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Chapter 2

The Metric System

Key Terms

1. What is the term for the amount of energy required to raise one gram of water one degree on the Celsius scale?
   (a) Calorie
   (B) calorie
   (c) joule
   (d) kilocalorie
   (e) none of the above

2. What is the term for the basic unit of temperature in the metric system?
   (A) Celsius degree (°C)
   (b) Fahrenheit degree (°F)
   (c) Kelvin unit (K)
   (d) all of the above
   (e) none of the above

3. What is the term for a unit that expresses the volume occupied by a cube 1 centimeter on a side?
   (a) cm^2
   (B) cm^3
   (c) mm^2
   (d) mm^3
   (e) none of the above

4. What is the term for the amount of mass in a unit volume?
   (A) density
   (b) specific mass
   (c) specific gravity
   (d) specific volume
   (e) none of the above

5. What is the term for a nondecimal system of measurement without a basic unit for length, mass, or volume?
   (A) English system
   (b) metric system
   (c) International System (SI)
   (d) all of the above
   (e) none of the above

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6. What is the term for a statement of two exactly equal values?
   (A) exact equivalent
   (b) exact value
   (c) identical equivalent
   (d) identical value
   (e) none of the above

7. What is the term for the basic unit of temperature in the English system?
   (a) Celsius degree (°C)
   (B) Fahrenheit degree (°F)
   (c) Kelvin unit (K)
   (d) all of the above
   (e) none of the above

8. What is the term for the basic unit of mass in the metric system?
   (A) gram
   (b) liter
   (c) meter
   (d) second
   (e) none of the above

9. What is the term that refers to the flow of energy from an object at a higher temperature to an object at a lower temperature?
   (a) calorie
   (B) heat
   (c) joule
   (d) specific heat
   (e) none of the above

10. What is the term that refers to a measurement system with seven base units?
   (a) English system
   (b) metric system
   (C) International System (SI)
   (d) all of the above
   (e) none of the above

11. What is the term for a unit of energy in the SI system?
   (a) Calorie
   (b) calorie
   (C) joule
   (d) kilocalorie
   (e) none of the above

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12. What is the term for the base unit of temperature in the SI system?
    (a) Celsius degree (°C)
    (b) Fahrenheit degree (°F)
    (C) Kelvin unit (K)
    (d) all of the above
    (e) none of the above

13. What is the term for the basic unit of volume in the metric system?
    (a) gram
    (B) liter
    (c) meter
    (d) second
    (e) none of the above

14. What is the term for the basic unit of length in the metric system?
    (a) gram
    (b) liter
    (C) meter
    (d) second
    (e) none of the above

15. What is the term for a decimal system of measurement with basic units for length, mass, and volume?
    (a) English system
    (B) metric system
    (c) troy system
    (d) all of the above
    (e) none of the above

16. What is the term that expresses the amount of a single quantity compared to an entire sample; an expression of parts per hundred parts?
    (A) percent
    (b) proportion
    (c) quotient
    (d) reciprocal
    (e) none of the above

17. What is the term for the relationship between a fraction and its inverse?
    (a) percent
    (b) proportion
    (c) ratio
    (D) reciprocal
    (e) none of the above

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18. What is the term for the basic unit of time in the metric system?
    (a) gram
    (b) liter
    (c) meter
    (D) second
    (e) none of the above

19. What is the term for the ratio of the density of a substance compared to the density of water at 4 °C?
    (a) density
    (b) specific mass
    (C) specific gravity
    (d) specific volume
    (e) none of the above

20. What is the term for the amount of energy required to raise one gram of any substance one degree on the Celsius scale?
    (a) calorie
    (b) heat
    (C) specific heat
    (d) joule
    (e) none of the above

21. What is the term for the average energy of molecules in motion?
    (a) heat
    (b) joule
    (c) specific heat
    (D) temperature
    (e) none of the above

22. What is the term for a systematic method of problem solving which proceeds from a given value to a desired value by the conversion of units?
    (a) algebraic analysis
    (b) metric analysis
    (c) problem analysis
    (D) unit analysis
    (e) none of the above

23. What is the term for a statement of two equivalent quantities?
    (a) unit analysis
    (B) unit equation
    (c) unit equivalent
    (d) unit factor
    (e) none of the above

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24. What is the term for the ratio of two equivalent quantities?
    (a) unit analysis
    (b) unit equation
    (c) unit equivalent
    (D) unit factor
    (e) none of the above

25. What is the term for the technique of determining the volume of a solid or a gas by measuring the volume of water it displaces?
    (a) volume by calculation
    (b) volume by difference
    (C) volume by displacement
    (d) volume by immersion
    (e) none of the above

Section 2.1 Basic Units and Symbols

1. Which of the following is a basic unit and symbol in the metric system?
    (a) meter (m)
    (b) gram (g)
    (c) liter (L)
    (D) all of the above
    (e) none of the above

2. Which of the following is a basic unit and symbol in the metric system?
    (a) centimeter (cm)
    (b) kilogram (kg)
    (c) milliliter (mL)
    (d) all of the above
    (E) none of the above

3. Which of the following is a basic unit and symbol in the metric system?
    (a) decimeter (dm)
    (b) gram (gm)
    (C) liter (L)
    (d) all of the above
    (e) none of the above

4. What is the symbol for the metric unit micrometer?
    (a) cm
    (b) mm
    (c) Mm

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(D) µm
(e) none of the above

5. What is the symbol for the metric unit nanogram?
   (a) mg
   (b) Ng
   (C) ng
   (d) µg
   (e) none of the above

6. What is the symbol for the metric unit microliter?
   (a) cL
   (b) mL
   (c) ML
   (D) µL
   (e) none of the above

7. What is the name corresponding to the metric symbol km?
   (a) kilomega
   (B) kilometer
   (c) kilomicro
   (d) kilomilli
   (e) none of the above

8. What is the name corresponding to the metric symbol dg?
   (a) decagram
   (B) decigram
   (c) dekagram
   (d) dekigram
   (e) none of the above

9. What is the name corresponding to the metric symbol mL?
   (a) megaliter
   (b) metroliter
   (c) microliter
   (D) milliliter
   (e) none of the above

10. What quantity is expressed by the metric unit centimeter?
    (A) length
    (b) mass
    (c) volume
    (d) time
    (e) none of the above

