DENSITY

Name _____

Which has the greater mass, air or lead? Most of you would answer lead, but actually this question does not have an answer. To compare these two things you need to now how much of each you have. A large amount of air could have a greater mass than a small amount of lead. To compare different things, we have to compare the masses of each that occupy the same space, or volume. This is called density.

$$\text{density} = \frac{\text{mass}}{\text{volume}}$$

Solve the following problems.

1. What is the density of carbon dioxide gas if 0.196 g occupies a volume of 100 mL?

   Answer: _____

2. A block of wood 3.0 cm on each side has a mass of 27 g. What is the density of this block?

   Answer: _____

3. An irregularly shaped stone was lowered into a graduated cylinder holding a volume of water equal to 2.0 mL. The height of the water rose to 7.0 mL. If the mass of the stone was 25 g, what was its density?

   Answer: _____

4. A 10.0 cm^3 sample of copper has a mass of 89.6 g. What is the density of copper?

   Answer: _____

5. Silver has a density of 10.5 g/cm^3 and gold has a density of 19.3 g/cm^3. Which would have a greater mass, 5 cm^3 of silver or 5 cm^3 of gold?

   Answer: _____

6. Five mL of ethanol has a mass of 3.9 g, and 5.0 mL of benzene has a mass of 4.4 g. Which liquid is denser?

   Answer: _____

7. A sample of iron has the dimensions of 2 cm x 3 cm x 2 cm. If the mass of this rectangular-shaped object is 94 g, what is the density of iron?

   Answer: _____

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Name _____ Date _____ Period _____

Density Practice Problems

1) What is the mass of ethyl alcohol that exactly fills a 200.0 mL container? The density of ethyl alcohol is 0.789 g/mL.

$D = \frac{m}{V}$ $M = D \cdot V$ $V = \frac{m}{D}$

$M = D \cdot V$

$(.789)(200) = 157.8\ g$

2) Calculate the volume of sulfuric acid with a mass of 65.14 g. The density of sulfuric acid is 1.84 g/mL.

3) Find the mass of 250.0 mL of benzene. The density of benzene is 0.8765 g/mL.

4) A block of lead has dimensions of 4.50 cm by 5.20 cm by 6.00 cm. The block weighs 1587 g. From this information, calculate the density of lead.

5) 28.5 g of iron shot is added to a graduated cylinder containing 45.50 mL of water. The water level rises to the 49.10 mL mark. From this information, calculate the density of iron.

6) What volume of silver metal will have a mass of exactly 2500.0 g? The density of silver is 10.5 g/cm^3.

The Recycling Factory

Suppose that you are the new owner of the Owl Recycling Factory and you are looking for business.

An official from the city of Westminster, Mr. Smith, tells you that they have a dump truck full of recycled materials that must be separated, and they will pay you $5,000 if you can do it. Unfortunately, the job is made more difficult by the fact that someone has ground all of the materials into a fine powder, making it impossible to separate them by hand.

Fortunately, Mr. Smith knows what the materials in the truck are, as well as their densities:

Material	Density (g/cm^3)
Aluminum soda cans	2.7
Steel cans	5.7
Milk jugs	0.95
Soda bottles	1.4

In your factory, you have the following materials at your disposal:

- A long conveyor belt
- A large tank that can be filled with water
- Another large tank labeled "Concentrated sugar water, density = 1.5 g/cm^3"
- Several powerful magnets hanging above the conveyor belt
- Several nets for skimming the tanks and scooping material from the bottoms.

Your job: Find a way to separate the four recycled materials. You may need to do this in several steps.

You will have to write a letter to the city official that describes your plan. You may draw diagrams if they are neat.

Scoring:

- All parts of a letter are included
- Your plan will work
- Your plan is understandable
- You describe what will be separated by each step
- Your work is neatly done
- You use correct grammar and spelling
- Your letter is less than two pages, one side only

Good luck!