Volumetric Analysis

Volumetric analysis Or Titration

Is a common laboratory method of quantitative chemical analysis that is used to determine the unknown concentration (analyte) wen react with substance of a known concentration (primary standard or titrant). Because volume measurements play a key role in titration, it is also known as volumetric analysis.

Some terms used in volumetric analysis

Equivalence point (Veq):

The point in a titration at which the amounts of analyte and titrant are stoichiometrically equivalent (theoritical end of titration).

End point (Vep):

The point of titration at which the completion of a reaction is practically observed.

Unfortunately, the endpoint and the equivalence point are not exactly the same.

The difference between the two is called the titration error.

Titration error:

The difference between the end point and the equivalence point

$$Et = Vep - Veq$$

Titrant: The standard solution of known concentration added from the burette.

Analyte: An unknown solution which is to be determined.

Indicator:

A colored compound reagent added to the analyte solution to produce an observable physical change (usually change in color) at or near the equivalence point when the titration reaction is complete, and so mark the endpoint e.g:

Phenolphthalein, Methyl Orange, Methyl red, Eriochrome Black T etc.

Back titration: A technique used to determine the excess of a reagent used in the neutralization of the sample by a titration with a second reagent

Standard solution: A reagent of known concentration used to react with analyte in a titrimetric analysis.

Primary standard:

Is a pure compound from which a standard solution of accurately known concentration can be prepared directly, without any need for standardization.

Secondary standard:

Is a solution that its concentration is not accurately known so it is to be standardized by "Primary Standard" before use in titration.

Standardization:

The process of finding the actual concentration of analyte or the secondary standard solution by titrating it with a suitable primary standard solution.

Requirements for the primary standard material

1 .High purity at least about 99.99%.

2 .Stable at normal temperature or drying temperature and not absorb moisture or CO_2

3 .Easily soluble in solvent used and have stoichiometric reactions.

4 .High Molecular weight

5 .Easily available at reasonable cost

Requirements of reaction in the volumetric analysis

1. Equation for the reaction must be known.
2. The substance to be determined should react completely with the reagent (Titrant)
3. The reaction should be quantitative and stoichiometric
4. The reaction should be rapid and not reversible.
5. A suitable indicator should be known to determine end point of the reaction.
6. The reaction performed without any side reaction and no interferences.

The Equipment used in the volumetric analysis

Pipette - for measuring accurate and precise volumes of solutions

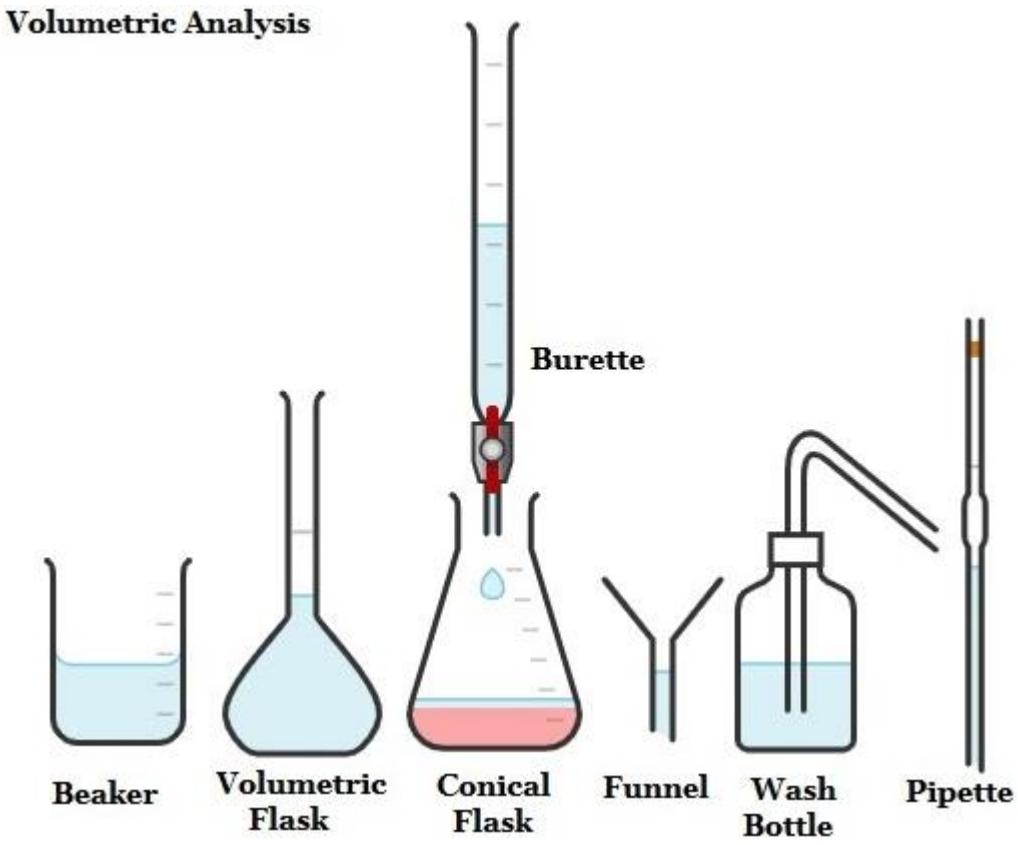
Burette - for pouring measured volumes of solutions