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11. What quantity is expressed by the metric unit kilogram?
    (a) length
    (B) mass
    (c) volume
    (d) time
    (e) none of the above
12. What quantity is expressed by the metric unit milliliter?
    (a) length
    (b) mass
    (C) volume
    (d) time
    (e) none of the above

Section 2.2 Metric Conversion Factors

13. According to the metric system, 1 Tm = _____ m.
    (A) 1×10^{12}
    (b) 1×10^{9}
    (c) 1×10^{-9}
    (d) 1×10^{-12}
    (e) none of the above

14. According to the metric system, 1 Gg = _____ g.
    (a) 1×10^{12}
    (B) 1×10^{9}
    (c) 1×10^{-9}
    (d) 1×10^{-12}
    (e) none of the above

15. According to the metric system, 1 ML = _____ L.
    (A) 1×10^{6}
    (b) 1×10^{3}
    (c) 1×10^{-3}
    (d) 1×10^{-6}
    (e) none of the above

16. According to the metric system, 1 ks = _____ s.
    (a) 1×10^{6}
    (B) 1×10^{3}

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(c) 1×10^{-3}

(d) 1×10^{-6}

(e) none of the above

17. According to the metric system, 1 m = _____ dm.

(a) 1×10^{2}

(B) 1×10^{1}

(c) 1×10^{-1}

(d) 1×10^{-2}

(e) none of the above

18. According to the metric system, 1 g = _____ cg.

(A) 1×10^{2}

(b) 1×10^{1}

(c) 1×10^{-1}

(d) 1×10^{-2}

(e) none of the above

19. According to the metric system, 1 L = _____ mL.

(A) 1×10^{3}

(b) 1×10^{2}

(c) 1×10^{-2}

(d) 1×10^{-3}

(e) none of the above

20. According to the metric system, 1 s = _____ µs.

(a) 1×10^{9}

(B) 1×10^{6}

(c) 1×10^{-6}

(d) 1×10^{-9}

(e) none of the above

21. According to the metric system, 1 s = _____ ns.

(a) 1×10^{12}

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(B) 1×10^{9}

(c) 1×10^{-9}

(d) 1×10^{-12}

(e) none of the above

22. According to the metric system, 1 s = _____ ps.

(A) 1×10^{12}

(b) 1×10^{9}

(c) 1×10^{-9}

(d) 1×10^{-12}

(e) none of the above

Section 2.3 Metric–Metric Conversions

23. What is the *first step* in the unit analysis method of problem solving?

(A) Write down the unit asked for in the answer.
(b) Write down the given value related to the answer.
(c) Apply a unit factor to convert a unit in the given value.
(d) Round off the answer in the calculator display.
(e) none of the above

24. What is the *second step* in the unit analysis method of problem solving?

(a) Write down the unit asked for in the answer.
(B) Write down the given value related to the answer.
(c) Apply a unit factor to convert a unit in the given value.
(d) Round off the answer in the calculator display.
(e) none of the above

25. What is the *third step* in the unit analysis method of problem solving?

(a) Write down the unit asked for in the answer.
(b) Write down the given value related to the answer.
(C) Apply a unit factor to convert a unit in the given value.
(d) Round off the answer in the calculator display.
(e) none of the above

26. What is the three-step sequence in applying the unit analysis method?

(a) 1–unknown unit, 2–unit factor, 3–relevant given value
(B) 1–unknown unit, 2–relevant given value, 3–unit factor
(c) 1–relevant given value, 2–unknown unit, 3–unit factor

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(d) 1–unit factor, 2–unknown unit, 3–relevant given value
(e) 1–unit factor, 2–relevant given value, 3–unknown unit

27. What is the three-step sequence in applying the unit analysis method?
(a) 1–unit factor, 2–unknown unit, 3–relevant given value
(b) 1–unit factor, 2–relevant given value, 3–unknown unit
(C) 1–unknown unit, 2–relevant given value, 3–unit factor
(d) 1–unknown unit, 2–unit factor, 3–relevant given value
(e) 1–relevant given value, 2–unknown unit, 3–unit factor

28. What is the three-step sequence in applying the unit analysis method?
(a) 1–relevant given value, 2–unknown unit, 3–unit factor
(b) 1–unit factor, 2–unknown unit, 3–relevant given value
(c) 1–unknown unit, 2–unit factor, 3–relevant given value
(D) 1–unknown unit, 2–relevant given value, 3–unit factor
(e) 1–unit factor, 2–relevant given value, 3–unknown unit

29. Which of the following unit factors is derived from 1 meter = 100 centimeters?
(a) 1 m/1 cm
(b) 100 cm/100 m
(C) 1 m/100 cm
(d) 1 cm/100 m
(e) none of the above

30. Which of the following unit factors is derived from 1 kilogram = 1000 grams?
(a) 1 g/1 kg
(b) 1000 kg/1000 g
(c) 1 g/1000 kg
(D) 1 kg/1000 g
(e) none of the above

31. Which of the following unit factors is derived from 1 liter = 1000 milliliters?
(a) 1 L/1 mL
(b) 1000 mL/1000 L
(C) 1 L/1000 mL
(d) 1 mL/1000 L
(e) none of the above

32. If a 20.0 mL test tube measures 15.0 cm, what is the length in meters?
(A) 0.150 m
(b) 1.50 m
(c) 15.0 m
(d) 1500 m
(e) none of the above

33. If a 250 mL beaker weighs 95.4 g, what is the mass in kilograms?
(A) 0.0954 kg
(b) 0.954 kg

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(c) 95.4 kg
(d) 95,400 kg
(e) none of the above

34. If a 125 mL Erlenmeyer flask weighs 88.5 g, what is the volume in liters?
(A) 0.125 L
(b) 1.25 L
(c) 125 L
(d) 125,000 L
(e) none of the above

35. If an automobile airbag inflates in 25 µs, what is the time in seconds?
(A) 0.000 025 s
(b) 0.000 25 s
(c) 25,000 s
(d) 25,000,000 s
(e) none of the above

36. If a downhill ski measures 185 cm, what is the length in decimeters?
(a) 1.85 dm
(B) 18.5 dm
(c) 1850 dm
(d) 18,500 dm
(e) none of the above

37. If a glass marble weighs 3150 mg, what is the mass in centigrams?
(a) 3.15 cg
(b) 31.5 cg
(C) 315 cg
(d) 31,050 cg
(e) none of the above

38. If a can of soda contains 355 mL, what is the volume in deciliters?
(a) 0.355 dL
(B) 3.55 dL
(c) 35.5 dL
(d) 3550 dL
(e) none of the above

39. If a computer chip switches off-on-off in 0.015 µs, what is the switching time in nanoseconds?
(a) 0.000 000 015 ns
(b) 0.000 015 ns
(C) 15 ns
(d) 15,000 ns
(e) none of the above

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40. If Earth is 1.50×10^{8} km from the Sun, what is the distance in Tm?

