Chapter 2

Suggested end-of-chapter questions

1. Why is it necessary to include units when reporting scientific measurements?

3. Why is scientific notation useful?

5. When do zeros count as significant digits and when don't they count?
6. How many significant digits are there in exact numbers? What kinds of numbers are exact?
7. What limits the number of significant digits in a calculation involving only multiplication and division?
8. What limits the number of significant digits in a calculation involving only addition and subtraction?
9. How do we determine significant figures in calculations involving both addition/subtraction and multiplication/division?

11. What are the basic SI units of length, mass, and time?

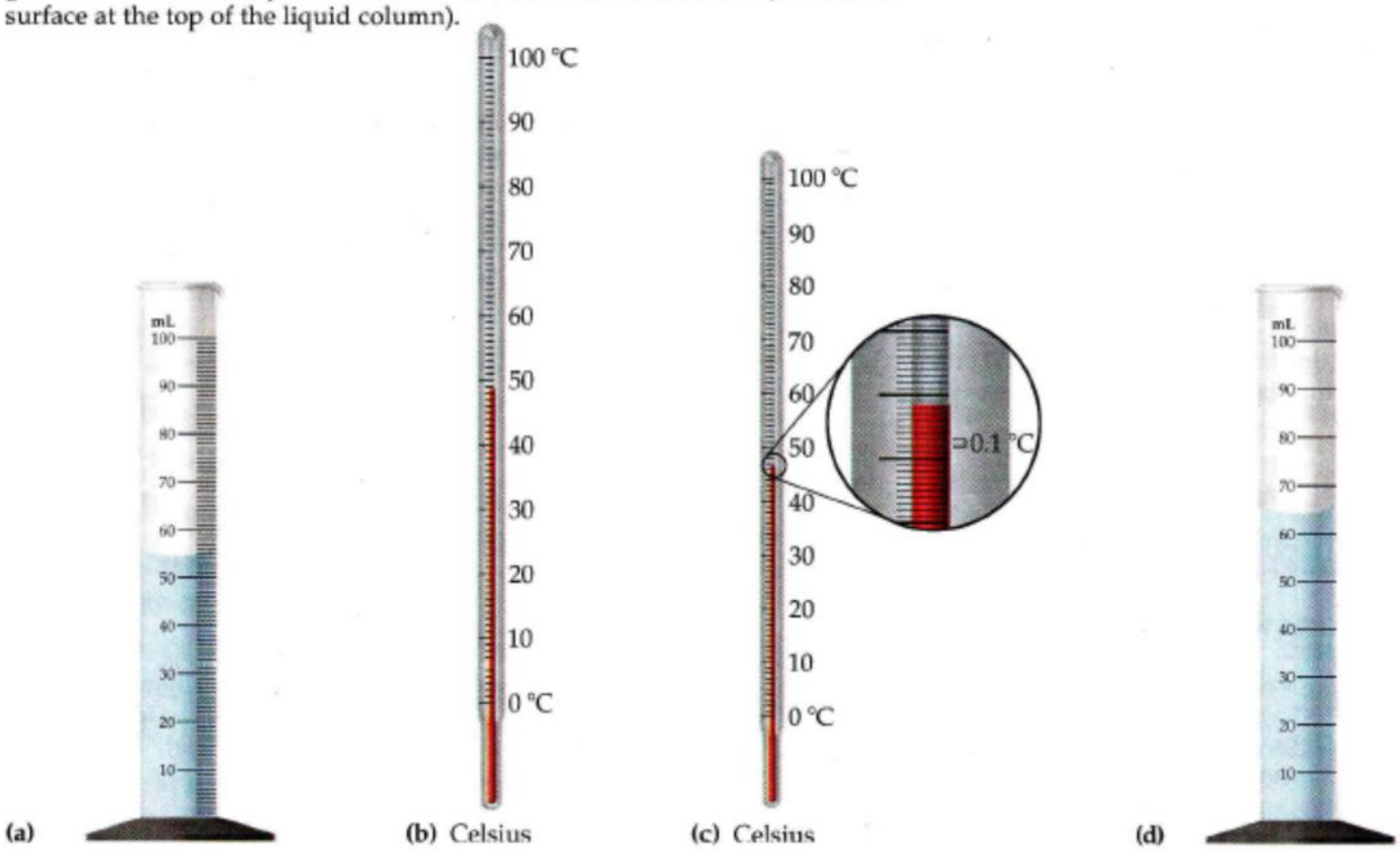
21. Write the conversion factor that converts a measurement in inches to feet. How does the conversion factor change for converting a measurement in feet to inches?
22. Write conversion factors for each.
    (a) miles to kilometers
    (b) kilometers to miles
    (c) gallons to liters
    (d) liters to gallons

