

## Range of Densities for Solids, Liquids and Gases

Most solids tend to have densities of more than  $1 \text{ g/cm}^3$ . Some exceptions are most varieties of wood, many plastics, pumice, and a new class of materials called aerogels.

Most liquids tend to have densities close to  $1 \text{ g/cm}^3$ , with some being a little more and others a little less. One notable exception is the element mercury (Hg), known since antiquity as quicksilver.

Most gases tend to have densities less than  $0.003 \text{ g/cm}^3$ , with exceptions like the Noble Gases Krypton, Xenon and Radon.

### Why Things Float or Sink

When you put an object like a piece of dry wood into water and you see it floating, did you ever notice that part of the wood is below the surface of the water? The wood below the surface has pushed (displaced) water out of the way. In fact, the amount of water that the wood displaced is equal to the weight of the entire piece of wood.

Whenever an object (or substance) can displace an amount of liquid equal to its own weight, it's able to float. This displaced water pushes up against the object, in effect keeping it afloat. This upward force is called buoyancy. If it can't displace an equal amount of water, then there won't be enough buoyancy force pushing up to counter the downward weight of the object. When this happens, the object sinks.

Suppose you are given a list of various solids, liquids and gases and you have to determine which will float or sink in various substances. How could this be done ?

If you know their densities, you can determine which will float or sink in various substances. It's easy to do. If a substance is more dense than the medium/substance it is placed in, it will sink. Likewise, if it is less dense than the medium/substance it is placed in, it will float.

This not only applies to liquids other than water, but it also applies to gases. A helium filled balloon for example, floats upward in the air, because the density of the helium is less than the density of air.

You can make a good guess as to the density of solid objects based on whether it sinks or floats in various liquids. In fact, if the object is able to float in water (density  $1.0 \text{ g/cm}^3$ ), the percent of water displaced and below the surface, will be equal to the density of the object !