(A) 1.50×10^{-1} Tm

(b) 1.50×10^{2} Tm

(c) 1.50×10^{5} Tm

(d) 1.50×10^{23} Tm

(e) none of the above

41. If Earth is 1.50×10^{8} km from the Sun, what is the distance in Gm?

(a) 1.50×10^{-1} Gm

(B) 1.50×10^{2} Gm

(c) 1.50×10^{5} Gm

(d) 1.50×10^{20} Gm

(e) none of the above

42. If Earth is 1.50×10^{8} km from the Sun, what is the distance in Mm?

(a) 1.50×10^{-1} Mm

(b) 1.50×10^{2} Mm

(C) 1.50×10^{5} Mm

(d) 1.50×10^{17} Mm

(e) none of the above

43. If the radius of a potassium atom is 2.27×10^{-7} mm, what is the radius in µm?

(a) 2.27×10^{-16} µm

(b) 2.27×10^{-10} µm

(C) 2.27×10^{-4} µm

(d) 2.27×10^{5} µm

(e) none of the above

44. If the radius of a silicon atom is 1.18×10^{-8} cm, what is the radius in nm?

(a) 1.18×10^{-15} nm

(b) 1.18×10^{-10} nm

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(C) 1.18×10^{-1} nm

(d) 1.18×10^{3} nm

(e) none of the above

45. If the radius of a nickel atom is 1.25×10^{-9} dm, what is the radius in pm?

(a) 1.25×10^{-20} pm

(b) 1.25×10^{-18} pm

(c) 1.25×10^{-10} pm

(D) 1.25×10^{2} pm

(e) none of the above

Section 2.4 Metric–English Conversions

46. Which of the following English–metric equivalents is correct?

(a) 1 in. = 2.54 cm

(b) 1 lb = 454 g

(c) 1 qt = 946 mL

(D) all of the above

(e) none of the above

47. Which of the following English–metric equivalents is correct?

(a) 1 in. = 454 cm

(b) 1 lb = 2.54 g

(C) 1 qt = 946 mL

(d) all of the above

(e) none of the above

48. Which of the following English–metric equivalents is correct?

(a) 1 in. = 2.54 cm

(b) 1 lb = 454 g

(c) 1 qt = 946 mL

(d) 1 sec = 1.00 s

(E) all of the above

49. Which of the following unit factors is derived from 1 meter = 39.4 inches?

(a) 1 m/1 in.

(B) 1 m/39.4 in.

(c) 39.4 in./39.4 m

(d) 1 in./39.4 m

(e) none of the above

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50. Which of the following unit factors is derived from 1 kilogram = 2.20 pounds?
    (a) 1 kg/1 lb
    (B) 1 kg/2.20 lb
    (c) 1 lb/1 kg
    (d) 1 lb/2.20 kg
    (e) none of the above

51. Which of the following unit factors is derived from 1 liter = 1.06 quarts?
    (a) 1 L/1 qt
    (B) 1 L/1.06 qt
    (c) 1 qt/1 L
    (d) 1 qt/1.06 L
    (e) none of the above

52. If a copper wire is 195 cm long, what is the length in inches?
    (a) 43.0 in.
    (B) 76.8 in.
    (c) 195 in.
    (d) 495 in.
    (e) 885 in.

53. If a silver chain has a mass of 25.0 g, what is the mass in pounds?
    (A) 0.0551 lb
    (b) 0.0264 lb
    (c) 18.1 lb
    (d) 37.8 lb
    (e) 11,400 lb

54. If a water bottle contains 375 mL, what is the volume in quarts?
    (A) 0.396 qt
    (b) 0.826 qt
    (c) 1.21 qt
    (d) 2.52 qt
    (e) 355,000 qt

55. If the Moon is 246,000 miles from Earth, what is the distance in kilometers?
    (Given: 1 mi = 1.61 km)
    (a) 0.000 006 54 km
    (b) 15,300 km
    (c) 153,000 km
    (D) 396,000 km
    (e) 3,960,000 km

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56. If 842 pounds of Moon samples have been collected from lunar landings, what is the mass expressed in kilograms? (Given: 1 kg = 2.20 lb)
    (a) 309 kg
    (B) 383 kg
    (c) 3830 kg
    (d) 1850 kg
    (e) 11,100 kg

57. If an automobile gas tank holds 17.4 gallons, what is the volume in liters?
(Given: 1 gal = 3.785 L)
    (a) 0.218 L
    (b) 3.785 L
    (c) 4.60 L
    (d) 17.4 L
    (E) 65.9 L

58. If a 10K race is 10.0 km, what is the distance in yards?
(Given: 1 yd = 0.914 m)
    (a) 0.00914 yd
    (b) 0.0109 yd
    (c) 9140 yd
    (d) 10,000 yd
    (E) 10,900 yd

59. If the mass of Mars is 6.42×10^{23} kg, what is the mass in pounds?
(Given: 1 lb = 454 g)
    (a) 1.41×10^{18} lb
    (b) 2.91×10^{23} lb
    (c) 6.42×10^{23} lb
    (D) 1.41×10^{24} lb
    (e) 2.91×10^{24} lb

60. If a patient is injected with 0.500 L of IV saline, what is the volume in quarts?
(Given: 1 qt = 946 mL)
    (a) 5.29×10^{-7} qt
    (b) 0.500 qt
    (C) 0.529 qt
    (d) 4.73 qt
    (e) 4.73×10^{5} qt

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61. If a 125 micron tissue slice is 125 µm thick, what is the thickness in inches?
    (a) 4.92×10^{-7} in.
    (B) 4.92×10^{-3} in.
    (c) 3.18×10^{-2} in.
    (d) 3.18×10^{6} in.
    (e) 4.92×10^{9} in.