29. What is density? Explain why density can work as a conversion factor. Between what quantities does it convert?

31. Express each number in scientific notation.
    (a) 37,692,000 (population of California)
    (b) 1,360,000 (population of Hawaii)
    (c) 19,306,000 (population of New York)
    (d) 568,000 (population of Wyoming)

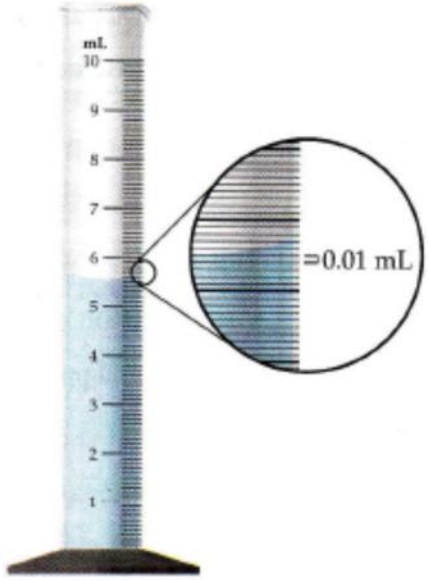
33. Express each number in scientific notation.
    (a) 0.00000000007461 m (length of a hydrogen–hydrogen chemical bond)
    (b) 0.0000158 mi (number of miles in an inch)
    (c) 0.000000632 m (wavelength of red light)
    (d) 0.000015 m (diameter of a human hair)

41. Read each instrument to the correct number of significant figures. Laboratory glassware should always be read from the bottom of the *meniscus* (the curved surface at the top of the liquid column).

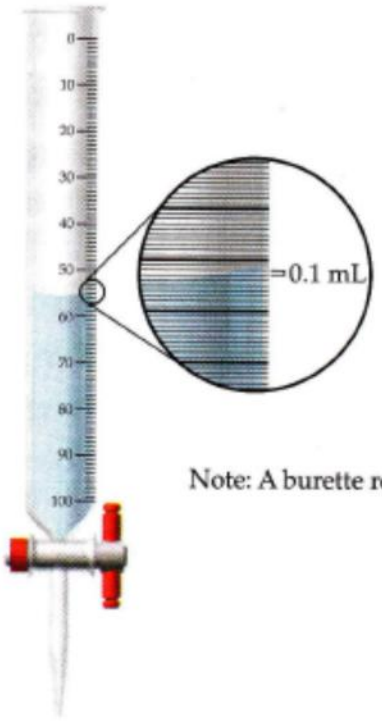


(a) (b) Celsius (c) Celsius (d)

42. Read each instrument to the correct number of significant figures. Laboratory glassware should always be read from the bottom of the meniscus (the curved surface at the top of the liquid column).



(a)



(b)

Note: A burette reads from the top down.

(c)

Note: A pipette reads from the top down.

(d)

Note: Digital balances normally display mass to the correct number of significant figures for that particular balance.

43. For each measured quantity, underline the zeros that are significant and draw an *X* through the zeros that are not.

(a) 0.005050 m
(b) 0.0000000000000060 s
(c) 220,103 kg
(d) 0.00108 in.

44. For each measured quantity, underline the zeros that are significant and draw an *X* through the zeros that are not.

(a) 0.00010320 s
(b) 1,322,600,324 kg
(c) 0.0001240 in.
(d) 0.02061 m

45. How many significant figures are in each measured quantity?

(a) 0.001125 m
(b) 0.1125 m
(c) 1.12500×10^4 m
(d) 11205 m

47. Correct any entries in the table that are wrong.

Quantity	Significant Figures
(a) 895675 m	6
(b) 0.000869 kg	6
(c) 0.5672100 s	5
(d) 6.022×10^{23} atoms	4

49. Round each number to four significant figures.

(a) 255.98612
(b) 0.0004893222
(c) 2.900856×10^{-4}
(d) 2,231,479

55. Round the number on the left to the number of significant figures indicated by the example in the first row. (Use scientific notation as needed to avoid ambiguity.)

