

CHAPTER 7 Comparing Densities

Goal • Use this page to compare the densities of different substances.

What to Do

Use the information in the table to answer the following questions.

| Fluid | Density (g/mL) | Solid | Density (g/cm ³) |
|----------------|----------------|------------|------------------------------|
| hydrogen | 0.000 09 | Styrofoam™ | 0.005 |
| helium | 0.0002 | cork | 0.24 |
| air | 0.0013 | oak | 0.70 |
| oxygen | 0.0014 | sugar | 1.59 |
| carbon dioxide | 0.002 | salt | 2.16 |
| ethyl alcohol | 0.79 | aluminum | 2.70 |
| machine oil | 0.90 | iron | 7.87 |
| water | 1.00 | nickel | 8.90 |
| seawater | 1.03 | copper | 8.92 |
| glycerol | 1.26 | lead | 11.34 |
| mercury | 13.55 | gold | 19.32 |

- You drop three things into a glass of water: a piece of Styrofoam™, a piece of oak, and a gold ring.
 - Which will float? *Styrofoam will float in water.*
 - Which will sink? *Oak + gold ring will sink.*
- Which is denser:
 - carbon dioxide for air?
 - oxygen for air?
 - hydrogen for air?

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- You find a white granular substance in a jar in your cupboard. You suspect that it may be either sugar or salt. How could you find out without tasting the substance? *Measure Mass + Volume to calc density + compare to chart.*
- Why is it easier to swim in seawater than it is to swim in fresh water? *See water is more dense than fresh water*
- A student comes to the conclusion that solids are denser than liquids. Is this true? Explain. *Only if it is the same substance, with the exception of water.*

But styrofoam, cork, some woods are solids that are less dense than many liquids (like water).

Goal • Use this page to calculate the mass and volume of different substances.

What to Do

Use the table and the following formula to solve the following problems.

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

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1. Calculate the mass of 550 mL of air.

$$M = D \times V$$

$$= 0.0013 \times 550 \text{ mL}$$

$$= 0.715 \text{ g/air}$$

2. Calculate the mass of 50 cm³ of copper.

$$M = D \times V$$

$$= 8.92 \text{ g/cm}^3 \times 50 \text{ cm}^3$$

$$= 446 \text{ g}$$

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3. What is the volume of a 2 g piece of gold?

$$V = \frac{M}{D} = \frac{2 \text{ g}}{19.32 \text{ g/cm}^3} = 0.104 \text{ g/cm}^3$$

4. How much space would 1 kg of air occupy?

$$V = \frac{M}{D} = \frac{1000 \text{ g}}{0.0013 \text{ g/cm}^3} = 769230 \text{ mL}$$

or 769.23 liters

5. In an experiment, two students find that 500 g of water occupies a space of 50 mL. Is this accurate? Explain.

No 500g should occupy 500 mL.

6. In the same class, two students find that a piece of wood with a mass of 70 g has a volume of 103 cm³. They conclude that the wood is oak. Is this accurate? Explain.

$$D = \frac{M}{V} = \frac{70 \text{ g}}{103 \text{ cm}^3} = 0.6796 \text{ g/cm}^3$$

Could be. It's pretty close.