



Practical General Chemistry

First year students

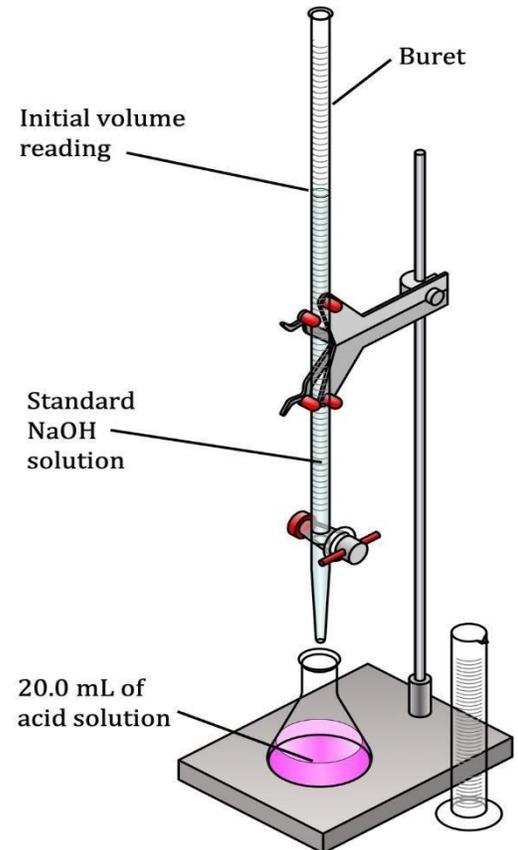
Tow Lecture: Titration

Presented by

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Titration

- ❑ A technique for determining the concentration of a solution by measuring the volume of one solution needed to completely react with another solution.
- ❑ Titration process involves addition of solution of known concentration from burette to the measured volume of analyte.



Principle of Titration: It is based on the complete chemical reaction between the analyte and the reagent (titrant) of known concentration.

Analyte: The solution of unknown concentration but known volume put in conical flask.

Titrant: The solution of known concentration put in burette.

Standard Solution: A solution of known concentration is called the standard solution.

Types of standard solution



<i>Primary standard solution</i> It has certain properties	<i>Secondary standard solution</i> It has certain properties
<input type="checkbox"/> Extremely pure.	<input type="checkbox"/> Less pure than primary standard.
<input type="checkbox"/> Highly stable.	<input type="checkbox"/> Less stable than primary standard.
<input type="checkbox"/> It should not be hygroscopic.	<input type="checkbox"/> Cannot be weighed easily.
<input type="checkbox"/> It should be stable toward air.	
<input type="checkbox"/> It should not undergo any side-reaction.	
<input type="checkbox"/> Can be weighed easily.	
<input type="checkbox"/> It should be available and not too expensive.	



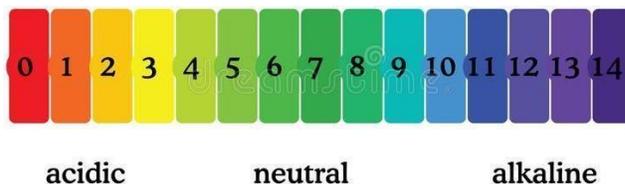
Equivalence Point: It is a theoretical point where the amount of two reactants are just equivalent.

