

2.11: Exercises

2.1: Taking Measurements

1. Identify the unit in each quantity.

- a. 2 boxes of crayons
- b. 3.5 grams of gold

Answer

- a. boxes of crayons
- b. grams of gold

2. Identify the unit in each quantity.

- a. 32 oz of cheddar cheese
- b. 0.045 cm^3 of water

Answer

- a. oz of cheddar cheese
- b. cm^3 of water

3. Identify the unit in each quantity.

- a. 9.58 s (the current world record in the 100 m dash)
- b. 6.14 m (the current world record in the pole vault)

Answer

- a. s
- b. m

4. Identify the unit in each quantity.

- a. 2 dozen eggs
- b. 2.4 km/s (the escape velocity of the moon, which is the velocity you need at the surface to escape the moon's gravity)

Answer

- a. eggs
- b. km/s

2.2: Scientific Notation

5. Express these numbers in scientific notation.

- a. 56.9
- b. 563,100
- c. 0.0804
- d. 0.00000667

Answer

- a. 5.69×10^1
- b. 5.631×10^5
- c. 8.04×10^{-2}

d. 6.67×10^{-6}

6. Express these numbers in scientific notation.

- a. -890,000
- b. 602,000,000,000
- c. 0.0000004099
- d. 0.000000000000011

Answer

- a. -8.9×10^5
- b. 6.02×10^{11}
- c. 4.099×10^{-7}
- d. 1.1×10^{-14}

7. Express these numbers in scientific notation.

- a. 0.00656
- b. 65,600
- c. 4,567,000
- d. 0.000005507

Answer

- a. 6.56×10^{-3}
- b. 6.56×10^4
- c. 4.567×10^6
- d. 5.507×10^{-6}

8. Express these numbers in scientific notation.

- a. 65
- b. -321.09
- c. 0.000077099
- d. 0.000000000218

Answer

- a. 6.5×10^1
- b. -3.2109×10^2
- c. 7.7099×10^{-5}
- d. 2.18×10^{-10}

9. Express these numbers in decimal notation.

- a. 1.381×10^5
- b. 5.22×10^{-7}
- c. 9.998×10^4

Answer

- a. 138,100
- b. 0.000000522
- c. 99,980

10. Express these numbers in decimal notation.

- a. 7.11×10^{-2}
b. 9.18×10^2
c. 3.09×10^{-10}

Answer

- 0.0711
- 918
- 0.000000000309

11. Express these numbers in decimal notation.

- a. 8.09×10^0
b. 3.088×10^{-5}
c. -4.239×10^2

Answer

- 8.09
- 0.00003088
- 423.9

12. Express these numbers in decimal notation.

- 2.87×10^{-8}
- 1.78×10^{11}
- 1.381×10^{-23}

Answer

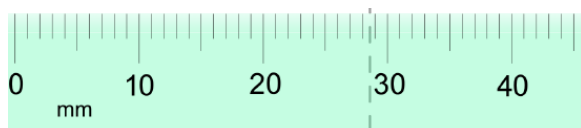
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2.3: Significant Figures

13. Express each measurement to the correct number of significant figures.



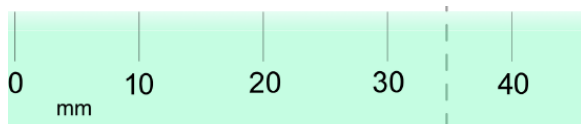
a.



b.



c.



d.