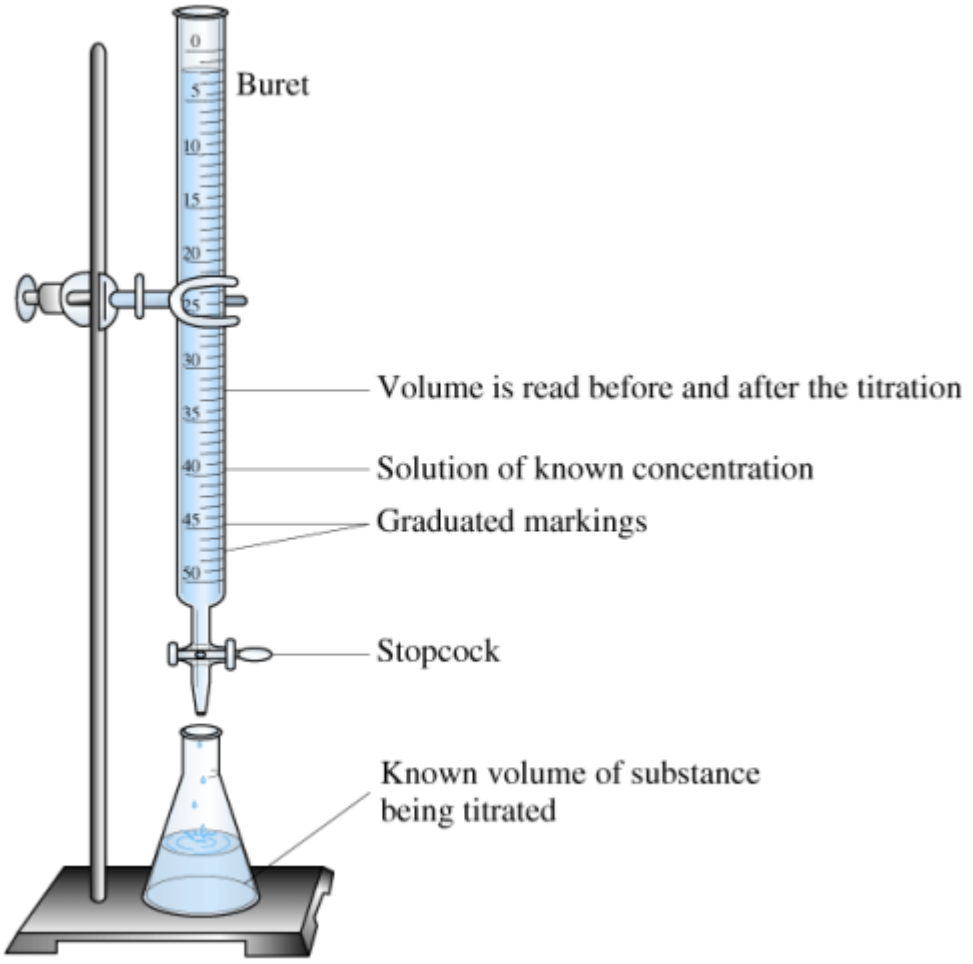
Conical flask - for mixing two solutions

