

Chapter 01: Introduction

7. Choose the response that includes all the items listed below that are pure substances.
i. orange juice ii. steam iii. ocean water iv. oxygen v. vegetable soup
A) i, iii, v B) ii, iv C) i, iii, iv D) iv only E) all of them are pure
9. Which one of the following is an example of a *physical* property?
A) dynamite explodes D) ice floats on top of liquid water
B) meat rots if it is not refrigerated E) a silver platter tarnishes
C) gasoline burns
11. All of the following are properties of sodium. Which one is a *physical* property of sodium?
A) It is a surface turns black when first exposed to air.
B) It is a solid at 25°C and changes to a liquid when heated to 98°C.
C) When placed in water it sizzles and a gas is formed.
D) When placed in contact with chlorine it forms a compound that melts at 801°C.
E) Sodium is never found as the pure metal in nature.
13. Which one of the following represents a *chemical* change?
A) boiling water to form steam
B) burning a piece of coal
C) heating lead until it melts
D) mixing iron filings and sand at room temperature
E) breaking glass
15. The SI prefixes *nano* and *deci* represent, respectively:
A) 10^{-9} and 10^{-6} . D) 10^9 and 10^{-6} .
B) 10^6 and 10^{-3} . E) 10^{-9} and 10^{-1} .
C) 10^3 and 10^{-3} .
17. The SI prefixes *kilo* and *centi* represent, respectively:
A) 10^3 and 10^{-2} . D) 10^{-6} and 10^2 .
B) 10^6 and 10^{-1} . E) 10^2 and 10^{-3} .
C) 10^{-3} and 10^{-2} .

19. A microliter corresponds to:
A) 10^{-2} liters. B) 10^{-3} liters. C) 10^{-6} liters. D) 10^{-9} liters. E) 10^{-12} liters.
21. 2.4 km is how many millimeters?
A) 2,400 mm D) 2.4×10^6 mm
B) 2.4×10^4 mm E) 2.4×10^{-5} mm
C) 2.4×10^5 mm
23. Express 7,500 nm as picometers.
A) 7.50 pm B) 75.0 pm C) 750 pm D) 7.5×10^6 pm E) 7.5×10^{12} pm
25. In 1828, the diameter of the U.S. dime was changed to approximately 18 mm. What is this diameter when expressed in nanometers?
A) 1.8×10^9 nm D) 1.8×10^{-5} nm
B) 1.8×10^7 nm E) 1.8×10^{-10} nm
C) 1.8×10^1 nm
27. Lead melts at 601.0°C . What temperature is this in $^\circ\text{F}$?
A) 302°F B) 365°F C) $1,050^\circ\text{F}$ D) $1,082^\circ\text{F}$ E) $1,114^\circ\text{F}$
29. Many home freezers maintain a temperature of 0°F . Express this temperature in $^\circ\text{C}$.
A) -32°C B) -18°C C) 0°C D) 18°C E) 57.6°C
31. Dry ice (carbon dioxide) changes from a solid to a gas at -78.5°C . What is this temperature in $^\circ\text{F}$?
A) -173°F
B) -12.6°F
C) -109°F
D) -75.6°F
E) none of them are within 2°F of the right answer
33. Liquid nitrogen boils at -195.8°C . Express the boiling point of liquid nitrogen in $^\circ\text{F}$.
A) -384.4°F B) -352.4°F C) -320.4°F D) -140.8°F E) -76.8°F

35. Express the number 0.000053 in scientific notation.
 A) 5.3×10^{-2} B) 5.3×10^{-3} C) 5.3×10^{-4} D) 5.3×10^{-5} E) 5.3×10^{-6}
37. How many significant figures are there in 1.3070 g?
 A) 6 B) 5 C) 4 D) 3 E) 2
39. Express the fraction 1/51 in scientific notation to 3 significant figures.
 A) $2 \times 10^{-2.00}$ D) 1.97×10^{-2}
 B) $2.0 \times 10^{-2.00}$ E) 2.00×10^{-2}
 C) 1.96×10^{-2}
41. How many significant figures does the result of the following operation contain?
 8.52010×7.9
 A) 2 B) 3 C) 4 D) 5 E) 6
43. How many significant figures does the result of the following sum contain?
 $8.520 + 2.7$
 A) 1 B) 2 C) 3 D) 4 E) 5
45. Do the indicated arithmetic and give the answer to the correct number of significant figures.
 $(1.5 \times 10^{-4} \times 61.3) + 2.01 =$
 A) 2.0192 B) 2.0 C) 2.019 D) 2.02 E) 2.019195
47. How many cubic inches are in 1.00 liter?
 A) 61.0 in³ B) 155 in³ C) 394 in³ D) 1.64×10^4 in³ E) none of them
49. A US barrel is 4.21 cubic feet. Express this volume in liters.
 A) 3.99×10^{-5} L B) 1.99×10^{-2} L C) 19.9 L D) 105 L E) 119 L

