

27.2: Density

The density of a small amount of matter is defined to be the amount of mass ΔM by the volume ΔV of that element of matter,

$$\rho = \frac{\Delta M}{\Delta V}$$

The SI unit for density is the kilogram per cubic meter, $\text{kg} \cdot \text{m}^{-3}$. If the density of a material is the same at all points, then the density is given by

$$\rho = M/V$$

where M is the mass of the material and V is the volume of material. A material with constant density is called *homogeneous*. For a homogeneous material, density is an *intrinsic* property. If we divide the material in two parts, the density is the same in both parts,

$$\rho = \rho_1 = \rho_2$$

However mass and volume are extrinsic properties of the material. If we divide the material into two parts, the mass is the sum of the individual masses

$$M = M_1 + M_2$$

as is the volume

$$V = V_1 + V_2$$

The density is tabulated for various materials in Table 27.1.

Table 27.1: Density for Various Materials (Unless otherwise noted, all densities given are at standard conditions for temperature and pressure, that is, 273.15 K (0.00 °C) and 100 kPa (0.987 atm).

Material	Density, ρ $\text{kg} \cdot \text{m}^{-3}$
Helium	0.179
Air (at sea level)	1.20
Styrofoam	75
Wood Seasoned, typical	0.7×10^3
Ethanol	0.81×10^3
Ice	0.92×10^3
Water	1.00×10^3
Seawater	1.03×10^3
Blood	1.06×10^3
Aluminum	2.70×10^3
Iron	7.87×10^3
Copper	8.94×10^3
Lead	11.34×10^3
Mercury	13.55×10^3
Gold	19.32×10^3
Plutonium	19.84×10^3
Osmium	22.57×10^3

If we examine a small volume element of a fluid, it consists of molecules interacting via intermolecular forces. If we are studying the motion of bodies placed in fluids or the flow of the fluid at scales that are large compared to the intermolecular forces then we

can consider the fluid to be continuous and quantities like density will vary smoothly from point to point in the fluid.

This page titled [27.2: Density](#) is shared under a [not declared](#) license and was authored, remixed, and/or curated by [Peter Dourmashkin](#) (MIT OpenCourseWare) via [source content](#) that was edited to the style and standards of the LibreTexts platform.