Chapter 1: Matter and Measurement

1. Which is <u>not</u> an example of a pure substance?
   A) Sugar   B) Air   C) Aluminum foil   D) Water   E) A block of dry ice
   Ans: B   Difficulty: Easy

2. Which is an example of a physical change?
   A)   The rusting of an iron nail
   B)   The burning of propane in a gas grill
   C)   Baking cookies
   D)   Polishing tarnished silver
   E)   Melting of an ice cube in a glass of soda
   Ans: E   Difficulty: Easy

3. Which measurement has the fewest number of significant figures?
   A)   12.80 m
   B)   0.1280 m
   C)   0.001280 m
   D)   1280 m
   E)   All of the measurements have the same number of significant figures.
   Ans: D   Difficulty: Easy

4. Which quantity is an exact number?
   A) 3 cars   B) 1,000 m   C) 2 L   D) 453.6 g
   Ans: A   Difficulty: Easy

5. The number 0.0035880 expressed correctly using scientific notation is
   A)   0.0035889   D) 3.5880×10^{-4}
   B) 3.5880×10^{3} E) 3.588×10^{-3}
   C) 3.5880×10^{-3}
   Ans: C   Difficulty: Easy

6. The measurement 78,005,760 expressed correctly using scientific notation is
   A) 7.8005760×10^{7} D) 7.800576×10^{-7}
   B) 7.8005760×10^{-7} E) 7.800576×10^{7}
   C) 7.8×10^{7}
   Ans: E   Difficulty: Easy

7. When 4.870×10^{-3} is correctly converted to its standard form the number becomes
   A) 4870   B) 4870.   C) 0.00487   D) 0.004870   E) 0.0004870
   Ans: D   Difficulty: Easy

8. Which number is the largest?
   A) 4.38×10^{3} B) 4.38×10^{2} C) 4.38×10^{-3} D) 4.38×10^{-2} E) 438
   Ans: A   Difficulty: Easy

9. Which number is the smallest?
   A) 4.38×10^3 B) 4.38×10^2 C) 4.38×10^{-3} D) 4.38×10^{-2} E) 438
   Ans: C   Difficulty: Easy

10. When 0.022189 is correctly rounded to two significant figures the number becomes
   A) 0.02   B) 0.022   C) 22   D) 0.023
   Ans: B   Difficulty: Easy

11. When 5.5490×10^8 is correctly rounded to three significant figures the number becomes
   A) 5.55   B) 5.55×10^8 C) 555   D) 554   E) 5.54×10^8
   Ans: B   Difficulty: Easy

12. Which number contains four significant figures?
   A)   3.978
   B)   0.780
   C)   0.0085
   D)   1700
   E)   Two or more of the above numbers contain four significant figures.
   Ans: A   Difficulty: Easy

13. Carry out the following calculation and report the answer using the proper number of significant figures: $38.251 + 73.1$
   A) 111   B) 111.3   C) 111.4   D) 111.35   E) 111.351
   Ans: C   Difficulty: Medium

14. Carry out the following calculation and report the answer using the proper number of significant figures:
   $549.101 + 8.12 + 95.0076 - 651.9$
   A) 3.286   B) 0.3286   C) 0.33   D) 0.3   E) 1268.1
   Ans: D   Difficulty: Medium

15. Carry out the following calculation and report the answer using the proper number of significant figures:
   38.251×73.1
   A) 2796.1481   B) 2796.15   C) 2796.1   D) 2796   E) 2.80×10^3
   Ans: E   Difficulty: Medium

16. Carry out the following calculation and report the answer using the proper number of significant figures:
   $$\frac{16.75 \text{ ft}}{0.54 \text{ s}}$$
   A) 31.0185 ft/s   B) 31.01 ft/s   C) 31.02 ft/s   D) 31.0 ft/s   E) 31 ft/s
   Ans: E   Difficulty: Difficult

17. What is the correct metric relationship between milliliters and microliters?
    A)   1 milliliter = 1 microliter
    B)   1,000 milliliters = 1 microliter
    C)   1 milliliter = 1,000 microliters
    D)   1,000,000 milliliters = 1 microliter
    E)   1 milliliter = 1,000,000 microliters
    Ans: C   Difficulty: Medium

18. Which metric relationship is <u>incorrect</u>?
    A)   1 milligram = 1,000 grams
    B)   1 dL = 100 mL
    C)   1 km = 1,000 m
    D)   100 cg = 1 g
    E)   1 liter = 1,000,000 microliters
    Ans: A   Difficulty: Medium