65. A block of iron has a mass of 483 g. What is the mass of a block of graphite that has the same volume as the block of iron? The following densities at 25°C are provided: magnesium, 1.7 g/cm³; graphite, 1.8 g/cm³; iron, 7.9 g/cm³.
- A) 110 g
 B) 2120 g
 C) 6870 g
 D) 34 g
 E) none of them are within 10 g of the right answer.
67. The density of lead is 11.4 g/cm³ at 25°C. Calculate the volume occupied by 25.0 g of lead.
- A) 2.19 cm³ B) 0.456 cm³ C) 285 cm³ D) 1.24 cm³ E) 6.05 cm³
69. Iridium is essentially tied with osmium for the distinction of being called the “densest element” with a density of 22.5 g/cm³. What would be the mass in pounds of a 1.0 ft × 1.0 ft × 1.0 ft cube of iridium? (1 lb = 453.6 g)
- A) 1.5 lb B) 5.2 lb C) 6.20 lb D) 1.4 × 10³ lb E) 6.4 × 10⁵ lb
71. The Hope diamond weighs 44.0 carats. Determine the volume occupied by the diamond, given that its density is 3.5 g/cm³ at 20°C, and that 1 carat = 0.200 g.
- A) 2.5 cm³ B) 0.40 cm³ C) 0.016 cm³ D) 63 cm³ E) 150 cm³
73. The density of mercury is 13.6 g/cm³. What is the mass in pounds of 1.0 gallons of mercury? (1 lb = 453.6 g; 1 gal = 3.785 L)
- A) 0.11 lb B) 30. lb C) 51 lb D) 83 lb E) 110 lb
75. The "escape velocity" from Earth (the speed required to escape Earth's gravity) is 2.5 × 10⁴ miles per hour. What is this speed in m/s? (1 mile = 1609 m)
- A) 4.2 × 10⁻³ m/s D) 1.1 × 10⁴ m/s
 B) 6.9 m/s E) 4.0 × 10⁷ m/s
 C) 4.2 × 10² m/s
77. Iron has a density of 7.87 g/cm³. What mass of iron would be required to cover a football playing surface of 120 yds × 60 yds to a depth of 1.0 mm? (1 inch = 2.54 cm; 1 lb = 453.6 g)
- A) 6.4 × 10³ lb D) 4.7 × 10⁷ lb
 B) 6.4 × 10⁴ lb E) 4.7 × 10⁸ lb
 C) 1.0 × 10⁵ lb

79. How many cubic centimeters of an ore containing only 0.22% gold (by mass) must be processed to obtain \$100 worth of gold? The density of the ore is 8.0 g/cm^3 and the price of gold is \$818 per troy ounce. ($14.6 \text{ troy oz} = 1.0 \text{ ordinary pound}$, called an avoirdupois pound;
1 lb = 454 g)
- A) 0.48 cm^3 D) $1.7 \times 10^3 \text{ cm}^3$
B) 220 cm^3 E) $1.8 \times 10^4 \text{ cm}^3$
C) $1.4 \times 10^3 \text{ cm}^3$
81. Radio waves travel at the speed of light, which is $3.00 \times 10^8 \text{ m/s}$. How many kilometers will radio messages travel in exactly one year?
- A) $9.46 \times 10^{15} \text{ km}$ D) $9.46 \times 10^{12} \text{ km}$
B) $7.30 \times 10^8 \text{ km}$ E) $3.33 \times 10^{-3} \text{ km}$
C) $7.10 \times 10^{10} \text{ km}$
83. The recommended daily allowance (RDA) of calcium is 1.2 g. Calcium carbonate contains 12.0% calcium by mass. How many grams of calcium carbonate are needed to provide the RDA of calcium?
- A) 0.10 g B) 0.14 g C) 1.2 g D) 10 g E) 14 g
85. The radius of the Earth is approximately 6370 km. If one could dig down straight towards the center of the Earth, one would find that the innermost 3480 km (the core) has an average density of about $11. \text{ g/cm}^3$. Above that are the mantle and crust. If the average density of the Earth is 5.5 g/cm^3 , what is the average density of the Earth's mantle and crust? (Recall that the volume of a sphere is given by $V = (4/3)\pi r^3$.)
- A) $57. \text{ g/cm}^3$ D) 5.3 g/cm^3
B) 4.5 g/cm^3 E) not enough data is provided
C) 8.7 g/cm^3
87. An object will float at the surface of a liquid if the mass of the object is less than the mass of the liquid that it displaces. A spherical vessel (diameter = 2.00 cm) when empty has a mass of 2.00 g. What is the greatest volume of water that can be placed in the vessel and still have the vessel float at the surface of water? (Given: density of water = 1.00 g/cm^3)
- A) 2.00 mL
B) 31.5 mL
C) 2.19 mL
D) 4.19 mL
E) the vessel will not float even when empty

89. One of the common intravenous fluids, called physiological saline, is a homogeneous mixture of NaCl in water. In this mixture, 0.89% of the mass is contributed by the NaCl. What mass of NaCl is found in 450. mL of physiological saline?
(Given: density of physiological saline = 1.005 g/cm^3)
A) 2.0 g B) 4.0 g C) 5.1 g D) 508 g E) 400 g
91. A particular flask has a mass of 17.4916 g when empty. When filled with ordinary water at 20.0°C (density = 0.9982 g/mL), the mass of the flask is now 43.9616 g. The density of so-called “heavy water” at 20.0°C is 1.1053 g/mL . What will the mass of the flask be when filled with heavy water at 20.0°C ?
A) 29.2573 g B) 46.8016 g C) 46.7489 g D) 29.3100 g E) 43.9140 g