62. If 500 mL of liquid mercury weighs 6.53 kg, what is the mass in pounds?
    (a) 1.44 lb
    (b) 2.96 lb
    (c) 7.19 lb
    (D) 14.4 lb
    (e) 2960 lb

63. If 10.0 kg of water occupies 10.0 liters, what is the volume in quarts?
    (a) 9.46×10^{6} qt
    (B) 10.6 qt
    (c) 10.0 qt
    (d) 9.46 qt
    (e) 1.06×10^{-5} qt

Section 2.5 The Percent Concept

64. A sample of white gold is: 18.0 g gold, 3.0 g silver, 2.0 g cobalt, and 1.0 g platinum. What is the percent platinum in the sample?
    (A) 4.2%
    (b) 8.3%
    (c) 13%
    (d) 25%
    (e) 75%

65. A sample of rose gold is: 12.0 g gold, 5.0 g silver, and 7.0 g copper. What is the percent copper in the sample?
    (a) 12%
    (B) 29%
    (c) 50%
    (d) 58%
    (e) 75%

66. A sample of lime gold is: 14.0 g gold, 7.0 g silver, and 3.0 g copper. What is the percent copper in the sample?

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(a) 3.0%
(B) 13%
(c) 29%
(d) 58%
(e) 67%

67. A sample of 10K gold contains the following: 10.0 g gold, 4.0 g silver, 5.0 g copper, and 5.0 g nickel. What is the percent gold in the sample?
(a) 10%
(b) 14%
(C) 42%
(d) 58%
(e) 71%

68. A sample of 18K gold contains the following: 18.0 g gold, 3.0 g silver, and 3.0 g copper. What is the percent gold in the sample?
(a) 6.0%
(b) 18%
(c) 25%
(d) 33%
(E) 75%

69. A sample of 22K gold contains the following: 22 g gold, 1.0 g silver, and 1.0 g copper. What is the percent gold in the sample?
(a) 1.0%
(b) 4.5%
(c) 9.1%
(D) 92%
(e) 96%

70. Sterling silver contains 925 parts silver and 75 parts copper by mass. What is the percent silver in sterling silver in the sample?
(a) 7.50%
(b) 8.11%
(c) 12.3%
(D) 92.5%
(e) 100%

71. Sterling silver contains 925 parts silver and 75 parts copper by mass. What is the percent copper in sterling silver in the sample?
(A) 7.5%
(b) 8.1%
(c) 12%
(d) 93%
(e) 100%

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72. A 1980 penny has a mass of 3.015 g and is 95.0% copper. What is the mass of copper in the coin?
    (a) 0.151 g
    (b) 0.286 g
    (c) 0.603 g
    (d) 1.51 g
    (E) 2.86 g

73. A 1980 penny has a mass of 3.015 g and is 5.00% zinc. What is the mass of zinc in the coin?
    (A) 0.151 g
    (b) 0.286 g
    (c) 0.603 g
    (d) 1.51 g
    (e) 2.86 g

74. A 2015 penny has a mass of 2.507 g and is 2.5% copper. What is the mass of copper in the coin?
    (A) 0.063 g
    (b) 0.24 g
    (c) 0.63 g
    (d) 2.4 g
    (e) 6.3 g

75. A 2015 penny has a mass of 2.507 g and is 97.5% zinc. What is the mass of zinc in the coin?
    (a) 0.0627 g
    (b) 0.244 g
    (c) 0.627 g
    (d) 2.38 g
    (E) 2.44 g

76. If a 5¢ coin has a mass of 5.07 g and is 75.0% copper, what is the mass of copper in the coin?
    (a) 0.203 g
    (b) 0.676 g
    (c) 1.27 g
    (d) 1.69 g
    (E) 3.80 g

77. If a 5¢ coin has a mass of 5.07 g and is 25.0% nickel, what is the mass of nickel in the coin?
    (a) 0.203 g
    (b) 0.676 g
    (C) 1.27 g
    (d) 1.69 g
    (e) 3.80 g

78. Stainless steel is an alloy of iron, chromium, nickel, and manganese metals. If a 5.00 g sample is 18.0% chromium, what is the mass of chromium in the sample?

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(a) 0.0450 g
(b) 0.0900 g
(c) 0.450 g
(D) 0.900 g
(e) 1.80 g

79. Stainless steel is an alloy of iron, chromium, nickel, and manganese metals. If a 5.00 g sample is 10.5% nickel, what is the mass of nickel in the sample?
(a) 0.0263 g
(b) 0.0525 g
(c) 0.263 g
(D) 0.525 g
(e) 1.05 g

80. Stainless steel is an alloy of iron, chromium, nickel, and manganese metals. If a 5.00 g sample is 2.00% manganese, what is the mass of manganese in the sample?
(a) 0.00500 g
(b) 0.0100 g
(c) 0.0500 g
(D) 0.100 g
(e) 0.200 g

81. Sterling silver is composed of 92.5% silver and 7.5% copper. If a sterling silver ring contains 6.55 g of silver, what is the mass of the ring?
(a) 0.0708 g
(b) 0.491 g
(c) 6.06 g
(D) 7.08 g
(e) 87.3 g

82. A ruby contains 52.7% aluminum, 47.1% oxygen, and traces of chromium. If the ruby contains 0.125 g of aluminum, what is the mass of the gemstone?
(a) 0.0659 g
(b) 0.125 g
(C) 0.237 g
(d) 0.265 g
(e) 0.625 g

83. A sapphire contains 52.7% aluminum, 47.1% oxygen, and traces of titanium. If the sapphire contains 0.155 g of oxygen, what is the mass of the gemstone?
(a) 0.0730 g
(b) 0.155 g
(c) 0.294 g
(D) 0.329 g
(e) 0.775 g

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Section 2.6 Volume by Calculation

84. If a brass rectangular solid measures 3.80 cm by 2.55 cm by 1.25 cm, what is the volume of the solid?
    (a) 0.0826 cm^3
    (b) 1.19 cm^3
    (c) 1.86 cm^3
    (d) 7.75 cm^3
    (E) 12.1 cm^3