19. Which is the proper conversion factor for converting a mass expressed in pounds (lb) to the same mass expressed in grams (g)?
    A) $\dfrac{1\ \text{lb}}{454\ \text{g}}$ B) $\dfrac{1\ \text{g}}{454\ \text{lb}}$ C) $\dfrac{454\ \text{g}}{1\ \text{lb}}$ D) $\dfrac{454\ \text{lb}}{1\ \text{g}}$
    Ans: C   Difficulty: Medium

20. Which length is the longest?
    A) 12 m   B) 12,000 mm   C) 12,000 µm   D) 12,000 cm   E) 0.0012 km
    Ans: D   Difficulty: Difficult

21. What is the mass in kilograms of an individual who weighs 197 lb?
    A) 197 kg   B) 8.95 kg   C) 89.5 kg   D) 90 kg   E) 433 kg
    Ans: C   Difficulty: Medium

22. If a balloon has a volume of 21.6 cups, what is the volume of this balloon expressed in L?
    A) 86.4 L   B) 81.51 L   C) 5.72 L   D) 5.094 L   E) 5.09 L
    Ans: E   Difficulty: Difficult

23. Which volume is equivalent to 225 mL?
    A) $2.25 \times 10^5\ \mu L$
    B) $2.25 \times 10^2\ \mu L$
    C)   2.25 L
    D) $2.25 \times 10^{-5}\ \mu L$
    E)   0.225 µL
    Ans: A   Difficulty: Difficult

24. If a package of nuts weighs 41.3 oz, what is the mass of the package expressed in milligrams?
    A)   1.17 mg
    B) $1.17 \times 10^3\ \text{mg}$
    C) $1.17 \times 10^6\ \text{mg}$
    D)   117 mg
    E) $3.00 \times 10^5\ \text{mg}$
    Ans: C   Difficulty: Difficult

25. If a tree is 89.5 cm tall, what is the tree's height expressed in yards?
    A) 0.979 yd   B) 6.31 yd   C) 18.9 yd   D) 35.2 yd   E) 227 yd
    Ans: A   Difficulty: Difficult

26. If honey has a density of 1.36 g/mL, what is the mass of 1.25 qt, reported in kilograms?
    A) 1.60 kg   B) 1.6×10^3 kg   C) 0.974 kg   D) 974 kg   E) 1.80 kg
    Ans: A   Difficulty: Difficult

27. If a piece of rock has a volume of 0.73 L and a mass of 1524 g, what is the density of the rock in g/mL?
    A) 2.1×10^3 g/mL   D)   2.1 g/mL
    B)   0.48 g/mL   E)   2.088 g/mL
    C) 4.8×10^{-4} g/mL
    Ans: D   Difficulty: Difficult

28. A hiker with hypothermia has a body temperature of 82 °F. What is his body temperature in °C?
    A) 14 °C   B) 28 °C   C) 31 °C   D) 50 °C
    Ans: B   Difficulty: Medium

29. On an autumn day in Washington, DC the outdoor temperature was 21 °C. What was this outdoor temperature in °F?
    A) 44 °F   B) 57 °F   C) 69 °F   D) 70 °F
    Ans: D   Difficulty: Medium

30. An oven is set for a temperature of 298 °F. What is the oven temperature in K?
    A) 166 K   B) 421 K   C) 148 K   D) 571 K   E) 439 K
    Ans: B   Difficulty: Difficult

31. Which of the following temperatures is the hottest?
    A) 100 °C   B) 100 °F   C) 100 K   D) All would feel equally warm.
    Ans: A   Difficulty: Medium

32. The recommended dietary allowance for calcium for teenage children is 1,300 mg per day. If a typical 8.0-fl oz glass of reduced-fat milk contains 298 mg of calcium, how many fluid ounces of milk does a teenager need to drink to get the entire recommended amount of calcium from this milk?
    A) 4.4 fl oz   B) 1.8 fl oz   C) 3.5 fl oz   D) 35 fl oz   E) 32 fl oz
    Ans: D   Difficulty: Difficult

33. What is the density of a sample of rubbing alcohol if it has a specific gravity of 0.789?
    A) 1.27 g/mL   B) 0.789 g/mL   C) 1.00 g/mL   D) 0.895 g/mL
    Ans: B   Difficulty: Easy

34. Which of the following conversions is correct and expresses the answer using the proper number of significant figures?

