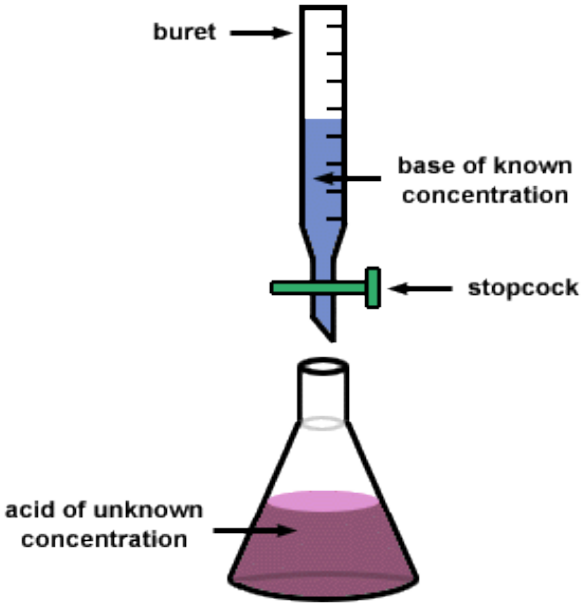
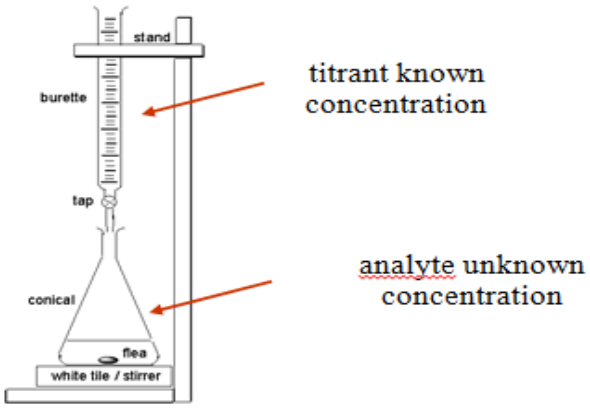
Name of exp.: Titration acid-base

Purpose of exp.: determine the concentration of unknown acid or base

Theory

Titration is a general class of experiment where a known property of one solution is used to infer an unknown property of another solution. In acid-base chemistry, we often use titration to determine the pH of a certain solution. The concentration of acids and bases can be experimentally determined by neutralization reactions. We use this instrumentation to calculate the amount of unknown acid in the receiving flask by measuring the amount of base, or titrant, it takes to neutralize the acid. There are two major ways to know when the solution has been neutralized. The first uses a pH meter in the receiving flask adding base slowly until the pH reads exactly 7. The second method uses an indicator. An indicator is an acid or base whose conjugate acid or conjugate base has a color different from that of the original compound. The color changes when the solution contains a 1:1 mixture of the differently colored forms of the indicator.





Titration: the process of analyzing composition by measuring the volume of one solution needed to completely react with another solution.

Analyte: the solution of unknown concentration but known volume.

***Titrant*:** the solution of known concentration.

Analyte + Titrant → Products

Add titrant until all of the analyte has reacted, then detect the excess of titrant.

Equivalence Point: the point at which exactly the right volume of titrant has been added to complete the reaction.

***Indicator*:** substance that changes color when an excess of titrant has been added (phenolphthalein, bromocresol green).

Indicator	Color on acidic side	Range of color change	Color on basic side
Methyl Violet	Yellow	0.0–1.6	Violet
Bromophenol Blue	Yellow	3.0–4.6	Blue
Methyl Orange	Red	3.1–4.4	Yellow
Methyl Red	Red	4.4–6.3	Yellow
Litmus	Red	5.0–8.0	Blue
Bromothymol Blue	Yellow	6.0–7.6	Blue
Phenolphthalein	Colorless	8.3–10.0	Pink
Alizarin Yellow	Yellow	10.1–12.0	Red

Procedure

Fill the burette with NaOH (0.1 M) and run through to the zero mark (use a funnel to fill the burette and a beaker to collect the excess solution).(Titrant)

Add 10 ml of s hydrochloric acid (unknown concentration)to a conical flask using a measuring cylinder and add a 2-5 drops of phenolphthalein indicator.(analyte)

Add the sodium hydroxide to the hydrochloric acid solution in small volumes swirling after each addition. Continue until the solution turns red and record this reading on the burette.

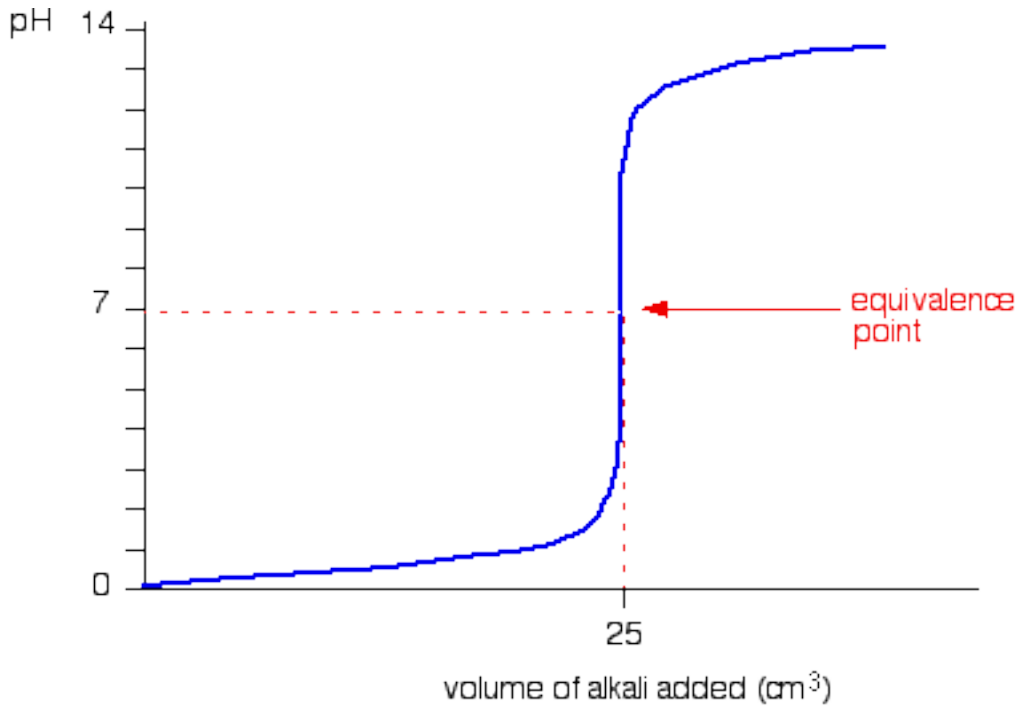
Calculation and Result:-

$M_{acid} \times V_{acid} = M_{base} \times V_{base}$

Titration curves

There is the initial slow rise in pH until the reaction nears the point where just enough base is added to neutralize all the initial acid. This point is called the equivalence point. For a strong acid/base reaction, this occurs at

pH = 7. As the solution passes the equivalence point, the pH slows its increase where the solution approaches the pH of the titration solution.



Tools of use in the exp
Burette
Pipette
Volumetric flask
Conical flask
Beakers
Funnel
Hydrochloric acid
Phenolphtalein Indicator