

Density

Equal size does not mean equal mass

You come into contact with many kinds of matter every day. Some matter is solid and hard, like iron and plastic. Some matter is liquid like water; some is a gas like air. Even within the category of solid matter, there are big differences. Think about the differences between polyethylene plastic, iron and glass. Imagine you had a solid cube of each substance, and all the cubes were the same size and painted black. Does each contain the same amount of matter? Could you tell which was plastic, iron or glass?

Equal size does not mean equal mass



Polethylene plastic

Glass

Iron

Density describes the mass per unit volume

A block of plastic and a block of steel may be the same size but one has a lot more *mass* than the other. Because of the difference, plastic floats in water and iron sinks. Whether an object floats or sinks in water is related to its *density*. **Density** describes how much mass is in a given volume of a material. The units of density are mass divided by volume, often grams per cubic centimeter (g/cm^3). Iron has a high density; it contains 7.8 grams of mass per cubic centimeter ($7.8 \text{ g}/\text{cm}^3$). A one centimeter cube of polyethylene plastic contains only 0.94 grams of matter ($0.94 \text{ g}/\text{cm}^3$).

Density

$$\text{density} = \frac{\text{mass (g)}}{\text{volume (cm}^3\text{)}} \quad (\text{g}/\text{cm}^3)$$

$$d = \frac{m}{V}$$

1. Density is a property of matter - independent of size or shape
2. Density is mass per unit volume.

The density of water and air

Solids range in density from cork ($0.12 \text{ g}/\text{cm}^3$) to platinum, a precious metal with a density of $21.5 \text{ g}/\text{cm}^3$. The density of water is about one gram per cubic centimeter. The density of air is much lower, about 0.001 grams per cubic centimeter.

Chemistry terms

density - a property of a substance that describes how much matter the substance contains per unit volume - typical units are grams per cubic centimeter (g/cm^3)