Chapter 2
Scientific Measurements

Multiple Choice Questions

Section 2.1
Difficulty Level: easy
1.   Water can also exist as a gas that is called
        a. ice.
    * b. steam.
        c. the melt.
        d. molecules.
        e. atomic water.

Section 2.1
Difficulty Level: easy
2. An example of a chemical change is

        a. the mixing of glucose with table salt.
        b. the dissolving of table salt in water.
    * c. sodium combining with chlorine to form table salt.
        d. mixing rust with sand.
        e. mixing chalk with helium in a balloon.

Section 2.1
Difficulty Level: easy
3.   Which of the examples below is a chemical change?
        a. A bottle of wine completely evaporates in two weeks.
    * b. Bleach changes the color of the stain on the white shirt.
        c. The 'dry ice' (solid CO_2) changes to vapor.
        d. Bubbles form in the water when He gas is blown into the water.
        e. These are all examples of chemical change.

Section 2.1
Difficulty Level: easy
4.   Which is an example of a chemical reaction?

        a. the separation of air into oxygen, nitrogen, and other components
    * b. the separation of a compound into its elements
        c. the separation of gases from liquids
        d. the separation of a mixture into its components
        e. the separation of solids from liquids

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Section 2.1
Difficulty Level: easy
5.   Which one of the following is a physical change?

        a. When ignited with a match in open air, paper burns.
*   b. In cold weather, water condenses on the inside surface of single pane windows.
        c. When treated with bleach, some dyed fabrics change color.
        d. When heated strongly, sugar turns dark brown.
        e. Grape juice left in an open unrefrigerated container turns sour.

Section 2.1
Difficulty Level: easy
6.   Which is an example of a physical change?

*   a. The 'dry ice' (solid CO_2) changes to vapor.
        b. A bottle of wine turns into vinegar in a few months.
        c. Bleach changes the color of the stain on the white shirt.
        d. Bubbles form on the egg shell when it is placed in the vinegar.
        e. A portion of the figurine dissolves after being placed in the container of acid.

Section 2.1
Difficulty Level: easy
7.   Which one of the following examples does not involve a chemical change?

        a. A fish that is left for some time in an unrefrigerated place decomposes.
        b. Apple juice which is left in an open bottle, ferments.
        c. A loaf of bread rises and its volume expands when it is baked in an oven.
*   d. When a lake starts to freeze in winter, ice is formed on the surface.
        e. When sugar is fermented under certain conditions, alcohol is produced.

Section 2.1
Difficulty Level: easy
8.   Which one of the following is a chemical change?

*   a. When blood is mixed with 3% hydrogen peroxide solution, it changes color.
        b. When water is boiled, it forms steam.
        c. When a solid stick of butter is heated, it becomes a liquid.
        d. When blue paint is mixed with yellow paint, a green colored paint is obtained.
        e. When a bar of gold metal is pounded with a hammer, it flattens out.

Section 2.1
Difficulty Level: easy
9.   Which of the following is *not* a chemical change?

        a. A nail rusts when exposed to air and moisture.
        b. Milk turns sour if left unrefrigerated.
        c. Yeast produces carbon dioxide to help bread rise.
        d. Copper is molded with heat to form pipes.

     *   e. Mixing baking soda and vinegar causes fizzing and bubbling.

Section 2.1
Difficulty Level: easy
10. Each of the following properties of a sample of a pure substance can be used for identification except its

        a. density.
        b. freezing point temperature.
   * c. mass.
        d. melting point temperature.
        e. solubility in water.

Section 2.1
Difficulty Level: medium
11. A physical property is one that

   * a. can be observed without changing the chemical identity of a substance.
        b. is based on one particular scientific law.
        c. describes a chemical reaction that a substance undergoes.
        d. cannot be seen with the naked eye.
        e. is considered hypothetical in origin.

Section 2.1
Difficulty Level: medium
12. Which of the following describes a chemical property?

        a. A property based solely on the scientific method.
        b. A property which is based on a particular scientific law.
   * c. A property which describes a change a substance undergoes.
        d. A property which cannot be seen.
        e. A property which is considered hypothetical.

Section 2.1
Difficulty Level: medium
13. Which is an example of a chemical property?

   * a. combustibility
        b. volatility
        c. viscosity
        d. malleability
        e. ductility

Section 2.1
Difficulty Level: medium
14. Which is an example of an intensive property of matter?

      *   a. color
            b. volume
            c. mass
            d. weight
            e. length

Section 2.2
Difficulty Level: easy
15. The *kilo* is
            a. a unit of mass.
            b. a unit used in medical terminology.
      * c. a decimal multiplier in the metric system.
            d. a unit of speed.
            e. a volume unit used by the DEA (drug enforcement agency).

Section 2.2
Difficulty Level: easy
16. The SI base units of temperature and mass, respectively, are

            a. degree and gram.
      * b. kelvin and kilogram.
            c. Celsius and milligram.
            d. degree and kilogram.
            e. kelvin and gram.