85. If a copper rectangular solid measures 5.15 cm by 1.25 cm by 1.25 cm, what is the volume of the solid?
    (a) 0.124 cm^3
    (b) 3.30 cm^3
    (c) 4.12 cm^3
    (d) 6.44 cm^3
    (E) 8.05 cm^3

86. If a stainless steel rectangular solid measures 5.05 cm by 1.50 cm by 1.25 cm, what is the volume of the solid?
    (a) 0.106 cm^3
    (b) 2.69 cm^3
    (c) 4.21 cm^3
    (d) 6.06 cm^3
    (E) 9.47 cm^3

87. A sheet of aluminum foil has a volume of 0.555 cm^3. If the foil measures 10.0 cm by 10.0 cm, what is the thickness of the foil?
    (a) 0.000 555 cm
    (B) 0.005 55 cm
    (c) 0.0555 cm
    (d) 55.5 cm
    (e) 180 cm

88. A sheet of tin foil has a volume of 0.645 mm^3. If the foil measures 10.0 mm by 12.5 mm, what is the thickness of the foil?
    (a) 0.000 516 mm
    (B) 0.005 16 mm
    (c) 0.0516 mm
    (d) 80.6 mm

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(e) 194 mm

89. A sheet of gold foil has a volume of 0.750 cm^3. If the foil measures 50.0 cm by 10.0 cm, what is the thickness of the foil?
    (a) 0.000 150 cm
    (B) 0.001 50 cm
    (c) 0.0150 cm
    (d) 375 cm
    (e) 667 cm

90. If a brass solid has a volume of 46.5 cm^3, what is the volume in cubic inches?
    (A) 2.84 $in.^3$
    (b) 7.21 $in.^3$
    (c) 18.3 $in.^3$
    (d) 118 $in.^3$
    (e) 762 $in.^3$

91. If a bronze solid has a volume of 25.5 cm^3, what is the volume in cubic inches?
    (A) 1.56 $in.^3$
    (b) 3.95 $in.^3$
    (c) 10.0 $in.^3$
    (d) 64.8 $in.^3$
    (e) 418 $in.^3$

92. If a copper solid has a volume of 8.75 cm^3, what is the volume in cubic inches?
    (A) 0.534 $in.^3$
    (b) 1.36 $in.^3$
    (c) 3.44 $in.^3$
    (d) 22.2 $in.^3$
    (e) 143 $in.^3$

Section 2.7 Volume by Displacement

93. A piece of jade is added to a 100-mL graduated cylinder with 50.0 mL of water. If the resulting water level is 60.5 mL, what is the volume of the jade?
    (A) 10.5 mL
    (b) 39.5 mL
    (c) 50.0 mL
    (d) 89.5 mL
    (e) none of the above

94. A piece of jade is added to a 100-mL graduated cylinder with 45.0 mL of water. If the resulting water level is 60.5 mL, what is the volume of the jade?
    (A) 15.5 mL
    (b) 39.5 mL

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(c) 55.0 mL
(d) 84.5 mL
(e) none of the above

95. A piece of jade is added to a 100-mL graduated cylinder with 55.5 mL of water. If the resulting water level is 68.0 mL, what is the volume of the jade?
(A) 12.5 mL
(b) 32.0 mL
(c) 44.5 mL
(d) 87.5 mL
(e) none of the above

96. A sample of baking soda is heated and releases carbon dioxide gas into a 1000-mL flask. If the flask initially contains 555 mL of water and 101 mL remain after the gas has displaced a portion of the water, what is the volume of the gas?
(a) 101 mL
(b) 445 mL
(C) 454 mL
(d) 899 mL
(e) none of the above

97. A sample of baking soda is heated and releases carbon dioxide gas into a 1000-mL flask. If the flask initially contains 655 mL of water and 203 mL remain after the gas has displaced a portion of the water, what is the volume of the gas?
(a) 203 mL
(b) 345 mL
(C) 452 mL
(d) 797 mL
(e) none of the above

98. A sample of baking soda is heated and releases carbon dioxide gas into a 1000-mL flask. If the flask initially contains 752 mL of water and 305 mL remain after the gas has displaced a portion of the water, what is the volume of the gas?
(a) 248 mL
(b) 305 mL
(C) 447 mL
(d) 695 mL
(e) none of the above

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Section 2.8 The Density Concept

99. A glass cylinder contains four liquid layers: mercury (d = 13.6 g/mL), chloroform (d = 1.49 g/mL), water (d = 1.00 g/mL), ether (d = 0.708 g/mL). If a cork stopper (d = 0.50 g/mL) is dropped into the cylinder, where does it come to rest?
    (A) on top of the ether layer
    (b) on top of the water layer
    (c) on top of the chloroform layer
    (d) on top of the mercury layer
    (e) on the bottom of the cylinder

100. A glass cylinder contains four liquid layers: mercury (d = 13.6 g/mL), chloroform (d = 1.49 g/mL), water (d = 1.00 g/mL), and ether (d = 0.708 g/mL). If an ice cube (d = 0.92 g/mL) is dropped into the cylinder, where does it come to rest?
    (a) on top of the ether layer
    (B) on top of the water layer
    (c) on top of the chloroform layer
    (d) on top of the mercury layer
    (e) on the bottom of the cylinder

101. A glass cylinder contains four liquid layers: mercury (d = 13.6 g/mL), chloroform (d = 1.49 g/mL), water (d = 1.00 g/mL), ether (d = 0.708 g/mL). If a rubber stopper (d = 1.2 g/mL) is dropped into the cylinder, where does it come to rest?
    (a) on top of the ether layer
    (b) on top of the water layer
    (C) on top of the chloroform layer
    (d) on top of the mercury layer
    (e) on the bottom of the cylinder

102. A glass cylinder contains four liquid layers: mercury (d = 13.6 g/mL), chloroform (d = 1.49 g/mL), water (d = 1.00 g/mL), and ether (d = 0.708 g/mL). If a marble (d = 2.7 g/mL). is dropped into the cylinder, where does it come to rest?
    (a) on top of the ether layer
    (b) on top of the water layer
    (c) on top of the chloroform layer
    (D) on top of the mercury layer
    (e) on the bottom of the cylinder

