

Determining Density

Density can be calculated using the formula

$$\text{density} = \frac{\text{mass}}{\text{volume}} \quad \text{or} \quad D = \frac{m}{V}$$

Density is often expressed as grams per cubic centimetre, represented as g/cm^3 . When calculating density using these units, make sure that the mass is in grams and the volume is in cubic centimetres.

Sample Problem: Calculating Density

Problem

A sample of silver has a mass of 5.04 g and a volume of 0.480 cm^3 . What is the density of silver?

Solution

This problem requires you to determine the density.

The values for mass and volume are given:

$$m = 5.04 \text{ g and } V = 0.480 \text{ cm}^3$$

The equation for density is $D = \frac{m}{V}$

Substitute the given values into the equation, and solve:

$$D = \frac{5.04 \text{ g}}{0.480 \text{ cm}^3}$$

$$D = 10.5 \text{ g/cm}^3$$

The density of silver is 10.5 g/cm^3 .

Check Your Solution

By rounding the mass to 5 g and the volume to 0.5 cm^3 , you can see that the mass is about 10 times larger than the volume. An estimate of 10 g/cm^3 for the density is close to the calculated value of 10.5 g/cm^3 .

Practice Problems

1. A sample of an unknown metal has a mass of 21.6 g and a volume of 8.00 cm^3 . Calculate the density of the unknown metal.
2. What is the density of a liquid if 95.5 cm^3 has a mass of 101 g?
3. A balloon contains 5470 cm^3 of gas and has a mass of 10.24 g. The mass of the empty balloon is 2.42 g. What is the density of the gas?
4. One side of a cube of an unknown metal measures 0.53 cm. If the mass of the cube is 0.92 g, what is the density of the cube?
5. A scientist has developed a new type of material that is supposed to float on water. This material has a mass of 2.0 g for every 3.0 cm^3 of volume. Will this material float on water (density = 1.0 g/cm^3)? Explain.

Study Toolkit

Previewing Text Features

Notice how the sample problem is presented on this page. How do you think this text feature will help you to learn about calculating density?

GRASP

Go to **Science Skills Toolkit 9** to learn about an alternative problem solving method.

Water's Unique Physical Properties

Suggested Investigation

Inquiry Investigation 4-A,
Testing Physical Properties
of Substances, on page 166

One of the most interesting pure substances is also one of the most common—water. Water is colourless, tasteless, and odourless. The “hidden” properties of water, however, allow it to support life on Earth. Some of the unique physical properties of water that make it so special are summarized in **Figure 4.15**.

Water is the only natural substance that exists in all three phases at the temperatures and pressures experienced on Earth.

Water is called the “universal solvent” because it dissolves more substances than any other liquid. This property allows it to carry a large number of essential nutrients and chemicals in waterways and the human body.

Water is unusual because its solid form, ice, is less dense than its liquid form. This means that ice forms on the surface of lakes. The ice acts as an insulator, preventing the water below it from freezing and allowing wildlife in the water to survive.

Water can absorb a lot of heat before it begins to get hot. This makes it resistant to sudden changes in temperature. As a result, aquatic habitats do not experience the extreme fluctuations in temperature that can happen on land.

Figure 4.15 The physical properties of water allow it to support life on Earth.