Mass, Volume, and Density (Science 8)

Mass is: _____

Volume is: _____

Density is: _____

MASS UNITS	VOLUME UNITS	DENSITY UNITS
- g (grams) - mg (miligrams) - kg (kilograms, equal to 1000 grams) - lb (pounds) - t (tonnes)	- mL (milliliters) - L (milliliters) - oz (ounces) - cm³ ("centimeters cubed") - m³ ("meters cubed")	The formula to calculate density is: $$density = \frac{mass}{volume}$$ Therefore, the units for density are **any mass unit divided by any volume unit**: e.g. $\frac{g}{mL}$, $\frac{g}{cm^3}$ are the ones most commonly used, but you could also see $\frac{kg}{L}$, $\frac{lb}{m^3}$, etc.

Most often, you will see the volume of solids in _____ and the volume of liquids in _____.

Therefore, density of solids is given in units of _____. The density of liquids is given in units of _____.

PRACTICE

1. A gold ring sinks in water. Therefore, gold is ((more)/less) dense than water.

2. If oil floats on top of water, that means that oil must be (more/(less)) dense than water.

3. Classify the following as masses, volumes, densities, or none of these.

    a. 15kg — mass

    b. 3.25g — mass

    c. 2L — volume

    d. 11.5 cm³ — volume

    e. 1.2 g/mL — density

    f. 32 g — mass

    g. 6.3 cm² — none

    h. 2.4 g/cm³ — density

    i. 13.582 g/kg — none

    j. 12.8 g — mass

    k. 21 cm³ — volume

    l. 2.7 mL/g — none

    m. 3.8 kg/oz — density

    n. 150 mL — volume

4. What is the density of water? Remember units.

$$\frac{1 \frac{g}{mL}}{} \Big| \underline{1 g/mL}$$

Material	Density (g/cm³)
Foam plastics	0.01-0.6
Wood	0.4-0.8
Natural rubber	0.83-0.91
Polypropylene	0.90
H.D. polyethylene	0.96
Polystyrene	1.0-1.1
Polyvinyl chloride	1.40
Magnesium and alloys	1.74-1.88
Hollow aluminum	2.2-2.5
Aluminum and alloys	2.6-2.9
Zinc and alloys	5.2-7.2
Stainless steels	7.5-7.7
Brass and bronze	5.2-7.2
Copper and alloys	7.5-9.0
Lead and alloys	10.7-11.3

5. Use the table on the right to answer the following questions.

   a. What **weighs more**: a gram of foam or a gram of zinc?

   weigh the same

   b. What is **more dense**: a gram of foam or a gram of zinc?

   zinc

   c. In water, will foam float or sink? _float_

   d. In water, will zinc float or sink? _sink_

6. There is 30 mL of water in a graduated cylinder. When a rock is put into the water, it sinks, and the water level rises to 34 mL. What is the volume of the rock? Remember units and show your work.

   $Volume = 34 \, mL - 30 \, mL = 4 \, mL$
   (but rock is a solid… volume in cm³).
   The volume of the rock is $4 \, cm^3$.

7. Calculate the density of a rock that weighs 8g and has a volume of 3 cm³. Remember units and show your work.

   $$density = \frac{mass}{volume} = \frac{8g}{3 cm^3} = 2.67 \frac{g}{cm^3}$$

8. Calculate the density of a piece of Styrofoam™ that has a volume of 50 cm³ and weighs 3g. Remember units and show your work.

   $$density = \frac{mass}{volume} = \frac{3g}{50 cm^3} = 0.06 \frac{g}{cm^3}$$

9. There is a graduated cylinder with 20 mL of water. A ring weighing 12g is dropped into the water and it sinks to the bottom, causing the water level to rise to 21.5 mL.

   a. What is the volume of the ring? Remember units and show your work.

   $Volume = 21.5 \, mL - 20 \, mL = 1.5 \, mL \Rightarrow 1.5 \, cm^3$ (because the ring is a solid)

   b. What is the density of the ring? Remember units and show your work.

   $$density = \frac{mass}{volume} = \frac{12g}{1.5 cm^3} = 8 \frac{g}{cm^3}$$

   c. Compare the density you calculated in "b" to the table from question #6. What material is the ring most likely made out of?

   Copper or an alloy