Section 2.2
Difficulty Level: easy
17. Which is a unit of surface area of a circular object?

            a. pascal
            b. joule
      * c. square meter
            d. cubic centimeter
            e. kilometer

Section 2.2
Difficulty Level: easy
18. The SI prefixes giga and micro, indicate respectively:

      * a. 10^9 and 10^{-6}
            b. 10^{-9} and 10^{-6}
            c. 10^6 and 10^{-3}
            d. 10^3 and 10^{-3}
            e. 10^{-9} and 10^{-3}

Section 2.2
Difficulty Level: easy
19. The SI prefixes mega and nano indicate, respectively:

        a. 10^9 and 10^{-6}
        b. 10^{-6} and 10^9
*   c. 10^6 and 10^{-9}
        d. 10^6 and 10^9
        e. 10^{-6} and 10^{-9}

Section 2.2
Difficulty Level: easy
20. The boiling point of chlorine is -34.6 $^{\circ}$C. This temperature expressed in kelvins is

        a. -30.3 K
        b. 177.4 K
*   c. 238.6 K
        d. 243.0 K
        e. 307.6 K

Section 2.2
Difficulty Level: easy
21. Convert 25.4 K to $^{\circ}$C.

        a. -30.3 $^{\circ}$C
*   b. -247.8 $^{\circ}$C
        c. -38.6 $^{\circ}$C
        d. -13.8 $^{\circ}$C
        e. -107.6 $^{\circ}$C

Section 2.2
Difficulty Level: medium
22. Which of the following is an SI base unit?

        a. dyne
        b. newton
        c. milliliter
*   d. ampere
        e. calorie

Section 2.2
Difficulty Level: medium
23. The SI derived unit for area is

        a. square centimeter.
        b. square yard.
        c. square kilometer.
*   d. square meter.
        e. pascal.

Section 2.2

Difficulty Level: medium

24. The momentum of an object is its mass times its velocity. What is the derived SI unit for momentum?

      a. kg/m
* b. kg m/s
      c. g m/s
      d. m/s^2
      e. pounds per inches

Section 2.2

Difficulty Level: medium

25. The force experienced by an object is its mass times its acceleration. What is the derived SI unit for force?

* a. $kg\ m/s^2$
      b. kg m/s
      c. g m/s
      d. m/s^2
      e. pounds per inches squared

Section 2.2

Difficulty Level: medium

26. The density of an object is the ratio of its mass to its volume. What is the derived SI unit for density?

      a. $kg\ m/s^3$
      b. kg m/s
* c. kg/m^3
      d. m/s^2
      e. pounds per cubic inches

Section 2.2

Difficulty Level: medium

27. The volume of a cylinder is $\pi r^2 h$, where r is the radius and h is the height. What is the derived SI unit for the volume of a cylinder?

      a. $kg\ m/s^3$
      b. liter
      c. cm^3
* d. m^3
      e. cubic inches

Section 2.2
Difficulty Level: medium
28. Which is the longest measurement?

          a. 10 mm
   * b. 10 dm
          c. 10 cm
          d. 10 μm
          e. They are all the same measurement.

Section 2.2
Difficulty Level: medium
29. Which is the shortest measurement?

          a. 10 mm
          b. 1 km
          c. 10 cm
   * d. 10 μm
          e. They are all the same measurement.

Section 2.2
Difficulty Level: medium
30. Which is the shortest measurement?

   * a. 10 mm
          b. 1 km
          c. 10 cm
          d. 10 in
          e. They are all the same measurement.

Section 2.2
Difficulty Level: medium
31. What is the number needed to complete the following: 1 dm = __ m?

          a. 10
          b. 20
          c. 1
   * d. 0.1
          e. 0.01

Section 2.2
Difficulty Level: medium
32. What is the number needed to complete the following: 1 m = __ pm?

       a. 10^{-6}
       b. 2.0×10^{-9}
       c. 10^{-12}
       d. 0.1
   * e. 10^{12}

Section 2.2
Difficulty Level: medium
33. What is the number needed to complete the following: 1 g = __ kg?

       a. 10^{3}
       b. 2.0×10^{-9}
   * c. 10^{-3}
       d. 0.1
       e. 10^{12}

Section 2.2
Difficulty Level: medium
34. What is the number needed to complete the following: 1 g = __ µg?

   * a. 10^{6}
       b. 10^{-9}
       c. 10^{-3}
       d. 0.1
       e. 10^{-2}

Section 2.2
Difficulty Level: medium
35. The boiling point of barium is 725 $^{\circ}$C. Determine the equivalent value in $^{\circ}$F.

       a. 435 $^{\circ}$F
   * b. 1337 $^{\circ}$F
       c. 1247 $^{\circ}$F
       d. 1392 $^{\circ}$F
       e. 1273 $^{\circ}$F

Section 2.2
Difficulty Level: medium
36. The melting point of a metal is listed in one handbook as 630.5 °C. Determine the equivalent value in °F.

        a. 382.41 °F
        b. 1103.3 °F
        c. 1077.7 °F
   *   d. 1166.9 °F
        e. 1192.9 °F

Section 2.2
Difficulty Level: medium
37. The melting point of lead acetate, a white solid, is 280 °C. Determine the melting point of this compound in units of °F.

        a. 446 °F
        b. 472 °F
        c. 504 °F
   *   d. 536 °F
        e. 562 °F

Section 2.2
Difficulty Level: hard
38. Which is the longest measurement?

        a. 10 mm
        b. 10 dm
        c. 10 cm
   *   d. 10 in
        e. They are all the same measurement.