    A) $3.779 \text{ lb} \times \dfrac{454 \text{ g}}{1 \text{ lb}} \times \dfrac{1{,}000 \text{ mg}}{1 \text{ g}} = 1.7 \times 10^6 \text{ mg}$

    B) $553 \text{ dL} \times \dfrac{1 \text{ L}}{10 \text{ dL}} \times \dfrac{10^3 \text{ mL}}{1 \text{ L}} = 5.5 \times 10^4 \text{ mL}$

    C) $623 \text{ nm} \times \dfrac{1 \text{ m}}{10^9 \text{ nm}} \times \dfrac{39.4 \text{ in}}{1 \text{ m}} = 2.45 \times 10^{-5} \text{ in}$

    D) $623 \text{ nm} \times \dfrac{1 \text{ m}}{10^6 \text{ nm}} \times \dfrac{39.4 \text{ in}}{1 \text{ m}} = 2.45 \times 10^{-2} \text{ in}$

    Ans: C   Difficulty: Difficult

35. What is the mass in grams of 85.32 mL of blood plasma with a density of 1.03 g/mL?
    A) 85.32 g   B) 82.83 g   C) 82.8 g   D) 87.88 g   E) 87.9 g
    Ans: E   Difficulty: Medium

36. If a 185-lb patient is prescribed 145 mg of the cholesterol lowering drug Tricor daily, what dosage is the patient receiving in mg/kg of his body weight?
    A)   0.784 mg/kg   D)   1.72 mg/kg
    B)   1.28 mg/kg   E)   0.580 mg/kg
    C)   0.356 mg/kg
    Ans: D   Difficulty: Difficult

37. The estimated average daily requirement of folic acid for pregnant females is 520 micrograms. Which accurately expresses this value?
    A) 520 mg   B) 520 Mg   C) 520 mG   D) 520 µg
    Ans: D   Difficulty: Easy

38. For a person between the ages of 10 and 29, the normal range of blood triglycerides is 53 $\times 10^4$ mg/dL. What is the correct interpretation of the units in this measurement?
    A)   milligrams times deciliter   C)   megagrams per deciliter
    B)   micrograms per deciliter   D)   milligrams per deciliter
    Ans: D   Difficulty: Easy

39. A patient's urine sample has a density of 1.02 g/mL. If 1250 mL of urine was excreted by the patient in one day, what mass of urine was eliminated?
    A) 1.28 kg   B) 1225 g   C) 1275 g   D) 128 g
    Ans: A   Difficulty: Difficult

40. The density of human urine is normally between 1.003 and 1.030g/mL, and is often used as a diagnostic tool. If a 25.00 mL sample of urine from a patient has a mass of 26.875 g, how does the density of the urine sample compare to the normal range?
    A)   the density of the sample is lower than the normal range
    B)   the density of the sample is greater than the normal range
    C)   the density of the sample is within the normal range
    D)   there is insufficient information to make a comparison
    Ans: B   Difficulty: Medium

41. Which volume has the most uncertainty associated with the measurement?
    A)   10 mL
    B)   10.0 mL
    C)   10.00 mL
    D)   all have the same degree of uncertainty
    Ans: A   Difficulty: Medium

42. Air has a density of 0.001226 g/mL. What volume of air would have a mass of 1.0 lb?
    A) 2.7 mL   B) 815.6 mL   C) 37 mL   D) 3.7×10^2 L
    Ans: D   Difficulty: Difficult

43. A beaker contains 145.675 mL of a saline solution. If 24.2 mL of the saline solution are removed from the beaker, what volume of solution remains?
    A) 121.475 mL   B) 121.4 mL   C) 121.5 mL   D) 121 mL
    Ans: C   Difficulty: Medium

44. PVC plastic, which is used in pipes, is an example of a synthetic material.
    Ans: True   Difficulty: Easy

45. Nitrogen gas (N_2) would properly be classified as a compound.
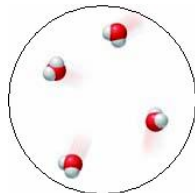   Ans: False   Difficulty: Medium

46. Changes in state such as melting and boiling are physical changes.
    Ans: True   Difficulty: Easy

47. A compound cannot be broken down into simpler substances.
    Ans: False   Difficulty: Easy

48. The water molecules in this image are best described as being in the liquid state.

    Ans: False   Difficulty: Easy

49. The base unit for mass in the metric system is kilograms (kg).
    Ans: False   Difficulty: Easy

50. The base unit for volume in the metric system is liter (L).
    Ans: True   Difficulty: Easy

51. An inexact number results from a measurement or observation and contains some uncertainty.
    Ans: True   Difficulty: Easy

52. A zero counts as a significant figure when it occurs at the end of a number that contains a decimal point.
    Ans: True   Difficulty: Easy

53. 8 mL is larger than 8 dL.
    Ans: False   Difficulty: Medium

54. Specific gravity is a quantity that compares the density of a substance with the density of water.
    Ans: True   Difficulty: Easy

