Chemistry
Density

Name _____

Perhaps someone has tried to trick you with this question: "Which is heavier, a pound of lead or a pound of feathers?" Many people would instinctively answer "lead." When they give this incorrect answer, these people are really thinking of density. If a piece of lead and a feather of the same volume are weighed, the lead would have a greater mass than the feather. It would take a much larger volume of feathers to equal the mass of a given volume of lead.

Density is the relationship of the mass of an object to its volume. Density is usually reported in units of grams per cubic centimeter (g/cm3). For example, water has a density of 1.00 g/cm^3. Since a cubic centimeter contains the same volume as a milliliter, in some cases you may see density expressed as g/cm^3 or g/mL.

$$density = \frac{mass}{Volume} \qquad\qquad d = \frac{m}{V}$$

To solve density problems, list the known and unknown values, then use one of the following.

- When a problem requires you to calculate density, use the density equation, $d = \dfrac{m}{V}$

- You can solve for mass by multiplying both sides of the density equation by volume.

- $$V \bullet d = \frac{m}{V} \bullet V \qquad \Rightarrow \qquad m = d \bullet V$$

- You can solve for volume by dividing both sides of the equation above by density.

$$m = d \bullet V \qquad \Rightarrow \qquad \frac{m}{d} = \frac{d \bullet V}{d} \qquad \Rightarrow \qquad V = \frac{m}{d}$$

Example: What is the mass of an object that has a density of 8 g/cm3 and a volume of 64 cm3?

Known: D = 8 g/ cm^3 | Equation to use: m = d V

           V = 64 cm^3

Unknown: M = ? | "Plug and chug": m = (8 g/ cm^3) (64 cm^3) = 512 g

PROBLEMS List the known and unknown values; try to derive the equation without looking above.

1. A piece of tin has a mass of 16.52 g and a volume of 2.26 cm^3. What is the density of tin?

Known:

Unknown:

2. A man has a 50.0 cm^3 bottle completely filled with 163 g of a slimy green liquid. What is the density of the liquid?

Known:

Unknown:

3. A sealed 2500 cm³ flask is full to capacity with 0.36 g of a substance. Determine the density of the substance. Guess if the substance is a gas, a liquid, or a solid.

Known:

Unknown:

4. Different kinds of wood have different densities. The density of oak wood is generally 0.7 g/cm3. If a 35 cm³ piece of wood has a mass of 25 g, is the wood likely to be oak?

Known:

Unknown:

5. The density of pine is generally about 0.5 g/ cm³. What is the mass of a 800 cm³ piece of pine?

Known:

Unknown:

6. What is the volume of 325 g of metal with a density of 9.0 g/ cm³?

Known:

Unknown:

7. Diamonds have a density of 3.5 g/ cm³. How big is a diamond that has a mass of 0.10 g?

Known:

Unknown:

8. What mass of water in grams will fill a fish tank 100 cm long, 50 cm wide, and 30 cm high?

Known:

Unknown:

9. Air has a density of 1.29g/L. Calculate the mass of air in a room 5.0m x 10.m x 4.0m. 1m³ = 1000.L.

Known:

Unknown:

10. A graduated cylinder is filled with water to a level of 40.0 mL. When a piece of copper is lowered into the cylinder, the water level rises to 63.4 mL. Find the volume of the copper sample. If the density of the copper is 8.9 g/ cm³, what is its mass?

Known:

Unknown: