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The density of air

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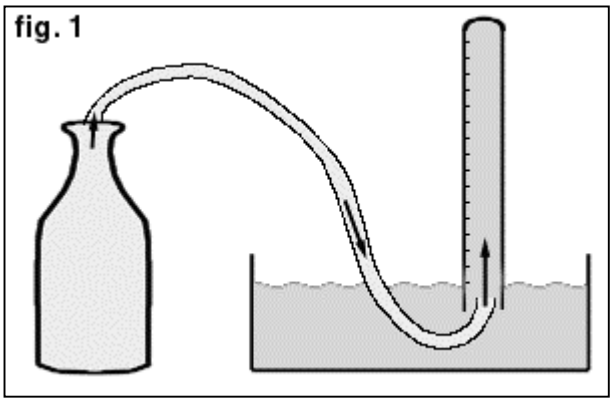
In this experiment we are to measure the density of air. It is a quite simple experiment, you learn how important it is to measure exact and be aware of the sources of error when measuring such small quantities.

The whole idea is that you know the mass of a certain volume of air, and then measure the volume. A digital scale that shows two decimals measures the first variable. We simply took a plastic bottle, weighed it when the lid was open, then with the help of a compressor, we filled it with more air and closed the bottle with a snap, and weighed again. The last value minus the second gives delta m (Δm).

Now that we know the mass, we just have to find out the volume of the added air. The problem with air is that it is hard to keep in one place, but under water it is easy to see if some air is escaping. So we took a bowl with water, and placed a volumetric scaled tube, filled it with water and placed it up side down in the bowl. Then we could easily lead the redundant air into the tube and measure the volume (see fig. 1).



So now we know both the mass and the volume, now it is just to put it into the formula:

$\rho = m / v$. Here is the data from the experiment:

Mass of bottle: 113,7 g

$m_2 = 114.1$ g
$\Delta m = 0.4$ g
$V = 540$ cm^3
$\rho = 0.4 / 540 = 7.41*10^{-4}$ g/cm^3

$m_2 = 114.1$ g
$\Delta m = 0.4$ g
$V = 390$ cm^3
$\rho = 0.4 / 390 = 1.03*10^{-3}$ g/cm^3

$m_2 = 113.9$ g
$\Delta m = 0.2$ g
$V = 220$ cm^3
$\rho = 0.2 / 220 = 9.09*10^{-4}$ g/cm^3

The actual value of the density of the air here in Jönköping is 1.29 kg/m^2. The results differ because it is so small amounts that we measured.