Answer

- a. 6.3 psi
- b. 28.6 mm
- c. 477 psi
- d. 35 mm

14. How many significant figures do these numbers have?

- a. 23
- b. 23.0
- c. 0.00023
- d. 0.0002302

Answer

- a. 2
- b. 3
- c. 2
- d. 4

15. How many significant figures do these numbers have?

- a. 5.44×10^8
- b. 1.008×10^{-5}
- c. 43.09
- d. 0.0000001381

Answer

- a. 3
- b. 4

- c. 4
- d. 4

16. How many significant figures do these numbers have?

- a. 765,890
- b. 765,890.0
- c. 1.2000×10^5
- d. 0.0005060

Answer

- a. 5 or 6, ambiguous
- b. 7
- c. 5
- d. 4

17. How many significant figures do these numbers have?

- a. 0.009
- b. 0.0000009
- c. 65,444
- d. 65,040

Answer

- a. 1
- b. 1
- c. 5
- d. 4 or 5, ambiguous

18. Write the number 87,449 in scientific notation with four significant figures.

Answer

$$8.745 \times 10^4$$

19. Write the number 0.000066600 in scientific notation with five significant figures.

Answer

$$6.6600 \times 10^{-5}$$

20. Write the number 0.0000558 in scientific notation with two significant figures.

Answer

$$5.6 \times 10^{-5}$$

2.4: Significant Figures in Calculations

21. Compute and express each answer with the proper number of significant figures, rounding as necessary.

- a. $56.0 + 3.44 = ?$

- b. $0.00665 + 1.004 = ?$
- c. $45.99 - 32.8 = ?$
- d. $45.99 - 32.8 + 75.02 = ?$

Answer

- a. 59.4
- b. 1.011
- c. 13.2
- d. 88.2

22. Compute and express each answer with the proper number of significant figures, rounding as necessary.

- a. $1.005 + 17.88 = ?$
- b. $5,670.0 - 324 = ?$
- c. $405,007 - 123.3 = ?$
- d. $55.5 + 66.66 - 77.777 = ?$

Answer

- a. 18.89
- b. 5,346
- c. 404,884
- d. 44.4

23. Compute and express each answer with the proper number of significant figures, rounding as necessary.

- a. $56.7 \times 66.99 = ?$
- b. $1.00 \div 77 = ?$
- c. $1.00 \div 77.0 = ?$
- d. $6.022 \times 1.89 = ?$

Answer

- a. 3.80×10^3
- b. 0.013
- c. 0.0130
- d. 11.4

24. Compute and express each answer with the proper number of significant figures, rounding as necessary.

- a. $0.000440 \times 17.22 = ?$
- b. $203,000. \div 0.044 = ?$
- c. $67 \times 85.0 \times 0.0028 = ?$
- d. $999,999 \div 3,310 = ?$

Answer

- a. 0.00758
- b. 4.6×10^6
- c. 16
- d. 302

25. Compute and express each answer with the proper number of significant figures, rounding as necessary.

- a. $67,883 \times 0.004321 = ?$

b. $(9.67 \times 10^3) \times 0.0055087 = ?$

Answer

- a. 293.3
- b. 53.3

26. Compute and express each answer with the proper number of significant figures, rounding as necessary.

- a. $18,900. \times 76.33 \div 0.00336 = ?$
- b. $0.77604 \div 76,003 \times 8.888 = ?$

Answer

- a. 4.29×10^8
- b. 9.075×10^{-5}

2.5: The Metric System

27. Indicate what multiplier each prefix represents.

- a. k
- b. m
- c. M

Answer

- a. 10^3 or $1,000 \times$
- b. 10^{-3} or $\frac{1}{1000} \times$
- c. 10^6 or $1,000,000 \times$

28. Indicate what multiplier each prefix represents.

- a. c
- b. G
- c. μ

Answer

- a. 10^{-2} or $\frac{1}{100} \times$
- b. 10^9 or $1,000,000,000 \times$
- c. 10^{-6} or $\frac{1}{1,000,000} \times$

29. Give the prefix that represents each multiplier.

- a. 10^{-3} or $\frac{1}{1000} \times$
- b. 10^3 or $1,000 \times$
- c. 10^9 or $1,000,000,000 \times$

Answer

- a. m or milli
- b. k or kilo
- c. G or giga

30. Give the prefix that represents each multiplier.

- a. $\frac{1}{1,000,000,000} \times$
- b. $\frac{1}{100} \times$
- c. $1,000,000 \times$