Section 2.2
Difficulty Level: hard
39. On a day in the summer of 1992, the temperature fell from 98 °F to 75 °F in just three hours. The temperature drop expressed in Celsius degrees (°C) was

   *   a. 13 °C
        b. 41 °C
        c. 45 °C
        d. 9 °C
        e. 75 °C

Section 2.2
Difficulty Level: hard
40. On a day in the summer of 1976, the temperature fell from 95 °F to 75 °F in just three hours. The temperature drop expressed in Celsius degrees (°C) was

*   a. 11 °C
      b. 13 °C
      c. 18 °C
      d. 20 °C
      e. -12 °C

Section 2.2
Difficulty Level: hard
41. The melting point of antimony is listed in one handbook as 1167.3 °F. Expressed in kelvins this temperature would be

      a. 357.6 K
      b. 496.8 K
      c. 583.7 K
      d. 894.2 K
*   e. 903.9 K

Section 2.2
Difficulty Level: hard
42. The highest temperature recorded in the athletic field house when the cooling units were being replaced and upgraded was 122.0 °F. Express this temperature in kelvins.

*   a. 323.2 K
      b. 337.6 K
      c. 341.0 K
      d. 435.2 K
      e. 492.8 K

Section 2.2
Difficulty Level: hard
43. A metal alloy melts at 874 K. What is this temperature in °F?

      a.   302 °F
      b.   365 °F
      c. 1050 °F
      d. 1082 °F
*   e. 1114 °F

Section 2.2
Difficulty Level: hard
44. The boiling point of carbonyl selenide is 251.4 K. What is this temperature in $^\circ$F?

  * a. - 7.1 $^\circ$F
    b. - 44.1 $^\circ$F
    c. - 96.7 $^\circ$F
    d. 0.00 $^\circ$F
    e. +18.5 $^\circ$F

Section 2.3
Difficulty Level: easy
45. A number resulting from a measurement was properly expressed in scientific notation as
  3.170×10^{-2} meters (m). The number could also be written correctly as

    a. 0.0317 m
  * b. 0.03170 m
    c. 0.032 m
    d. 317 m
    e. 317.0 m

Section 2.3
Difficulty Level: easy
46. An electronic balance used in the mailroom displays tenths of a kilogram from 0 to 140 kg. How
  many significant figures should be used to express the mass of a package which has a mass between
  80.2 and 83.5 kg.?

  * a. 3
    b. 5
    c. 4
    d. 2
    e. 1

Section 2.3
Difficulty Level: easy
47. Which response gives the correct number of significant figures for all three of the following
  measurements? 7.103 cm, 0.00005 inch, and 1.3400×10^{-4} dm^3

    a. 3, 5, and 4
    b. 3, 1, and 3
    c. 4, 1, and 3
  * d. 4, 1, and 5
    e. 4, 5, and 5

Section 2.3
Difficulty Level: easy
48. How many significant figures should be displayed in the result of the operation, 8.5201 + 1.93?

        a. 1
        b. 2
        c. 3
    *   d. 4
        e. 5

Section 2.3
Difficulty Level: easy
49. The number 0.0030600 is properly expressed in scientific notation as

        a. 3.0600×10^{-2}
        b. 0.30600×10^{-2}
        c. 0.306×10^{-2}
        d. 3.06×10^{-3}
    *   e. 3.0600×10^{-3}

Section 2.3
Difficulty Level: easy
50. The number 0.02100 is properly expressed in scientific notation as

        a. 0.21×10^{-1}
        b. 2.1×10^{-2}
    *   c. 2.100×10^{-2}
        d. 21.0×10^{-3}
        e. 2.10×10^{-2}

Section 2.3
Difficulty Level: medium
51. After evaluating the expression,
$$\frac{13.726 + 0.027}{8.221}$$
how many significant figures should be displayed in the result?

        a. 1
        b. 2
        c. 3
    *   d. 4
        e. 5

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Section 2.3
Difficulty Level: medium
52. When the expression, 412.272 + 0.00031 - 1.00797 + 0.000024 + 12.8, is evaluated, the result should be expressed as

        a. 424
        b. 424.0
  * c. 424.1
        d. 424.06
        e. 424.064364

Section 2.3
Difficulty Level: medium
53. When the expression, 16.0200 + 0.00048 - 11.184 - 221.1, is evaluated, the result should be expressed as

  * a. -216.3
        b. -216.26
        c. -216.2635
        d. -216.26352
        e. -2.2×10^2

Section 2.3
Difficulty Level: medium
54. Evaluate the expression to the correct number of significant figures.

$$\frac{0.04616 \times 0.082057 \times 293.30}{0.654}$$

        a. 1.69
  * b. 1.70
        c. 1.699
        d. 1.6987
        e. 1.69870

Section 2.3
Difficulty Level: medium
55. Evaluate the expression to the correct number of significant figures.

$$\frac{4.268 \times 0.082057 \times 373.15}{\frac{744.6}{760.0} \times 2.688}$$

        a. 49.623
        b. 49.631
  * c. 49.62
        d. 49.64

e. 49.623202

Section 2.4
Difficulty Level: medium
56. A distance of 1.8×10^{-2} meters is equal to

      a. 1.8 micrometers.
      b. 1.8 millimeters.
      c. 0.18 meters.
   * d. 1.8 centimeters.
      e. 18 kilometers.

