Measuring Specific Gravity

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1 The Water Method For An Object of Specific Gravity Greater than one

This method finds the specific gravity of an object of weight w, where w_w is the measured weight when the object is submerged in water. The difference between the two weights is the buoyant force exherted by the water.

$$b = w - w_w.$$

$$b = \rho_w g v,$$

where ρ_w is the density of water, g is the acceleration of gravity, and v is the volume of the object. Thus

$$v = \frac{w - w_w}{\rho_w g}$$

Let m be the mass of the object, then

$$v = \frac{m}{\rho},$$

where ρ is the density of the object. Thus

$$\frac{m}{\rho} = \frac{w - w_w}{\rho_w g}.$$

The specific gravity is then

$$\frac{\rho}{\rho_w} = \frac{mg}{w - w_w} = \frac{w}{w - w_w}.$$

2 The Water Method For An Object of Specific Gravity Less than one

In this case the object will float. By hanging a sufficiently heavy weight to the bottom of the object it can be made to submerge. Then let w' be the weight of the object and heavy weight with only the heavy weight submerged, and w'_w be the weight with both the object and the heavy weight submerged. Then the specific gravity of the object is

$$\frac{\rho}{\rho_w} = \frac{mg}{w - w_w} = \frac{w}{w' - w'_w},$$

where w is the measured weight of the object. Measuring very precisely might require taking into account the weight and buoyant force of the apparatus used to suspend the object, aa well as the buoyant force of the air.

3 Measuring the Specific Gravity of a Liquid

Usually this would be done by measuring the mass and volume of a sample of the liquid, but could be done by measuring the buoyand force of an object of known mass and density when submerged in the liquid.