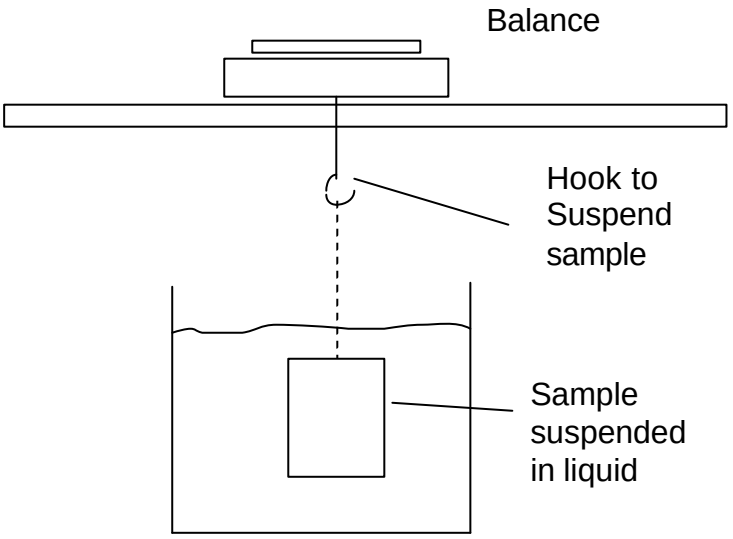
ADAM EQUIPMENT

USING BALANCES TO DETERMINE DENSITY OF A MASS

It is possible to use almost any balance to determine the density of a sample. The principle is based upon the Archimedean Principle that a body suspended in a liquid has forces acting on it that make it appear to weigh less than in air.

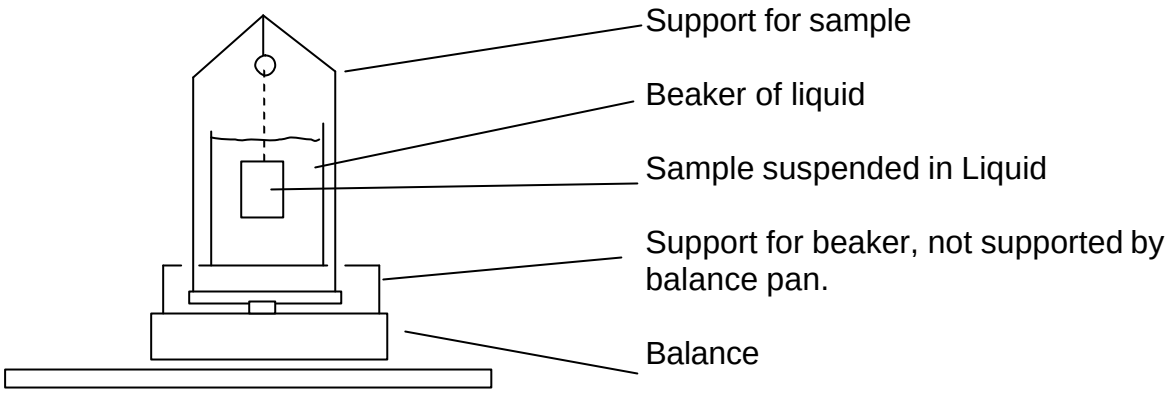
A balance can be used to measure the apparent mass in air and also when the mass is suspended in water. To accomplish this it is necessary to find a method to suspend the mass in a liquid while it is being weighed on a balance. This is normally done using either a hook to suspend the body below the balance (a) or an arrangement of parts to suspend the mass in the liquid while it is being weighed on a special pan attached to the balance (b).

A> Suspending a sample from a below balance hook



B> Assembly for weighing within a liquid on top of a balance.

The support for the beaker is not part of the weight on the balance pan. It is supported by the table or the body of the balance.



The procedure is to weigh the sample in the air first. This gives a value for M_{air}.

Suspend the sample by a thread. Make sure the balance is tared with the supports, weight of the thread and any other weights is tared before attaching the sample to the thread (or fine wire).

Then suspend the sample in the liquid. Make certain there are no air bubbles, trapped air in voids and that the sample is completely under water. This will give a mass of M_{liq} .

To determine the density of the sample it is necessary to know the density of the liquid. If distilled water is used it is given below. If liquids other than water are used it will be necessary to determine the density from tables or other measurements.

To determine the density of the sample calculate from:

$$\text{Density of sample} = \text{density of liquid} \times \frac{M_{air}}{M_{air} - M_{liq}}$$

For example assume a piece of metal is 380.0g in air and 330.0g in water at 25ºC.

The results would give a density of (0.99705 g/cc X 380g/ (380g-330g) =7.58g/cc. The metal could be Tin with a typical density 7.61g/cc.

DENSITY OF DISTILLED WATER

WATER TEMPERATURE	DENSITY
0ºC	0.99984 g/cm^3
4ºC	0.99997 g/cm^3
10ºC	0.99970 g/cm^3
15ºC	0.99910 g/cm^3
20ºC	0.99821 g/cm^3
25ºC	0.99705 g/cm^3
30ºC	0.99565 g/cm^3