Section 2.4
Difficulty Level: medium
57. The diameter of a certain atom was found to be 2.35×10^{-8} cm. How many nanometers is this?

      a. 2.35×10^{1} nm
      b. 2.35×10^{-19} nm
      c. 2.35×10^{-15} nm
   * d. 2.35×10^{-1} nm
      e. 2.35×10^{-10} nm

Section 2.4
Difficulty Level: medium
58. How many micrometers are there in 3.672 km?

      a. 3.672×10^{6} micrometers
      b. 2.723×10^{-7} micrometers
      c. 2.723×10^{-4} micrometers
   * d. 3.672×10^{9} micrometers
      e. 3.672×10^{3} micrometers

Section 2.4
Difficulty Level: medium
59. How many mm (millimeters) are there in 6.3 km?

      a. 6.3×10^{-5} mm
      b. 6300 mm
      c. 6.3×10^{4} mm
      d. 6.3×10^{5} mm
   * e. 6.3×10^{6} mm

Section 2.4
Difficulty Level: medium
60. How many cm^3 are in 0.00424 dm^3?

        a. 0.0424 cm^3
        b. 0.424 cm^3
    * c. 4.24 cm^3
        d. 0.00000424 cm^3
        e. 424 cm^3

Section 2.4
Difficulty Level: medium
61. How many cubic inches are in 1.00 dm^3? 1 in. = 2.54 cm.

    * a. 61.0 in^3
        b. 155 in^3
        c. 394 in^3
        d. 1.64×10^4 in^3
        e. 3.83×10^3 in^3

Section 2.4
Difficulty Level: medium
62. Which one of the following represents the smallest distance?

    * a. 4.5 mm
        b. 0.20 inch
        c. 0.83 cm
        d. 0.73 m
        e. 0.30 yard

Section 2.4
Difficulty Level: medium
63. How many m^3 are in a 1.5 L bottle of soda?

        a. 1.5×10^1 m^3
    * b. 0.0015 m^3
        c. 0.015 m^3
        d. 0.00015 m^3
        e. 1.5 m^3

Section 2.4
Difficulty Level: medium
64. One radio station operates on an assigned frequency of 96.3 megahertz while another one operates on an assigned frequency of 1280 kilohertz. What is the ratio of the larger to the smaller value?

      a. 13.3
      b. 13.29
  * c. 75.2
      d. 75.23
      e. 13.2918

Section 2.4
Difficulty Level: medium
65. One radio station operates on an assigned frequency of 88.1 megahertz while another one operates on an assigned frequency of 1460 kilohertz. What is the ratio of the larger to the smaller value?

      a. 16.5
      b. 16.57
      c. 16.57208
  * d. 60.3
      e. 60.342

Section 2.4
Difficulty Level: medium
66. An industrial container was filled with 210.8 liters of a solvent. How many gallons of solvent does this container contain?
1 pint (pt) = 473.2 mL, 1 gallon (gal) = 8 pt.

      a. 55.00 gal
  * b. 55.69 gal
      c. 59.15 gal
      d. 179.1 gal
      e. 798.0 gal

Section 2.4
Difficulty Level: hard
67. How many square meters are in a rectangular piece of carpet which measures 12.0 feet by 22.0 feet?
1 m = 39.37 in., 1 ft = 12 in.

  * a. 24.5 m^2
      b. 28.4 m^2
      c. 866 m^2
      d. 80.5 m^2
      e. 966 m^2

Section 2.4
Difficulty Level: hard
68. How many square meters of floor space are in a room which has 225.0 square yards of floor space? 1 m = 39.37 in., 1 yard = 36 in.

     *   a.   188.1 square meters
          b.   269.0 square meters
          c.   246.0 square meters
          d.   205.7 square meters
          e.   172.0 square meters

Section 2.4
Difficulty Level: hard
69. If a car has an EPA mileage rating of 3.0×10^1 miles per gallon, what is this rating in m L^{-1}? 1 liter = 1 dm^3, 1 gallon = 3.785 liter, 1 mile = 1.609 meter.

     *   a.   13   m L^{-1}
          b.   200 m L^{-1}
          c.   180 m L^{-1}
          d.   70   m L^{-1}
          e.   11   m L^{-1}

Section 2.5
Difficulty Level: medium
70. The density of gold, expressed in non-SI units is 19.3 g/cm^3. In SI units, the density is

          a.   0.0193 kg/cm^3
          b. 1.93×10^4 kg/cm^3
     *   c. 1.93×10^4 kg/m^3
          d.   193 kg/m^3
          e. 1.93×10^{-2} kg/m^3

Section 2.5
Difficulty Level: medium
71. What is the volume of a 52.5 gram sample of nickel, if its density = 8.90 g/cm^3?

          a.   467 cm^3
          b.   0.170 cm^3
     *   c.   5.90 cm^3
          d.   43.6 cm^3
          e.   61.4 cm^3

Section 2.5
Difficulty Level: medium
72. What is the volume of a 66.7 gram sample of vanadium (density = 6.11 g/cm^3)?

        a. 11.9 cm^3
        b. 9.92 cm^3
        c. 60.6 cm^3
   * d. 10.9 cm^3
        e. 0.0916 cm^3

Section 2.5
Difficulty Level: medium
73. A sample of zinc metal (density = 7.14 g/cm^3) was submerged in a graduated cylinder containing water. The water level in the cylinder rose from 162.5 cm^3 to 186.0 cm^3. How many grams did the sample weigh?

