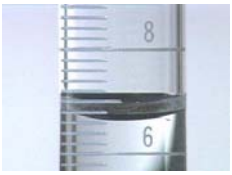
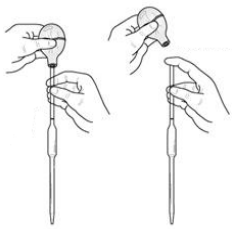
Titration Review



Titration is the chemical analysis involving the progressive addition of a solution of known solute concentration, called the **titrant**, into a solution (or a solid suspension) of unknown concentration, called the **sample**. The purpose is to determine the amount of a specified chemical in the sample, from which the molar mass and/or the concentration of the chemical may be determined. This is possible because the titrant and the sample contain substances that react according to known stoichiometry.

In general, the sample is placed in a receiving flask, and the titrant is dispensed from a buret. Before the sample can be analyzed, it is important that we know, to a considerable degree of accuracy, the concentration of the titrant, because this concentration is used to calculate the concentration of the sample. However, since titrants will be used in bulk, they need to be affordable and readily soluble, which means they are often of lesser quality (degrade or change in concentration over a period of time. This issue is resolved by "**standardizing**" the titrant as the first stage of a titration. A **primary standard** for this and is chosen based on stability and purity so we can be confident that their stated concentrations are accurate. Primary standards are solids at SATP so they can be dispensed easily, are not hygroscopic (absorb water from the air) and they are not readily volatile so their concentrations remain constant over a long period. They must also be available in very pure form and it is best if produce colourless aqueous solutions so colour changes can easily be monitored. Although this makes them very suitable for titration, the longer process to prepare them and the much higher cost makes it impossible to use them as the titrant. So, standardization process is itself a titration in which a primary standard is titrated against a titrant which, once standardized, can now easily and cheaply be used for further titrations.



An acid–base titration involves the reaction between an acid and a base. In a typical titration, a measured volume of standardized titrant is delivered from a buret to a known volume of the sample. The addition continues until the amount of reactant in the sample is just consumed by the reactant in the titrant. This is called the **equivalence point** or the **stoichiometric point**.

Before beginning an acid–base titration, a drop or two of an acid–base indicator is added to the sample. The acid–base indicator signals the end of the titration by sharply and permanently changing colour (called the **end point**) when the equivalence point is reached. At this point, the volume of titrant added is recorded, and the number of moles of titrant used to reach the equivalence point is calculated. Ideally, an acid–base indicator is chosen such that the endpoint occurs precisely at the equivalence point (so the colour change occurs sharply at the point where a complete reaction is attained). Bromothymol blue and phenolphthalein are common indicators used in acid–base titrations. Bromothymol blue changes from yellow to blue in the range pH 6.0 to 7.6. Phenolphthalein changes from colourless to pink in the range pH 8.2 to 10.0.