Answer

- a. n or nano
- b. c or centi
- c. M or mega

31. Express each quantity in a more appropriate unit. There may be more than one acceptable answer.

- a. $3.44 \times 10^{-9} \text{ s}$
- b. 3,500 L
- c. 0.045 m

Answer

- a. 3.44 ns
- b. 3.5 kL
- c. 45 mm

32. Express each quantity in a more appropriate unit. There may be more than one acceptable answer.

- a. 0.000066 m/s (Hint: you need consider only the unit in the numerator.)
- b. $4.66 \times 10^6 \text{ s}$
- c. 7,654 L

Answer

- a. 66 $\mu\text{m/s}$
- b. 4.66 Ms
- c. 7.654 kL

33. Express each quantity in a more appropriate unit. There may be more than one acceptable answer.

- a. 43,600 mL
- b. 0.0000044 m
- c. 1,438 ms

Answer

- a. 43.6 L
- b. 4.4 μm
- c. 1.438 s

2.6: Problem Solving and Unit Conversions

34. Write the two conversion factors that exist between the two given units.

- a. milliliters and liters
- b. nanoseconds and seconds
- c. kilometers and meters

Answer

- a.

- b. $\frac{1000 \text{ mL}}{1 \text{ L}}$ and $\frac{1 \text{ L}}{1000 \text{ mL}}$
- c. $\frac{1,000,000,000 \text{ ns}}{1 \text{ s}}$ and $\frac{1 \text{ s}}{1,000,000,000 \text{ ns}}$
- d. $\frac{1 \text{ km}}{1000 \text{ m}}$ and $\frac{1000 \text{ m}}{1 \text{ km}}$

35. Write the two conversion factors that exist between the two given units.

- kilograms and grams
- milliseconds and seconds
- centimeters and meters

Answer

- a. $\frac{1 \text{ kg}}{1000 \text{ g}}$ and $\frac{1000 \text{ g}}{1 \text{ kg}}$
- b. $\frac{1000 \text{ ms}}{1 \text{ s}}$ and $\frac{1 \text{ s}}{1000 \text{ ms}}$
- c. $\frac{100 \text{ cm}}{1 \text{ m}}$ and $\frac{1 \text{ m}}{100 \text{ cm}}$

36. Perform the following conversions.

- 5.4 km to meters
- 0.665 m to millimeters
- 0.665 m to kilometers

Answer

- 5,400 m
- 665 mm
- 6.65×10^{-4} km

37. Perform the following conversions.

- 90.6 mL to liters
- 0.00066 ML to liters
- 750 L to kiloliters

Answer

- 0.0906 L
- 660 L
- 0.75 kL

38. Perform the following conversions.

- 17.8 μg to grams
- 7.22×10^2 kg to grams
- 0.00118 g to nanograms

Answer

- 1.78×10^{-5} g

- b. 7.22×10^5 g
- c. 1.18×10^6 ng

39. Perform the following conversions.

- a. 833 ns to seconds
- b. 5.809 s to milliseconds
- c. 2.77×10^6 s to megaseconds

Answer

- a. 8.33×10^{-7} s
- b. 5,809 ms
- c. 2.77 Ms

40. Perform the following conversions.

- a. 45.0 m/min to meters/second
- b. 0.000444 m/s to micrometers/second
- c. 60.0 km/h to kilometers/second

Answer

- a. 0.750 m/s
- b. 444 $\mu\text{m/s}$
- c. 0.0167 km/s

41. Perform the following conversions.

- a. 3.4×10^2 cm/s to centimeters/minute
- b. 26.6 mm/s to millimeters/hour
- c. 13.7 kg/L to kilograms/milliliters

Answer

- a. 2.0×10^4 cm/min
- b. 9.58×10^4 mm/h
- c. 0.0137 kg/mL

2.7: Solving Multi-Step Conversion Problems

42. Perform the following conversions.

- a. 0.674 kL to milliliters
- b. 2.81×10^{12} mm to kilometers
- c. 94.5 kg to milligrams