   * a. 168 g
        b. 22.7 g
        c. 26.1 g
        d. 48.8 g
        e. 3.29 g

Section 2.5
Difficulty Level: medium
74. A sample of an alloy (density = 9.62 g/cm^3) was submerged in a graduated cylinder containing water. The water level in the cylinder rose from 166.5 cm^3 to 182.0 cm^3. How many grams did the sample weigh?

        a. 0.621 g
        b. 175 g
        c. 18.9 g
        d. 17.8 g
   * e. 149 g

Section 2.5
Difficulty Level: medium
75. "Isooctane", a fuel used in gasoline engines because it has an antiknock octane rating of 100, has a density of 0.6919 g/cm^3. How many pounds would 20.4 gallons of this fuel (a typical full tank) weigh? 1 gallon = 3785 cm^3 = 4 quart; 1 pound = 453.6 g

        a. 77.2 pounds
        b. 246 pounds
   * c. 118 pounds
        d. 24.2 pounds
        e. 50.6 pounds

Section 2.5
Difficulty Level: medium
76. Mercury, which has a density of 13.595 g/cm^3, is usually stored in iron vessels for shipment. These vessels typically have a capacity of 2.60 liters. How many pounds of mercury would a filled container hold? 1 pound = 0.4536 kg, 1 liter = 1 dm^3 = 1000 cm^3.

*   a. 77.9 pounds
    b. 86.7 pounds
    c. 11.5 pounds
    d. 16.0 pounds
    e. 42.6 pounds

Section 2.5
Difficulty Level: medium
77. Iron has a density of 7.86 g/cm^3. How many pounds does a block of iron with a volume of 1.650 cubic feet weigh? 1 pound = 0.4536 kg, 1 foot = 12 in., 1 in. = 2.54 cm.

*   a. 809.6 pounds
    b. 0.8715 pounds
    c. 871.1 pounds
    d. 491.2 pounds
    e. 3.015 pounds

Section 2.5
Difficulty Level: medium
78. Iridium has a density of 22.65 g/cm^3. A student has an iridium figurine on his desk which weighs 11.50 pounds. What is its volume, in cubic inches? 1 pound = 0.4536 kg, 1 inch = 2.54 cm.

    a. 5.533 cubic inches
    b. 9.410 cubic inches
*   c. 14.05 cubic inches
    d. 35.70 cubic inches
    e. 90.67 cubic inches

Section 2.5
Difficulty Level: medium
79. The metric equivalent of a 55 gallon drum has a volume of 0.200 cubic meters. One such drum was filled with a colorless liquid, Sukanol, which has a density of 1.168 g/cm^3. How many kg should this quantity of Sukanol weigh? 1000 cm^3 = 1 L, 1000 L = 1 m^3.

    a. 24.3 kg
*   b. 234 kg
    c. 243 kg
    d. 2.34×10^5 kg
    e. 500 kg

Section 2.5

Difficulty Level: medium

80. The metric equivalent of a 55 gallon drum has a volume of 0.200 cubic meters. One such drum was filled with a colorless liquid, Sukanol, which has a density of 1.168 g/cm^3. How many pounds should this quantity of Sukanol weigh? 1000 cm^3 = 1 L, 1000 L = 1 m^3.

        a. 53.6 lb
    * b. 515 lb
        c. 536 lb
        d. 5.15 × 10^5 lb
        e. 1102 lb

Section 2.5

Difficulty Level: medium

81. A 55.25 gallon container was filled with an industrial solvent whose density is 1.146 g/cm^3. How many kg should the solvent in the container weigh? 1 gallon (gal) = 3.785 liters (L) .

        a. 23.9 kg
    * b. 239.7 kg
        c. 239 kg
        d. 2.39 × 10^5 kg
        e. 500 kg

Section 2.5

Difficulty Level: medium

82. The density of iron is 7.86 g/cm^3. What is the mass (in kg) of 20.00 cubic inches of iron? 1 inch = 2.54 cm, exactly.

        a. 6.46 × 10^{-3} kg
        b. 4.17 × 10^{-2} kg
        c. 0.393 kg
        d. 2.54 kg
    * e. 2.58 kg

Section 2.5

Difficulty Level: medium

83. Acetone has a density of 0.791 g/mL. If 1 gallon = 3.7854 liters, how many kg should the contents of a 5.00 gallon container filled with acetone weigh?

        a. 1.045 kg
        b. 12.6 kg
        c. 13.8 kg
    * d. 15.0 kg
        e. 23.9 kg

Section 2.5
Difficulty Level: hard
84. The density of cadmium metal is 8.642 g/cm^3. Given that 1 foot (ft) = 12 inches (in.), 1 in. = 2.54 cm, and 1 pound (lb) = 453.6 g, what is the density of cadmium in lb/ft^3?

