1.21 Bromine is a reddish-brown liquid. Calculate its density (in g/mL) if 586 g of the substance occupies 188 mL.

\[
\text{density} = \frac{3.12 \text{ g}}{\text{mL}}
\]

1.22 The density of ethanol, a colorless liquid that is commonly known as grain alcohol, is 0.798 g/mL. Calculate the mass of 17.4 mL of the liquid.

\[
\text{mass of ethanol} = 13.9 \text{ g}
\]

1.35 Carry out the following operations and express each answer with the correct units and with the correct number of digits. (Remember: Keep the least number of decimal places for addition and subtraction and keep the least number of significant figures for multiplication and division.)

(a) \[5.6792 \text{ m} + 0.6 \text{ m} + 4.33 \text{ m} = 10.6 \text{ m}\]

(b) \[3.70 \text{ g} - 2.9133 \text{ g} = 0.79 \text{ g}\]

(c) \[(4.51 \text{ cm})(3.6666 \text{ cm}) = 16.5 \text{ cm}\]

(d) \[(0.00005 \text{ cm})(538 \text{ cm}^2) = 0.03 \text{ cm}^3\]

1.36 Carry out the following operations and express each answer with the correct units and with the correct number of digits. (Again-- Keep the least number of decimal places for addition and subtraction and keep the least number of significant figures for multiplication and division.)

(a) \[\frac{7.310 \text{ km}}{5.70 \text{ km}} = 1.28\]

(b) \[0.00326 \text{ mg} - 0.0000788 \text{ mg} = 0.00318 \text{ mg} = 3.18 \times 10^{-3} \text{ mg}\]

(c) \[(0.402 \times 10^7 \text{ dm}) + (7.74 \times 10^7 \text{ dm}) = 8.14 \times 10^7 \text{ dm}\]

(d) \[(220 \text{ cm})(34.0 \text{ cm})(0.0456 \text{ cm}) = 341.088 \text{ cm}^3 = 340 \text{ cm}^3\]

(e) \[\frac{(3.54 \text{ m} - 0.14 \text{ m})}{28.2 \text{ s}} = \frac{3.40 \text{ m}}{28.2 \text{ s}} = 0.12057 \text{ m/s} = 0.121 \text{ m/s}\]

1.37 Carry out the following conversions:

(a) \[22.6 \text{ m} = ? \text{ dm} = 226 \text{ dm}\]

(b) \[25.4 \text{ mg} = ? \text{ Kg} = 2.54 \times 10^{-5} \text{ Kg}\]

(c) \[556 \text{ mL} = ? \text{ L} = 0.556 \text{ L}\]

(d) \[10.6 \text{ kg/m}^3 = ? \text{ g/cm}^3 = 0.0106 \text{ g/cm}^3\]

1.39 The average speed of helium at 25°C is 1255 m/s. Convert this speed to miles per hour.

Helpful info: 1 mile = 1609 m

\[2808 \text{ mi/hr}\]
1.41 How many minutes does it take for light to travel from the sun to the Earth?

Helpful info: The distance from the sun to Earth is 93 million miles (93 x 10^6 mi).
The speed of light = 3.00 x 10^8 m/s; 1 mile = 1609 m

8.3 min

1.49 Aluminum is a lightweight metal (density = 2.70 g/cm^3) used in aircraft construction, high-voltage transmission lines, beverage cans and foils. What is its density in kg/m^3?

2.70 x 10^3 kg / m^3

1.54 In determining the density of a rectangular metal bar, a student made the following measurements: length = 8.53 cm; width = 2.4 cm; height = 1.0 cm; mass = 52.7064 g. Calculate the density of the metal to the correct number of significant figures.

2.6 g/cm^3

1.79 Chalcopyrite, the principal ore of copper (Cu), contains 34.63 percent Cu by mass. How many grams of Cu can be obtained from 5.11 x 10^3 kg of the ore?

Hint: “34.63 percent Cu by mass” means that there are 34.63 kg of Cu in 100 kg of ore.

1.77 x 10^6 g Cu

1.81 A 1.0 mL volume of seawater contains about 4.0 x 10^-12 g of gold. The total volume of ocean water is 1.5 x 10^21 L. Calculate the total amount of gold (in grams) that is present in seawater, and the worth of the gold in dollars.

Assume gold costs $1300 per ounce (This was the price of gold in June 2019).
1 lb = 453.6 g; 1 lb = 16 oz

6.0 x 10^12 g Au

$2.8 x 10^{14} = 280$ trillion dollars!!

1.83 The thin outer layer of Earth, called the crust, contains only 0.50 % of Earth’s total mass and yet it is the source of almost all of the elements found on Earth. Silicon (Si) is the second most abundant element in Earth’s crust (27.2 % by mass). Calculate the mass of silicon (in kg) in Earth’s crust.

The mass of Earth is 5.9 x 10^24 tons. 1 ton = 2000 lbs; 1 kg = 2.205 lbs

mass of Si in crust = 7.3 x 10^21 kg Si

1.85 One gallon of gasoline in an automobile’s engine produces on the average 9.5 kg of CO₂, which is a greenhouse gas. (It promotes the warming of Earth’s atmosphere) Calculate the annual production of CO₂ (in kg) if there are 40 million cars in the United States and each car covers a distance of 5000 miles at a consumption rate of 20 miles per gallon.

9.5 x 10^10 kg CO₂