Answer

- a. 6.74×10^5 mL
- b. 2.81×10^6 km
- c. 9.45×10^7 mg

43. Perform the following conversions.

- a. 6.79×10^{-6} kg to micrograms

- b. 1.22 mL to kiloliters
- c. 9.508×10^{-9} ks to milliseconds

Answer

- a. 6.79×10^3 μg
- b. 1.22×10^{-6} kL
- c. 9.508×10^{-3} ms

44. Perform the following conversions.

- a. 6.77×10^{14} ms to kiloseconds
- b. 34,550,000 cm to kilometers

Answer

- a. 6.77×10^8 ks
- b. 345.5 km

45. Perform the following conversions.

- a. 4.701×10^{15} mL to kiloliters
- b. 8.022×10^{-11} ks to microseconds

Answer

- a. 4.701×10^9 kL
- b. 0.08022 μs

46. Perform the following conversions. Note that you will have to convert units in both the numerator and the denominator.

- a. 88 ft/s to miles/hour
- b. 0.00667 km/h to meters/second

Answer

- a. 6.0×10^1 mi/h
- b. 1.85×10^{-3} m/s

47. Perform the following conversions. Note that you will have to convert units in both the numerator and the denominator.

- a. 3.88×10^2 mm/s to kilometers/hour
- b. 1.004 kg/L to grams/milliliter

Answer

- a. 1.40 km/h
- b. 1.004 g/mL

2.8: Units Raised to a Power

48. Perform the following conversions.

- a. 9.44 m^2 to square centimeters
- b. $3.44 \times 10^8 \text{ mm}^3$ to cubic meters

Answer

- a. $9.44 \times 10^4 \text{ cm}^2$
- b. 0.344 m^3

49. Perform the following conversions.

- a. 0.00444 cm^3 to cubic meters
- b. $8.11 \times 10^2 \text{ m}^2$ to square nanometers

Answer

- a. $4.44 \times 10^{-9} \text{ m}^3$
- b. $8.11 \times 10^{20} \text{ nm}^2$

50. Why would it be inappropriate to convert square centimeters to cubic meters?

Answer

One is a unit of area and the other is a unit of volume.

51. The formula for the area of a triangle is $\frac{1}{2} \times \text{base} \times \text{height}$. What is the area of a triangle in square meters if its base is 166 mm and its height is 930.0 mm? Express the answer to the proper number of significant figures.

Answer

0.0772 m^2

52. What is the area in square millimeters of a rectangle whose sides are $2.44 \text{ cm} \times 6.077 \text{ cm}$? Express the answer to the proper number of significant figures.

Answer

$1.48 \times 10^3 \text{ mm}^2$

53. What is the volume in cubic centimeters of a cube with sides of 0.774 m? Express the answer to the proper number of significant figures.

Answer

$4.64 \times 10^5 \text{ cm}^3$

54. The formula for the area of a triangle is $\frac{1}{2} \times \text{base} \times \text{height}$. What is the area of a triangle in square centimeters if its base is 1.007 m and its height is 0.665 m? Express the answer to the proper number of significant figures.

Answer

$3.35 \times 10^3 \text{ cm}^2$

2.9: Density

55. A block of metal alloy has a mass of 34.96 g. Its dimensions are 3.9 cm by 4.2 cm by 1.6 cm. What is the density of the metal alloy?

Answer

1.3 g/cm³

56. A plastic cylinder with a mass of 26.7 g is added to a graduated cylinder containing 45.8 mL of water. Once the cylinder was submerged, the volume increased to 61.3 mL. What was the density of the plastic cylinder?