        a. 17.70 lb/ft^3
        b. 141.6 lb/ft^3
    * c. 539.5 lb/ft^3
        d. 263.4 lb/ft^3
        e. 327.7 lb/ft^3

Section 2.5
Difficulty Level: hard
85. The density of chromium metal is 7.20 g/cm^3. Given that 1 foot (ft) = 12 inches (in.), 1 in. = 2.54 cm, and 1 pound (lb) = 453.6 g, what is the density of chromium in lb/ft^3?

        a. 14.7 lb/ft^3
        b. 118 lb/ft^3
    * c. 449 lb/ft^3
        d. 219 lb/ft^3
        e. 393 lb/ft^3

Section 2.5
Difficulty Level: hard
86. The density of copper metal is 8.92 g/cm^3. Given that 1 foot (ft) = 12 inches (in.), 1 in. = 2.54 cm, and 1 pound (lb) = 453.6 g, what is the density of copper in lb/ft^3?

        a. 18.3 lb/ft^3
        b. 146 lb/ft^3
    * c. 557 lb/ft^3
        d. 272 lb/ft^3
        e. 317 lb/ft^3

Section 2.5
Difficulty Level: hard
87. An empty volumetric flask, weighing 27.16 grams, has a volume of 100.4 cm^3. How much would it weigh when filled with bromine, an element that has a density of 3.1028 g/cm^3?

        a. 59.51 g
        b. 284.4 g
        c. 311.5 g
    * d. 338.7 g
        e. 395.8 g

Section 2.5
Difficulty Level: hard
88. Gold has a density of 19.3 g/cm^3. How many pounds does a gold sphere
weigh if it has a diameter of 5.20 inches? 1 pound = 0.4536 kg. The volume of a sphere $= \frac{4}{3}(\pi r^3)$.

        a. 16.3 pounds
        b. 19.7 pounds
    * c. 51.3 pounds
        d. 63.7 pounds
        e. 411 pounds

Section 2.5
Difficulty Level: hard
89. A spherical cannonball which has a volume given by
$$\frac{4}{3}(\pi r^3)$$
is made of an iron alloy and has a diameter of 9.55 inches and a density of 7.89 g/cm^3. How many
pounds does this cannonball weigh? 1 pound = 0.4536 kg, 1 inch = 2.54 cm.

        a. 59.0 pounds
    * b. 1.30×10^2 pounds
        c. 41.4 pounds
        d. 1.24×10^3 pounds
        e. 21.0 pounds

Section 2.5
Difficulty Level: hard
90.   Sulfuric acid has a specific gravity of 1.84 at a certain temperature. If the density of water at the
same temperature is 62.4 pounds per cubic foot, how many cubic feet of the acid will weigh 44.5
kg?

        a. 2.04 ft^3
    * b. 0.854 ft^3
        c. 13.0 ft^3
        d. 1.55 ft^3
        e. 0.0154 ft^3

Fill-in-the-Blank Questions

Section 2.1
Difficulty Level: easy
91. The melting of lithium chloride is an example of a_____ .

Answer: physical change

Section 2.1
Difficulty Level: easy
92. The burning of sulfur is an example of a_____ .

Answer: chemical change

Section 2.1
Difficulty Level: easy
93. The dissolving of glucose in water is a _____.

Answer: physical change

Section 2.1
Difficulty Level: easy
94. Water has a freezing point of 0ºC. This is a _____ of water.

Answer: physical property

Section 2.2
Difficulty Level: medium
95. The SI prefix micro indicates _____.

Answer: 10^{-6}

Section 2.2
Difficulty Level: medium
96. A kilometer is _____ times longer than a centimeter.

Answer: 10^5

Section 2.2
Difficulty Level: medium
97. A 201 g sample weighs _____ mg.

Answer: 2.01×10^5 mg

Section 2.2
Difficulty Level: medium
98. Express the mass, 2.34×10^{-9} g, without scientific notation, and using the appropriate SI prefix

_____.

Answer: 2.34 ng

Section 2.2
Difficulty Level: medium
99. Many home freezers maintain a temperature of 0.0 °F. Express this temperature in $^{\circ}$C. _____

Answer: -17.8 $^{\circ}$C

Section 2.3
Difficulty Level: easy
100. How many significant figures does the number 30.340 contain? _____

Answer: 5

Section 2.3
Difficulty Level: medium
101. How many significant digits are there in the number 1.050×10^{9}? _____

Answer: 4

Section 2.3
Difficulty Level: medium
102. Express the result of the operation, $8.520 + 2.7 - 1.03$, to the proper number of significant digits.

_____

Answer: 10.2

Section 2.4
Difficulty Level: medium
103. What will be the cost, in dollars, of gasoline for a 3170 mile trip in a car pulling a trailer that delivers
13.30 miles per gallon, if the average price of gas is $1.449 cents per gallon? _____

Answer: $345

Section 2.4
Difficulty Level: medium
104. What will be the cost of gasoline for a 4710 mile automobile trip if the car delivers 27.35 miles per
gallon of gasoline, and the average price of gas is $1.249 per gallon? _____

Answer: $215

Section 2.4
Difficulty Level: medium
105. A spot on a microchip which is 7500 nm (nanometers) in diameter is _____ pm (picometers) in diameter.

