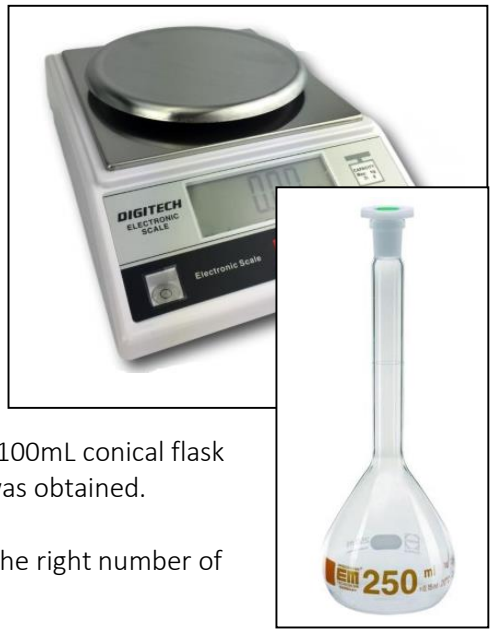
Lesson 6 – standard solution
Let's consider the problem posted below.

A HCl solution, whose concentration is unknown, is titrated with a 0.100 M Na_2CO_3 solution.
A 25.00 mL sample of the acid solution was transferred to a 100mL conical flask and titrated to the end point. An average titre of 40.00 mL was obtained.
As we have seen earlier in dealing with these problems we rely on two critical pieces of information.
1 – the volume of the titre, usually given by reading the burette.
2 – the concentration of the titrant. A standard solution is always used for the titrant as its concentration is accurately known. To prepare a standard solution we use a substance that is classified as a primary standard.
To be classified as a primary standard a substance must:

- be soluble, readily available and in pure form
- have a known formula
- not react with the atmosphere eg, absorb moisture, react with carbon
- have a relatively large molar mass (to minimise the percentage errors during weighing)

Some examples of primary standards are Na_2CO_3, a weak base, and a strong oxidant, $K_2Cr_2O_7$.
Now to prepare a standard solution, after you have identified the primary standard that will be used, an accurate electronic balance and volumetric flask are needed.



Let's try an example
A HCl solution, whose concentration is unknown, is titrated with a standard Na_2CO_3 solution made by weighing 1.065 grams of Na_2CO_3 into a 250 mL volumetric flask and filling to the mark with distilled water. The burette was then rinsed and filled with the standard solution.
A 25.00 mL sample of the acid solution was transferred to a 100mL conical flask and titrated to the end point. An average titre of 25.53 mL was obtained.

a. Calculate the concentration of the standard solution to the right number of significant figures.
   Step 1 find the mol of Na_2CO_3
   => 1.065g /106.0 = 0.01005
   Step 2 find the concentration
   => 0.01005 / 0.2500 =0.04019 M = 4.019 X 10^{-2}
   (the 250 mL volumetric flask is accurate enough to be expressed as 250.0 ml)
b. Calculate the concentration of HCl, in mol/L, in the original sample.
   Step 1 write a balanced chemical equation for the reaction taking place in the conical flask.
   $Na_2CO_3(aq) + 2HCl(aq) \rightarrow 2NaCl(aq) + H_2O(aq)$
   Step 2 Find the mol of Na_2CO_3 in the average titre.
   => mol = C X V = 0.04019 M X 0.02553 L = 0.00103 mol
   Step 3 Find the mol of HCl in the conical flask
   => mol of HCl = 2 X mol of Na_2CO_3 = 0.00206 mol
   Step 4 Find the concentration of the original HCl solution
   => C = mol /V(L) = 0.00206 / 0.02500 = 8.24 X 10^{-2}M