \cancel{\mu L} \times \frac{1\ \cancel{L}}{10^6 \cancel{\mu L}} \times \frac{10^3 mL}{1\ \cancel{L}} = 0.0756\ mL$

116 $500.\ \cancel{mg} \times \frac{1\ g}{10^3 \cancel{mg}} = 0.500\ g$

$0.500\ \cancel{g} \times \frac{10^6 \mu g}{1\ \cancel{g}} = 5.00 \times 10^5\ \mu g$

118 $5.2\ \cancel{years} \times \frac{365\ \cancel{days}}{1\ \cancel{year}} \times \frac{24\ \cancel{hrs}}{1\ \cancel{day}} \times \frac{60\ \cancel{min}}{1\ \cancel{hr}} \times \frac{60\ sec}{1\ \cancel{min}} = 1.6 \times 10^8\ sec$

120 $68.2\ \cancel{miles} \times \frac{5280\ \cancel{ft}}{1\ \cancel{mile}} \times \frac{12\ \cancel{in}}{1\ \cancel{ft}} \times \frac{1\ \cancel{m}}{39.37\ \cancel{in}} \times \frac{1\ km}{10^3 \cancel{m}} = 110.\ km$

122 $86\ \cancel{gallons} \times \frac{4\ \cancel{qt}}{1\ \cancel{gallon}} \times \frac{1\ L}{1.057\ \cancel{qt}} = 330\ L$

124 d. $14.3\ \cancel{cm}^3 \times \frac{1\ L}{10^3\ \cancel{cm}^3} = 0.0143\ L$

126 a. $0.234\ \cancel{Cal} \times \frac{10^3\ cal}{1\cancel{Cal}} = 234\ cal$

b. $0.0991\ \cancel{kcal} \times \frac{10^3\ cal}{1\cancel{kcal}} = 99.1\ cal$

c. $20.7\ \cancel{kcal} \times \frac{10^3\ cal}{1\cancel{kcal}} = 2.07 \times 10^4\ cal$

d. $352\ \cancel{Cal} \times \frac{10^3\ cal}{1\cancel{Cal}} = 3.52 \times 10^5 cal$

128 Convert all measurements to a common unit.

$5{,}000\ \cancel{\mu L}\ \times \frac{1\ \cancel{L}}{10^6 \cancel{\mu L}} \times \frac{10^3 mL}{1\ \cancel{L}} = 5\ mL$

$0.5000\ \cancel{L}\ \times \frac{10^3 mL}{1\ \cancel{L}} = 500.0\ mL$

$8.000\ cm^3 = 8.000\ mL$

Largest to smallest: 0.5000 L, 50.00 mL, 8.000 cm^3, 5,000μL

130 $34\ \cancel{lb} \times \frac{1\ \cancel{kg}}{2.205\ \cancel{lb}} \times \frac{25\ mg}{\cancel{kg} \cdot day} = 390 \frac{mg}{day}$

132 $density = \frac{9.22\ g}{8.7\ mL} = 1.1\ g/mL$

133 $density = \frac{3.8\ g}{2.0\ \cancel{cm^3}} \times \frac{1\cancel{cm^3}}{1\ mL} = 1.9\ g/mL$

134 Water has a density of 1.0 g/mL.

135 A liquid with a density greater than 1.0 g/mL will sink in water.

136 Volume = 2.3 mL

$2.3\ \cancel{mL} \times \frac{19.32\ g}{1\ \cancel{mL}} = 44\ g$

138 The gold sphere with a mass of 15 g would have a greater volume than the 6 g sphere. Therefore, the diameter of the sphere would be larger.

140 $specific\ gravity = \frac{1.037 \cancel{g/mL}}{1.0\ \cancel{g/mL}} = 1.037$

No, the specific gravity is not within the normal range.

142 $density\ of\ urine = 0.997 \times 1.0g\ \ mL = 0.997\ g/mL$

The specific gravity of the urine sample is not within the normal range.

144 Normal body temperature is 37 °C and 98.6 °F.

146 c. in a cabinet $1.8\ \times 15℃\ + 32 = 59℉$

$1.8\ \times 30℃\ + 32 = 90℉$

148 $31℃\ + 273.15 = 304\ K$

$1.8\ \times 31℃\ + 32 = 88℉$

You are wearing summer clothes.

150 $\frac{87.4℉ - 32}{1.8} = 30.8\ ℃$

152 $2.7 - 273.15 = -270.4\ ℃$

$1.8 \times (-270.4\ ℃) + 32 = -454.7°F$

154 $77 - 273.15 = -196\ ℃$

$1.8 \times (-196\ ℃) + 32 = -321°F$

156 $\Delta T = 49 - 22 = 27℃$

a. For brick: $Amount\ of\ heat = \frac{0.20\ cal}{\cancel{g}\ \cancel{℃}} \times 10.9\ \cancel{g} \times 27\cancel{℃} = 59\ cal$

b. For ethanol: $Amount\ of\ heat = \frac{0.58\ cal}{\cancel{g}\ \cancel{℃}} \times 10.9\ \cancel{g} \times 27\cancel{℃} = 170\ cal$

c. For wood: $Amount\ of\ heat = \frac{0.10\ cal}{\cancel{g}\ \cancel{℃}} \times 10.9\ \cancel{g} \times 27\cancel{℃} = 29\ cal$

Ethanol requires the greatest number of calories to warm10.9 g by 27 degrees.

158 $\Delta T = 43 - 16 = 27℃$

$mass = \frac{Heat}{specific\ heat \times \Delta T} = \frac{504\ \cancel{cal}}{\frac{0.58\ \cancel{cal}}{g\ \cancel{℃}} \times 27\cancel{℃}} = 32\ g$

160 $\Delta T = \frac{Heat}{specific\ heat \times mass} = \frac{2{,}820\cancel{cal}}{\frac{1.0\ \cancel{cal}}{\cancel{g}\ ℃} \times 127.2\ \cancel{g}} = 22.2℃$

162 Carbohydrates, proteins, and triglycerides (fats) provide us with energy.

164 Carbon dioxide and water are produced when glucose is metabolized.

166 The body will convert muscle into glucose to produce energy.

168 Energy is the ability to do work or transfer heat.