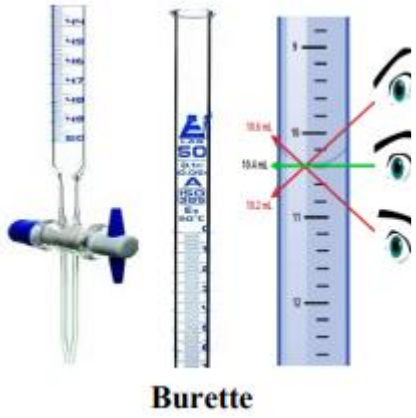
Wash bottles - these contain distilled water for cleaning equipment

Funnel - for transfer of liquids without spilling

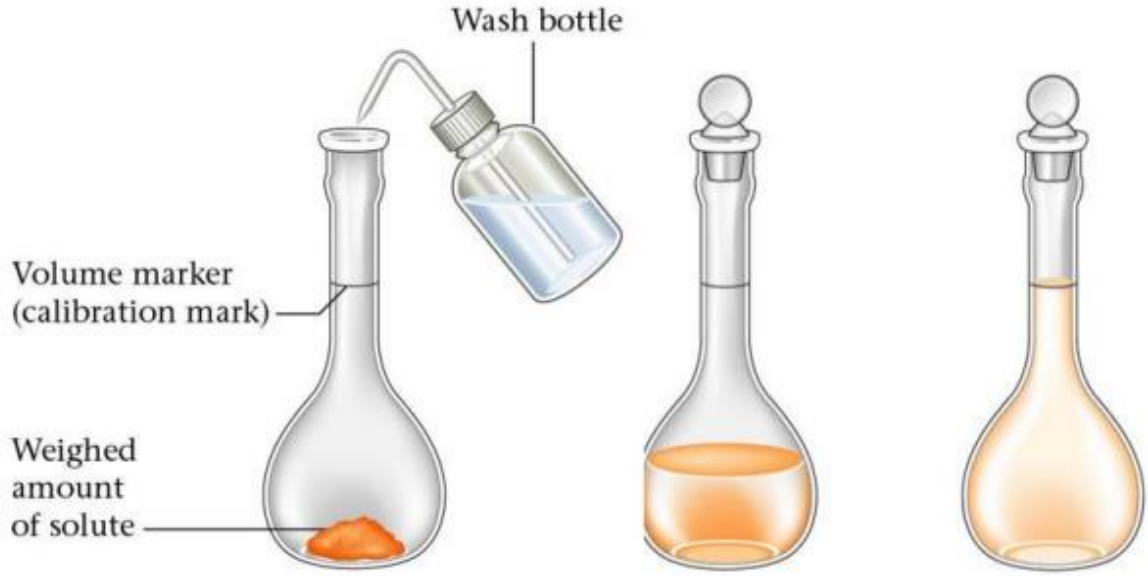
Volumetric flasks - a flask used to make up accurate volumes for solutions of known concentra tion




Buret
Volume is read before and after the titration
Solution of known concentration
Graduated markings
Stopcock
Known volume of substance being titrated



Burette


Wash bottle
Volume marker (calibration mark)
Weighed amount of solute