103. A glass cylinder contains four liquid layers: mercury (d = 13.6 g/mL), chloroform (d = 1.49 g/mL), water (d = 1.00 g/mL), ether (d = 0.708 g/mL). If a gold nugget (d = 19.3 g/mL) is dropped into the cylinder, where does it come to rest?
    (a) on top of the ether layer
    (b) on top of the water layer
    (c) on top of the chloroform layer
    (d) on top of the mercury layer
    (E) on the bottom of the cylinder

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104. If the density of air is 1.29 g/L, which of the following is a unit factor?
    (a) 1 g/1 L
    (b) 1 g/1.29 L
    (C) 1.29 g/1 L
    (d) 1.29 g/1.29 L
    (e) 1.29 L/1 g

105. If the density of alcohol is 0.813 g/mL, which of the following is a unit factor?
    (a) 1 g/1 mL
    (b) 1 g/0.813 mL
    (C) 0.813 g/1 mL
    (d) 0.813 g/0.813 mL
    (e) 0.813 mL/1 g

106. If the density of silver is 10.5 g/cm^3, which of the following is a unit factor?
    (a) 1 g/1 cm^3
    (b) 1 g/10.5 cm^3
    (C) 10.5 g/1 cm^3
    (d) 10.5 g/10.5 cm^3
    (e) 10.5 cm^3/1 g

107. A 10.0 mL volume of alcohol has a mass of 7.89 g. What is the density of the alcohol in grams per milliliter?
    (a) 0.0789 g/mL
    (B) 0.789 g/mL
    (c) 7.89 g/mL
    (d) 10.0 g/mL
    (e) 78.9 g/mL

108. A 10.0 mL volume of ether has a mass of 7.14 g. What is the density of the ether in grams per milliliter?
    (a) 0.0714 g/mL
    (B) 0.714 g/mL
    (c) 7.14 g/mL
    (d) 10.0 g/mL
    (e) 71.4 g/mL

109. A 10.0 cm^3 volume of alcohol has a mass of 0.00705 kg. What is the density of the alcohol in grams per cubic centimeter?
    (a) 0.0705 g/cm^3
    (B) 0.705 g/cm^3
    (c) 7.05 g/cm^3
    (d) 10.0 g/cm^3
    (e) 70.5 g/cm^3

110. A 10.0 mL volume of mercury has a mass of 0.136 kg. What is the density of mercury in grams per milliliter?

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(a) 1.36 g/mL
(b) 7.35 g/mL
(C) 13.6 g/mL
(d) 73.5 g/mL
(e) 136 g/mL

111. A block of aluminum has a mass of 39.589 g and measures 5.10 cm by 2.50 cm by 1.15 cm. What is the density of the rectangular aluminum block?
(a) 0.370 g/cm^3
(B) 2.70 g/cm^3
(c) 3.11 g/cm^3
(d) 14.7 g/cm^3
(e) 22.3 g/cm^3

112. A block of copper has a mass of 143.584 g and measures 5.05 cm by 2.55 cm by 1.25 cm. What is the density of the rectangular copper block?
(a) 0.112 g/cm^3
(B) 8.92 g/cm^3
(c) 11.1 g/cm^3
(d) 28.4 g/cm^3
(e) 29.0 g/cm^3

113. Osmium metal is one of the most dense elements (22.5 g/cm^3). What is the mass of 10.0 cm^3 of the metal?
(a) 0.444 g
(b) 2.25 g
(c) 22.5 g
(D) 225 g
(e) 444 g

114. The density of ether is 0.714 g/mL. What is the mass of 10.0 mL of ether?
(a) 0.0714 g
(b) 1.40 g
(C) 7.14 g
(d) 14.0 g
(e) 71.4 g

115. The density of ethanol is 0.789 g/mL. What is the volume of 35.5 g of ethanol?
(a) 2.80 mL
(b) 4.50 mL
(c) 28.0 mL
(D) 45.0 mL
(e) 280 mL

116. Platinum metal is one of the most dense elements (d = 21.5 g/cm^3). What is the volume of a 10.0 g sample of the metal?
(A) 0.465 cm^3

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(b) 2.15 cm^3
(c) 21.5 cm^3
(d) 215 cm^3
(e) 465 cm^3

117. Magnesium metal is one of the least dense elements (d = 1.74 g/cm^3). What is the volume of a 10.0 g sample of the metal?
(A) 5.75 cm^3
(b) 10.0 cm^3
(c) 17.4 cm^3
(d) 57.5 cm^3
(e) 174 cm^3

Section 2.9 Temperature

118. What are the freezing point and boiling point of water on the Fahrenheit scale?
(a) –32 °F and 212 °F
(b) 0 °F and 100 °F
(c) 0 °F and 212 °F
(d) 32 °F and 100 °F
(E) 32 °F and 212 °F

119. What are the freezing point and boiling point of water on the Celsius scale?
(A) 0 °C and 100 °C
(b) 0 °C and 212 °C
(c) 32 °C and 100 °C
(d) 32 °C and 212 °C
(e) 273 °C and 373 °C

120. What are the freezing point and boiling point of water on the Kelvin scale?
(a) 0 K and 100 K
(b) 0 K and 273 K
(c) 100 K and 273 K
(d) 100 K and 373 K
(E) 273 K and 373 K

121. Table salt melts at 801 °C. What is the melting point on the Fahrenheit scale?
(a) 427 °F
(b) 1384 °F
(c) 1410 °F
(D) 1470 °F
(e) 1490 °F

122. An antifreeze solution freezes at –100 °C. What is the freezing point on the Fahrenheit scale?
(a) –212 °F

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(B) –148 °F
(c) –88 °F
(d) –82 °F
(e) –73 °F

123. Aluminum melts at 1220 °F. What is the melting point on the Celsius scale?
(a) 646 °C
(B) 660 °C
(c) 696 °C
(d) 2138 °C
(e) 2164 °C

124. Rubbing alcohol freezes at –129 °F. What is the freezing point on the Celsius scale?
(a) –290 °C
(b) –200 °C
(c) –103 °C
(D) –89.4 °C
(e) –54 °C

125. Liquid hydrogen boils at –252 °C. What is the boiling point on the Kelvin scale?
(a) –525 K
(b) –252 K
(c) –21 K
(D) 21 K
(e) 525 K