Answer

1.72 g/mL

57. A sample of iron has a volume of 48.2 cm³. If the density of iron is 7.87 g/cm³, what is its mass?

Answer

379 g

58. A sample of air has a volume of 1,015 mL. What is its mass? Consult [Table 2.9.1](#) for the density.

Answer

1.22 g

59. The volume of hydrogen used by the *Hindenburg*, the German airship that exploded in New Jersey in 1937, was 2.000×10^8 L. What mass of hydrogen was used by the airship? Consult [Table 2.9.1](#) for the density.

Answer

1.7×10^7 g

60. The volume of an Olympic-sized swimming pool is 2.50×10^9 cm³. If the pool is filled with alcohol ($d = 0.789$ g/cm³), what mass of alcohol is in the pool?

Answer

1.97×10^9 g

61. A typical engagement ring has 0.77 cm³ of gold. What mass of gold is present? Consult [Table 2.9.1](#) for the density.

Answer

15 g

62. A typical mercury thermometer has 0.039 mL of mercury in it. What mass of mercury is in the thermometer? Consult [Table 2.9.1](#) for the density.

Answer

0.53 g

63. What is the volume of 100.0 g of lead? Consult [Table 2.9.1](#) for the density.

Answer

8.811 cm³

64. What is the volume of 255.0 g of uranium if uranium has a density of 19.05 g/cm³?

Answer

13.39 cm³

65. What is the volume in liters of 222 g of neon if neon has a density of 0.900 g/L?

Answer

247 L

66. What is the volume in liters of 20.5 g of sulfur hexafluoride if sulfur hexafluoride has a density of 6.164 g/L?

Answer

3.33 L

67. Which has the greater volume, 100.0 g of iron ($d = 7.87 \text{ g/cm}^3$) or 75.0 g of gold ($d = 19.3 \text{ g/cm}^3$)?

Answer

Iron. The volume of the iron is 12.7 cm³ and the volume of the gold is 3.87 cm³.

68. Which has the greater volume, 25.0 g of hydrogen gas ($d = 0.084 \text{ g/L}$) or 100.0 g of argon gas ($d = 1.78 \text{ g/L}$)?

Answer

Hydrogen. The volume of the hydrogen is 298 L and the volume of the argon is 56.2 L.

Additional Exercises

69. Evaluate $0.00000000552 \times 0.000000006188$ and express the answer in scientific notation. You may have to rewrite the original numbers in scientific notation first.

Answer

3.42×10^{-18}

70. Evaluate $333,999,500,000 \div 0.0000000003396$ and express the answer in scientific notation. You may need to rewrite the original numbers in scientific notation first.

Answer

9.835×10^{21}

71. Fill in the blank: 1 km = _____ μm.

Answer

$$10^9 \mu\text{m}$$

72. Fill in the blank: 1 Ms = _____ ns.

Answer

$$10^{15} \text{ ns}$$

73. Fill in the blank: 1 cL = _____ ML.

Answer

$$10^{-8} \text{ ML}$$

74. Fill in the blank: 1 mg = _____ kg.

Answer

$$10^{-6} \text{ kg}$$

75. Convert a speed of 60.0 mi/h into kilometers/hour.

Answer

$$96.5 \text{ km/h}$$

76. Convert a speed of 60.0 km/h into miles/hour.

Answer

$$37.3 \text{ mi/h}$$

77. Convert 52.09 km/h into meters/second.

Answer

$$14.47 \text{ m/s}$$

78. Convert 2.155 m/s into kilometers/hour.

Answer

$$7.758 \text{ km/h}$$

79. What is the mass of 12.67 L of mercury? Consult [Table 2.9.1](#) for the density.

Answer

$$1.723 \times 10^5 \text{ g}$$

80. What is the mass of 0.663 m^3 of air? Consult [Table 2.9.1](#) for the density.

Answer

796 g

81. What is the volume of 2.884 kg of gold? Consult [Table 2.9.1](#) for the density.

Answer

149 cm^3

82. What is the volume of 40.99 kg of cork? Assume a density of 0.22 g/cm^3 .

Answer

$1.9 \times 10^5 \text{ cm}^3$

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