Number	Rounded to 4 Significant Figures	Rounded to 2 Significant Figures	Rounded to 1 Significant Figure
1.45815	1.458	1.5	1
8.32466			
84.57225			
132.5512			

57. Perform each calculation to the correct number of significant figures.

(a) $4.5 \times 0.03060 \times 0.391$
(b) $5.55 \div 8.97$
(c) $(7.890 \times 10^{12}) \div (6.7 \times 10^4)$
(d) $67.8 \times 9.8 \div 100.04$

61. Perform each calculation to the correct number of significant figures.

(a) $87.6 + 9.888 + 2.3 + 10.77$

(b) $43.7 - 2.341$

(c) $89.6 + 98.33 - 4.674$

(d) $6.99 - 5.772$

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63. Correct any answers that have the incorrect number of significant figures.

(a) $(3.8 \times 10^5) - (8.45 \times 10^5) = -4.7 \times 10^5$

(b) $0.00456 + 1.0936 = 1.10$

(c) $8475.45 - 34.899 = 8440.55$

(d) $908.87 - 905.34095 = 3.5291$

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65. Perform each calculation to the correct number of significant figures.

(a) $(78.4 - 44.889) \div 0.0087$

(b) $(34.6784 \times 5.38) + 445.56$

(c) $(78.7 \times 10^5 \div 88.529) + 356.99$

(d) $(892 \div 986.7) + 5.44$

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67. Correct any answers that have the incorrect number of significant figures.

(a) $(78.56 - 9.44) \times 45.6 = 3152$

(b) $(8.9 \times 10^5 \div 2.348 \times 10^2) + 121 = 3.9 \times 10^3$

(c) $(45.8 \div 3.2) - 12.3 = 2$

(d) $(4.5 \times 10^3 - 1.53 \times 10^3) \div 34.5 = 86$

69. Perform each conversion.

(a) 3.55 kg to grams

(b) 8944 mm to meters

(c) 4598 mg to kilograms

(d) 0.0187 L to milliliters

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71. Perform each conversion.

(a) 5.88 dL to liters

(b) 3.41×10^{-5} g to micrograms

(c) 1.01×10^{-8} s to nanoseconds

(d) 2.19 pm to meters

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73. Perform each conversion.

(a) 22.5 in. to centimeters

(b) 126 ft to meters

(c) 825 yd to kilometers

(d) 2.4 in. to millimeters

78. Complete the table.

s	ms	μs	ns	ps
1.31×10^{-4} s	____	131 μs	____	____
____	____	____	____	12.6 ps
____	____	____	155 ns	____
____	1.99×10^{-3} ms	____	____	____
____	____	8.66×10^{-5} μs	____	____

79. Convert 2.255×10^{10} g to each unit.
(a) kg
(b) Mg
(c) mg
(d) metric tons (1 metric ton = 1000 kg)

80. Convert 1.88×10^{-6} g to each unit.
(a) mg
(b) cg
(c) ng
(d) μg

87. Fill in the blanks.
(a) $1.0\ km^2 =$ _____ m^2
(b) $1.0\ cm^3 =$ _____ m^3
(c) $1.0\ mm^3 =$ _____ m^3

89. The hydrogen atom has a volume of approximately $6.2 \times 10^{-31}\ m^3$. What is this volume in each unit?
(a) cubic picometers
(b) cubic nanometers
(c) cubic angstroms (1 angstrom = 10^{-10} m)

92. A classroom has a volume of 285 m^3. What is its volume in each unit?
(a) km^3
(b) dm^3
(c) cm^3

97. Glycerol is a syrupy liquid often used in cosmetics and soaps. A 2.50-L sample of pure glycerol has a mass of 3.15×10^3 g. What is the density of glycerol in grams per cubic centimeter?

101. Ethylene glycol (antifreeze) has a density of 1.11 g/cm^3.
(a) What is the mass in grams of 387 mL of ethylene glycol?
(b) What is the volume in liters of 3.46 kg of ethylene glycol?

105. A block of metal has a volume of 13.4 $in.^3$ and weighs 5.14 lb. What is its density in grams per cubic centimeter?

109. A typical backyard swimming pool holds 150 yd^3 of water. What is the mass in pounds of the water?

121. An aluminum sphere has a mass of 25.8 g. Find the radius of the sphere. (The density of aluminum is 2.7 g/cm^3, and the volume of a sphere is given by the equation $V = \frac{4}{3}\pi r^3$.)