How to Determine the Specific Gravity of a Substance

Specific gravity is a dimensionless unit used in engineering and science to describe the density of an object compared to the density of water. It has several uses in packaging and transportation. For example, one must know the specific gravity of liquid payloads prior to choosing a UN rated packaging.

To calculate a specific gravity, you must know how to calculate an object's density. The numerical value for the density of a substance depends on the units used for mass and volume. To calculate an object's density, two measurements are taken, one of them is the object's mass and the other is the volume. Density, which is the ratio of an object's mass to its volume can be expressed mathematically as:

Density(d) = $\frac{mass\ of\ object\ or\ \ substance(m)}{volume\ of\ object\ or\ substance(V)}$ or simply, d = $\frac{m}{V}$

Here are several examples how density can be expressed in different numerical values:

D_{water} = 1.00 g/mL
= 8.34 lb/gal
= 62.4 lb/ft^3

$D_{methanol}$ = 0.792 g/mL
= 6.61 lb/gal
=49.4 lb/ft^3

Specific Gravity can be defined as the ratio of the density of a substance divided by the density of water.

Specific gravity = $\frac{density\ of\ object\ or\ substance}{density\ of\ water}$

Specific gravity tells us how dense a substance is compared to water. For example, if its specific gravity is 2.0, then it is twice as dense as water; if its specific gravity is 0.50, then it is only half as dense as water.

Let's look at the specific gravity of methanol:

Specific gravity$_{\text{methanol}}$= $\frac{6.61\ lb/gal}{8.34\ lb/gal}$ = 0.792, or

Specific gravity$_{\text{methanol}}$= $\frac{49.4\ lb/\text{ft3}}{62.4\ \text{lb/ft3}}$ = 0.792, or

Specific gravity$_{\text{methanol}}$= $\frac{0.792\ \text{g/mL}}{1.00\ \text{g/mL}}$ = 0.792,

Notice that when density is expressed in g/mL, its numerical value is the same as the specific gravity because you are always dividing by 1.

If you need to determine the specific gravity of a liquid, simply take a known volume (size doesn't matter) and weigh it. Use the density formula to calculate the density and express in terms of g/mL and that numerical value will also be your specific gravity. Alternatively, you can use the formula for specific gravity. Just make sure you are dividing by the same units (i.e., lb/gal, lb/ft^3, g/mL, kg/M^3, etc…).