126. Liquid argon boils at –186 °C. What is the boiling point on the Kelvin scale?
(a) –459 K
(b) –186 K
(c) –87 K
(D) 87 K
(e) 459 K

127. Liquid krypton boils at –152 °C. What is the temperature on the Kelvin scale?
(a) –425 K
(b) –152 K
(c) –121 K
(D) 121 K
(e) 425 K

128. Liquid helium boils at 4 K. What is the boiling point on the Celsius scale?
(a) –277 °C

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(B) –269 °C
(c) 4 °C
(d) 269 °C
(e) 277 °C

129. Liquid neon boils at 27 K. What is the boiling point on the Celsius scale?
(a) –300 °C
(B) –246 °C
(c) 27 °C
(d) 246 °C
(e) 300 °C

130. Liquid xenon boils at 166 K. What is the boiling point on the Celsius scale?
(a) –439 °C
(B) –107°C
(c) 166 °C
(d) 107°C
(e) 439 °C

Section 2.10 The Heat Concept

131. What is the difference between a cup of tea at 95 °C, and a drop of tea at 95 °C?
(a) Temperature is greater in the cup of tea.
(b) Temperature is greater in the drop of tea.
(C) Heat is greater in the cup of tea.
(d) Heat is greater in the drop of tea.
(e) none of the above

132. What is the difference between a cup of tea at 95 °C, and a drop of tea at 95 °C?
(A) Heat is greater in the cup of tea.
(b) Heat is greater in the drop of tea.
(c) Temperature is greater in the cup of tea.
(d) Temperature is greater in the drop of tea.
(e) none of the above

133. Which of the following can express the *total* amount of heat energy in a sealed, insulated chamber?
(a) 20.0 °C
(b) 68.0 °F
(c) 293.0 K
(D) 20.0 kcal

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(e) all of the above

134. Which of the following can express the *average* amount of heat energy in a sealed, insulated chamber?
(A) 20.0 °C
(b) 68.0 cal
(c) 293.0 kcal
(d) 20.0 J
(e) all of the above

135. When 100.0 g of gasoline undergoes combustion, 9560 kJ of energy is released. Express the heat released in kilocalories. (Given: 4.184 kJ = 1 kcal)
(a) 2.28×10^0 kcal
(B) 2.28×10^3 kcal
(c) 2.28×10^6 kcal
(d) 4.00×10^4 kcal
(e) 4.00×10^7 kcal

136. When 100.0 g of gasoline undergoes combustion, 2280 kcal of energy is released. Express the heat released in kilojoules. (Given: 4.184 kJ = 1 kcal)
(a) 9.54×10^0 kJ
(B) 9.54×10^3 kJ
(c) 9.54×10^6 kJ
(d) 5.45×10^4 kJ
(e) 5.45×10^7 kJ

General Exercises

137. Which of the following are basic units and symbols in the English system?
(a) inch (in.), ounce (oz), pint (pt)
(b) foot (ft), pound (lb), quart (qt)
(c) yard (yd), pound (lb), gallon (gal)
(d) mile (mi), ton (ton), gallon (gal)
(E) The English system does not have basic units.

138. Which of the following are base units and symbols in the International system?
(a) centimeter (cm), gram (g), second (s)
(b) meter (m), gram (g), second (s)
(C) meter (m), kilogram (kg), second (s)
(d) kilometer (km), kilogram (kg), second (s)
(e) The International system does not have base units.

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139. In performing a multistep multiplication or division calculation, when should you round off the answer in the calculator display?
    (a) after each step in the calculation
    (b) after the first unit factor
    (c) after the second unit factor
    (D) after the final calculation
    (e) none of the above

140. How many significant digits are justified by the unit factor 1 m/100 cm?
    (a) 1
    (b) 2
    (c) 3
    (D) infinite
    (e) impossible to determine

141. How many significant digits are justified by the unit factor 1 lb/454 g?
    (a) 1
    (b) 2
    (C) 3
    (d) infinite
    (e) impossible to determine

142. How many significant digits are justified by the unit factor 1 qt/946 mL?
    (a) 1
    (b) 2
    (C) 3
    (d) infinite
    (e) impossible to determine

143. Which of the following is equivalent to the volume of a 1-cm cube?
    (a) 1 L
    (b) 1 cL
    (c) 1 dL
    (d) 1 kL
    (E) 1 mL

144. Which of the following is equivalent to the volume of a 10-cm cube?
    (A) 1 L
    (b) 1 cL
    (c) 1 dL
    (d) 1 kL
    (e) 1 mL

145. Which of the following is equivalent to the volume of a 1.00-L flask?

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(a) 1.00 cm^3
(b) 10.0 cm^3
(c) 100 cm^3
(d) 946 cm^3
(E) 1000 cm^3

146. If a diamond weighs 1.33 carats, what is the mass in grams?
(Given: 1 ct = 200 mg)
(a) 0.133 g
(b) 0.150 g
(c) 0.200 g
(D) 0.266 g
(e) 6.65 g

147. An Apple iPhone has a mass of 112 g. What is its weight in ounces?
(Given: 1 lb = 454 g; 1 lb = 16 oz)
(a) 0.0154 oz
(b) 0.247 oz
(C) 3.95 oz
(d) 1790 oz
(e) 3180 oz

148. An Apple iPad has a mass of 652 g. What is its weight in ounces?
(Given: 1 lb = 454 g; 1 lb = 16 oz)
(a) 0.0898 oz
(c) 1.44 oz
(C) 23.0 oz
(d) 40.8 oz
(e) 18,500 oz

149. An Apple iPad has a thickness of 9.4 mm. What is its thickness in inches?
(Given: 1 in. = 2.54 cm; 1 cm = 10 mm)
(a) 0.0239 in.
(b) 0.239 in.
(C) 0.370 in.
(d) 3.70 in.
(e) 37.0 in.