55. The specific gravity of a substance has units of g/mL.
    Ans: False   Difficulty: Medium

56. When the liquid carbon tetrachloride (density = 1.59 g/mL) is added to water, the top layer will be the water layer.
    Ans: True   Difficulty: Medium

57. When a piece of magnesium (density = 1.738 g/mL) is placed in a container of liquid carbon tetrachloride (density = 1.59 g/mL), the piece of magnesium will float on top of the carbon tetrachloride.
    Ans: False   Difficulty: Medium

58. In reading a number with a decimal point from left to right, all digits starting with the first nonzero number are significant figures.
    Ans: True   Difficulty: Easy

59. The number 900,027,300 has four significant figures.
    Ans: False   Difficulty: Easy

60. The number 900,027,300 has nine significant figures.
    Ans: False   Difficulty: Easy

61. The two conversion factors for the equality 1 in = 2.54 cm are properly shown below.

$$\frac{1 \text{ in}}{2.54 \text{ cm}} \quad \text{and} \quad \frac{2.54 \text{ in}}{1 \text{ cm}}$$

Ans: False   Difficulty: Easy

62. Dissolving sugar in water involves a chemical change.
Ans: False   Difficulty: Medium

63. One-thousand (1,000) ms is the same length of time as one (1) μs.
Ans: False   Difficulty: Medium

64. Assuming the numbers are measured values, when multiplying 762.85 by 15 the answer should be reported with two significant figures.
Ans: True   Difficulty: Medium

65. When subtracting 15 from 762.85 the answer should be reported with two significant figures.
Ans: False   Difficulty: Medium

66. In scientific notation, a number is written as $y \times 10^x$, where x can be any positive or negative number or fraction.
Ans: False   Difficulty: Easy

67. If the density of a substance is greater than 1 g/mL, the mass of a sample of this substance will be greater than the volume of the sample.
Ans: True   Difficulty: Medium

68. Dividing a number by 10^5 is the same as multiplying a number by 10^{-5}.
Ans: True   Difficulty: Medium

69. The measurement 10.3 cm has more significant figures than the measurement 10.3 m.
Ans: False   Difficulty: Medium

70. The density of olive oil is greater at 200 °C than at 25 °C.
Ans: False   Difficulty: Medium

71. One Kelvin is the same size as one degree Celsius.
Ans: True   Difficulty: Easy

72. The temperature 60 °C is higher than 60 °F.
Ans: True   Difficulty: Medium

73. The temperature –60 °C is higher than –60 °F.
Ans: False   Difficulty: Difficult

74. The temperature 60 °C is higher than 60 K.
    Ans: True   Difficulty: Medium

75. Elements and compounds are both classified as pure substances.
    Ans: True   Difficulty: Medium

76. The terms used in conversion factors must always be exact numbers.
    Ans: False   Difficulty: Medium

77. The number 87,927,000 is larger than the number 9.7×10^6.
    Ans: True   Difficulty: Medium

78. The number 0.0007270 is larger than the number 5.7×10^{-3}.
    Ans: False   Difficulty: Medium

79. A mixture can be separated into its components by physical changes.
    Ans: True   Difficulty: Easy

80. For a number written in scientific notation, a negative exponent indicates the value of the number is less than 1.
    Ans: True   Difficulty: Easy

81. The meaning of the metric prefix *milli-* is 1000.
    Ans: False   Difficulty: Medium

82. A _____ change converts one material to another.
    Ans: chemical
    Difficulty: Easy

83. The measurement 0.030500 m has _____ significant figures.
    Ans: five or 5
    Difficulty: Easy

84. When the measurement 340,942 s is rounded to two significant figures, the value is properly reported as _____.
    Ans: 340,000 s or 3.4×10^5 s
    Difficulty: Easy

85. To use conversion factors to solve a problem, set up the problem with any unwanted unit in the numerator of one term and the _____ of another term, so that unwanted units cancel.
    Ans: denominator
    Difficulty: Easy

86. If you have equal masses of two different substances (A and B), and the density of A is twice the density of B, then the volume of A is _____ the volume of B.
    Ans: one-half or 1/2
    Difficulty: Difficult

87. Every measurement is composed of a number and a _____.
    Ans: unit
    Difficulty: Easy

88. A small banana contains 323 mg of the nutrient potassium. You would need to eat approximately _____ small bananas in one day to obtain the recommended daily intake of 3.5 g of potassium.
    Ans: 11
    Difficulty: Difficult

89. The measurement 5342 nm is the same length as _____ cm, written in scientific notation.
    Ans: 5.342×10^{-4}
    Difficulty: Difficult

90. When crude oil leaks into the ocean from an oil tanker, the crude oil floats because it is _____ dense than water.
    Ans: less
    Difficulty: Easy