Answer: 7.5×10^6 pm

Section 2.4
Difficulty Level: medium
106. An object weighing 450 kg, expressed in megagrams (Mg), is _____ Mg.

Answer: 0.45 Mg

Section 2.5
Difficulty Level: easy
107. An organic liquid has a mass of 23.0 g. If the volume of the liquid is 29.75 mL, what is the density of the liquid? _____ (0.773 g/mL)

Section 2.5
Difficulty Level: medium
108. An organic liquid has a mass of 23.0 g. If the liquid has a density of 0.785 g/cm^3, what is the volume of this liquid? _____ (29.3 mL)

Section 2.5
Difficulty Level: hard
109. A metal ball has a radius of 1.42 inches, and a density of 3.94 g/cm^3. What is the mass in grams? _____ (774 g). 2.54 cm = 1 inch

True and False Questions

Section 2.1
Difficulty Level: medium
110. Density is one of the extensive properties of matter. ___

Answer: False

Section 2.1
Difficulty Level: medium
111. The volume of a sample is an extensive property of matter. ___

Answer: True

Section 2.1
Difficulty Level: medium
112. The evaporation of rubbing alcohol is a chemical change. ____

Answer: False

Section 2.2
Difficulty Level: medium
113. A liter of carbon tetrachloride is smaller than a quart of the same substance. ___

Answer: False

Section 2.2
Difficulty Level: medium
114. An increase of one Kelvin in temperature, is a smaller change than an increase of one degree Fahrenheit. ___

Answer: False

Section 2.2
Difficulty Level: medium
115. The measurement, 7.05×10^{-12} m, is the same measurement as 7.05 pm._____

Answer: True

Section 2.3
Difficulty Level: medium
116. A large crowd attending a celebration in a metropolitan area was described as 450,000 in the morning newspaper the next day. A chemistry student stated that, mindful of the purpose of using scientific notation, this should be correctly expressed in scientific notation as 4.50000×10^5. The number expressed this way truly represents the crowd size, true or false? ___

Answer: False

Section 2.3
Difficulty Level: easy
117. Any number known accurately to six or more significant digits is defined as an exact number. ___

Answer: False

Section 2.3
Difficulty Level: easy
118. In determining the number of significant digits in the result of a calculation, exact numbers are considered as having a value to six significant digits. ___

Answer: False

Section 2.3
Difficulty Level: medium
119. Ambiguity in the number of significant digits in a number being expressed can be eliminated by proper use of scientific notation. ___

Answer: True

Section 2.3
Difficulty Level: medium
120. The result of the operation, 8.52010×7.90, should be expressed as 67.3088. ___

Answer: False

Section 2.4
Difficulty Level: medium
121. A 15 km distance run is a shorter run than a 10 mile distance run. ___

Answer: True

Section 2.4
Difficulty Level: medium
122. A 5.00 pound bag of sugar weighs more than a 2.50 kg bag of sugar. ___

Answer: False

Section 2.4
Difficulty Level: medium
123. A piece of carpet which measures 44.0 square yards is smaller than a piece of carpet which measures 44.0 square meters. ___

Answer: True

Section 2.5
Difficulty Level: medium
124. A liquid which has a volume of 8.50 mL, and a mass of 7.05 g, has a density of 0.829 g/cm^3.

Answer: True

Section 2.5
Difficulty Level: medium
125. A liquid has a density of 3.10 g/mL. A 17.7 g sample of this liquid has a volume of 55 mL.

Answer: False

Section 2.5
Difficulty Level: hard
126. The density of a metal reported as 1.74 g/cm^3, also has a density of 1.74 kg/m^3.

Answer: False

Chemistry Outside the Classroom 2.1
Difficulty Level: medium
127. Yeast cells feed on glucose in grape juice to give ethyl alcohol and carbon dioxide during the fermentation reaction.___

Answer: True

Chemistry Outside the Classroom 2.1
Difficulty Level: medium
128. A very quick way to determine the sugar content of grapes is to determine the density of the grape juice using a hydrometer.___

Answer: True

Chemistry Outside the Classroom 2.1
Difficulty Level: medium
129. A sample of wine from grape juice can be distilled to obtain a mixture of alcohol and water.___

Answer: True

Chemistry Outside the Classroom 2.1
Difficulty Level: medium
130. One way to determine the alcohol content of wine is to determine the specific gravity of the wine using a hydrometer.___

Answer: False

Critical Thinking Questions

Section 2.2
Difficulty Level: hard
131. A young high school student has invented a new temperature scale, the Zuban scale (his last name, of course). In common with the Kelvin, Celsius, and Fahrenheit scales, it is a linear scale. According to Zuban,
        1) the boiling point of water which is 100.00 $^\circ$C = 373.15 K = 0.00 $^\circ$Z
        2) the boiling point of sulfur which is 444.60 $^\circ$C = 717.75 K = 250.00 $^\circ$Z
        3) the melting point of silver which is 960.15 $^\circ$C = 1233.30 K = 624.02 $^\circ$Z
Calculate the value of absolute zero on the Zuban Scale. _____