150. How many minutes for sunlight to travel from the Sun to Earth? (Assume the Sun is 93,000,000 miles from Earth and sunlight travels at 1.86×10^5 miles per second.)
(a) 0.0020 minute
(b) 2.0 minutes
(C) 8.3 minutes

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(d) 500 minutes
(e) 830 minutes

151. How many minutes for sunlight to travel from the Sun to Mars? (Assume the Sun is 2.28×10^8 kilometers from Mars and sunlight travels at 2.99×10^5 kilometers per second.)
(a) 0.00131 minutes
(b) 0.0787 minutes
(C) 12.7 minutes
(d) 763 minutes
(e) 45,800 minutes

152. A hybrid vehicle has a mileage rating of 22 km/L. What is the gas mileage in miles per gallon? (Given: 1 mi = 1.61 km, and 1 gal = 3.78 L)
(a) 3.6 mi/gal
(b) 9.4 mi/gal
(c) 35 mi/gal
(D) 52 mi/gal
(e) 130 mi/gal

153. An Indianapolis racecar car can travel 111 m/s. What is the speed of the car in miles per hour? (Given: 1 mi = 1.61 km, and 1 h = 3600 s)
(a) 111 mi/h
(b) 178 mi/h
(C) 248 mi/h
(d) 400 mi/h
(e) 643 mi/h

154. The Washington Monument capstone is composed of 1.00% iron, 0.75% silicon, 0.30% manganese, 0.05% copper, 0.02% tin, 0.01% sodium, and aluminum. What is the percentage of aluminum in the capstone?
(a) 2.13%
(b) 50.00%
(c) 95.74%
(D) 97.87%
(e) 100.00%

155. Why is a sterling silver spoon smaller than a stainless steel spoon of the same weight?
(a) sterling silver is less valuable than stainless steel
(b) sterling silver is more valuable than stainless steel
(c) sterling silver is less dense than stainless steel
(D) sterling silver is more dense than stainless steel
(e) none of the above

156. The density of water is 1.00 g/mL at 3.98 °C. What is the density of water in g/cm^3?
(A) 1.00 g/cm^3
(b) 2.54 g/cm^3

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(c) 3.98 g/cm^3
(d) 16.4 g/cm^3
(e) 62.4 g/cm^3

157. The density of water is 1.00 g/mL at 4 °C. What is the density of water in kg/L?
(A) 1.00 kg/L
(b) 2.54 kg/L
(c) 3.98 kg/L
(d) 16.4 kg/L
(e) 62.4 kg/L

158. The density of carbon tetrachloride is 1.60 g/cm^3. What is the density of the liquid expressed in SI units (kg/m^3)?
(a) 0.160 kg/m^3
(b) 1.60 kg/m^3
(c) 16.0 kg/m^3
(D) 1.60 x 10^3 kg/m^3
(e) 1.60 x 10^6 kg/m^3

159. Calculate the volume of Earth assuming it is spherical and has a radius (r) of 6370 km. The volume of a sphere equals 4 $\pi r^3/3$, and $\pi = 3.14$.
(a) 2.58 x 10^{11} km^3
(b) 3.45 x 10^{11} km^3
(c) 6.37 x 10^{11} km^3
(d) 1.03 x 10^{12} km^3
(E) 1.08 x 10^{12} km^3

160. Calculate a length of copper wire having a diameter of 0.200 cm and a mass of 15.620 g. The density of copper is 8.92 g/cm^3. The volume of copper wire equals πd^2 L/4, $\pi = 3.14$, d = diameter, and L = length.
(a) 1.80 x 10^{-4} cm
(b) 4.00 x 10^{-4} cm
(c) 5.50 x 10^{-2} cm
(d) 1.75 cm
(E) 55.8 cm

A CLOSER LOOK Metric Labels

1. What is the metric volume of a 12-ounce can of soda as currently shown on the label?
(a) 354 mL

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(b) 354.75 mL
(C) 355 mL
(d) 12 fl oz
(e) 12 oz

2. Which of the following indicates metric length on a product label?
(A) 25.0 cm
(b) 25.0 g
(c) 25.0 oz
(d) 25.0 mL
(e) 25.0 fl oz

3. Which of the following indicates metric mass on a product label?
(a) 25.0 cm
(B) 25.0 g
(c) 25.0 oz
(d) 25.0 mL
(e) 25.0 fl oz

4. Which of the following indicates metric volume on a product label?
(a) 25.0 cm
(b) 25.0 g
(c) 25.0 oz
(D) 25.0 mL
(e) 25.0 fl oz

CHEMISTRY CONNECTION The Olympics

1. Which Olympic running race is nearly equal in length to a quarter mile?
(a) 100 meters
(b) 200 meters
(C) 400 meters
(d) 1000 meters
(e) 2000 meters

2. Which Olympic swimming race is nearly equal in length to 100 yards?
(A) 100 meters
(b) 200 meters
(c) 500 meters
(d) 50 kilometers
(e) 100 kilometers

3. Which Olympic skiing race is nearly equal in length to 10 kilometers?
(a) 5000 yards
(B) 10,000 yards

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(c) 10 miles
(d) 15 miles
(e) 20 miles

4. Which of the following is a running event in the Olympic Summer Games?
   (a) 100 feet
   (b) 100 yards
   (c) 100 furlongs
   (D) 100 meters
   (e) 100 miles

5. Which of the following is a swimming event in the Olympic Summer Games?
   (a) 50 feet
   (b) 50 yards
   (c) 50 furlongs
   (D) 50 meters
   (e) 50 miles

6. Which of the following is a skiing event in the Olympic Winter Games?
   (a) 1000 feet
   (b) 100 yards
   (c) 10 miles
   (D) 10 kilometers
   (e) all of the above

A CLOSER LOOK Lower Gasoline Bills

1. At which of the following temperatures is it most economical to fill a gas tank?
   (a) 50 °C
   (b) 40 °C
   (c) 30 °C
   (d) 20 °C
   (E) 10 °C

2. At which of the following temperatures is it most economical to fill a gas tank?
   (A) 40 °F
   (b) 50 °F
   (c) 60 °F
   (d) 70 °F
   (e) 80 °F

3. With the exception of ice floating in water, what is the only other substance that is less dense in the solid state than the liquid state?
   (a) acetone

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(B) ammonia
(c) chloroform
(d) ethanol
(e) gasoline

4. What are the only two liquids that violate the principle of greater density at temperatures below their freezing points?
   (a) acetone and turpentine
   (B) ammonia and water
   (c) chloroform and ether
   (d) ethanol and methanol
   (e) gasoline and diesel fuel

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