Answer: -270.71 $^\circ$Z

Section 2.2
Difficulty Level: hard
132.   Carl, a ninth grade whiz kid, has invented a new temperature scale, the Vitellan scale (his last name, of course). In common with the Kelvin, Celsius, and Fahrenheit scales, it is a linear scale. According to Carl,

               1) the melting point of benzene which is 5.53 $^{\circ}$C = 0.00 $^{\circ}$V
               2) the boiling point of benzene which is 80.10 $^{\circ}$C = 100.00 $^{\circ}$V
               3) the melting point of lead which is 327.50 $^{\circ}$C = 431.77 $^{\circ}$V

Calculate the value for the melting point of mercury (-38.86 $^{\circ}$C) on the Vitellan scale. _____

Answer: -59.53 $^{\circ}$V

Section 2.3
Difficulty Level: easy
133.   A number resulting from a measurement was properly expressed in scientific notation as 2.1×10^{-3} meters (m). The number could also be correctly written as

    *   a. 0.0021 m
        b. 0.002100 m
        c. 0.00021 m
        d. 2.1000 m
        e. 21000 m

Section 2.3
Difficulty Level: medium
134. Solve the following: $(628.83 – 627.71) \times 124 + 122.08$

Answer: 261

Section 2.3
Difficulty Level: hard
135. Solve the following: $(2.15 \times 10^{6} + 3.2 \times 10^{2})/(2.332 + 22.0005 + 0.9861)$
        a.   1.45
        b.   48.8
        c.   233.1
   * d.   106
        e.   1,080.2

Section 2.4
Difficulty Level: medium
136. If 1 meter = 39.37 inch and 1 foot = 12.00 inch, calculate the relationship to four significant digits, which will convert cubic feet into cubic meters directly. 1 ft^{3} = _____ m^{3}

Answer: 0.02832

Section 2.4
Difficulty Level: hard
137. A home aquarium measures 17.0 inches wide, 17.0 inches long and 8.50 inches high. What is the volume in liters?

Answer: 40.2 L

Section 2.4
Difficulty Level: hard
138. Express 109 miles per hour, in meters per second.

Answer: 48.7 m/s

Section 2.5
Difficulty Level: medium
139. Consider this data from a lab, concerning the mass and the volume of water displaced in a graduated cylinder by introduction of a metal sample to the cylinder:

Mass of weighing cup = 0.452 g
Mass of weighing cup + metal sample = 72.943 g
Volume of water in cylinder = 15.2 cm^3

When the metal sample was carefully lowered into the graduated cylinder, the water above the submerged metal sample rose to the 19.0 cm^3 mark. What is the density of the metal?

    a. 2.2 g cm^{-3}
    b. 3.8 g cm^{-3}
    c. 4.8 g cm^{-3}
  * d. 19 g cm^{-3}
    e. 19.2 g cm^{-3}

Section 2.5
Difficulty Level: hard
140. A spherical cannonball made of an iron alloy has a specific gravity of 7.88, and weighs 22.12 pounds. It has a diameter of 13.46 cm. On the other hand, spent uranium (from processing which removes the commercially important rare isotope) has a specific gravity of 19.05. How many pounds would a uranium cannonball of the same dimensions as the iron cannonball weigh?

volume $\frac{4}{3}(\pi r^3)$ _____

Answer: 53.5 pounds

Section 2.5

Difficulty Level: hard

141. A spherical cannonball made of an iron alloy has a density of 7.86 g/cm³, and weighs 22.12 pounds. On the other hand, spent uranium (from processing which removes the commercially important rare isotope) has a density of 19.05 g/cm³. What would be the diameter, in cm, of a uranium round shot which has exactly twice the weight as the iron ball described above? 1 pound = 0.4536 kg.

volume $\frac{4}{3}(\pi r^3)$ _____

Answer: 12.62 cm

Section 2.5

Difficulty Level: hard

142. Some students in the AP chemistry class have come up with an idea they would like to have tested which involves collaboration with two or three DOD facilities. They want to test two small muzzle loading cannons like the ones used in the 18th century. One would be using spherical cannonballs made of iron, while the other would be using spherical cannonballs made of spent uranium. Both cannons will be using cannonballs with a diameter of 5.000 inches. If uranium has a density of 19.05 g/cm³, what would be the mass, in pounds, of the uranium cannonballs? 1 pound = 453.6 g, 1 inch = 2.54 cm exactly. volume $\frac{4}{3}(\pi r^3)$ _____

Answer: 45.04 pounds

Section 2.5

Difficulty Level: hard

143. Iron has a density of 7.86 g/cm³. As part of their exam, students in the junior class at a boarding school were to weigh a metal sphere, measure its diameter and calculate its density. Some of the seniors sneaked into the lab the weekend before, took the iron sphere, took it downtown, and had the interior partially hollowed and the surface repaired so it wouldn't be noticed and replaced it in the cabinet late on Sunday. The junior students who had this iron sphere for their "unknown" obtained 9.30 cm for the diameter and 2.44 kg for the mass. What value should they have reported for the mass of the sphere if it had not been tampered with, and what was the volume of the hollowed out space in the interior of the sphere? volume $\frac{4}{3}(\pi r^3)$ _____

Answer: 3.31 kg and 111 cm³