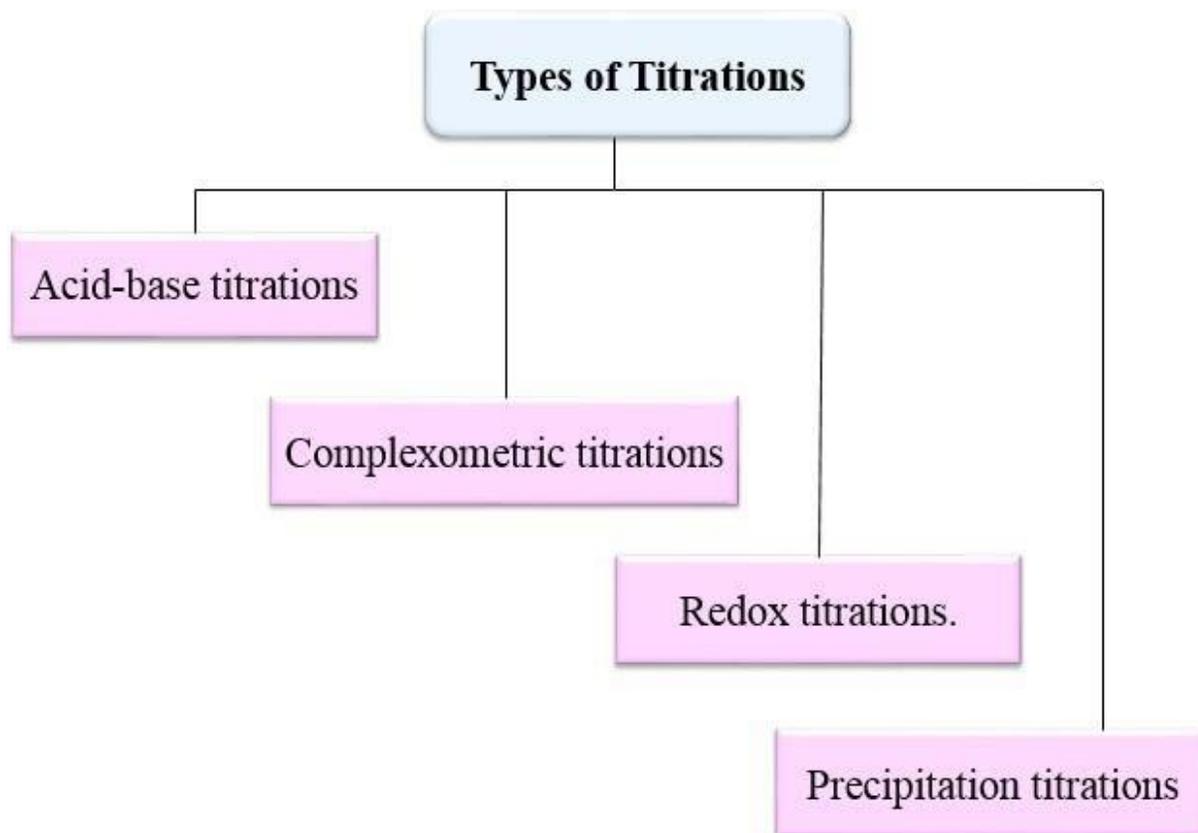
End Point: It is a practical point at which the reaction is observed to be complete, this point is usually observe with the help of indicator.

Indicator

An auxiliary substance (either weak acids or weak bases) which helps in the usual detection of the completion of the titration process at the end point. acid-base titrations, are generally used indicators. They change their color within a certain pH range.

pH scale





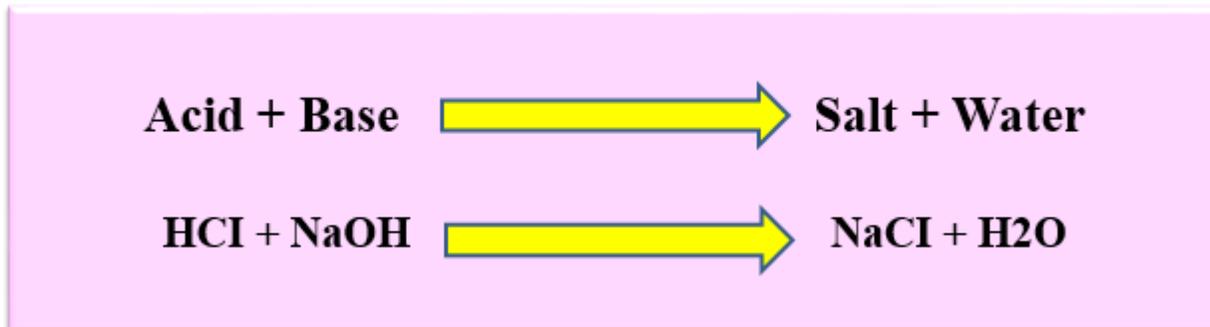
Acid – base Titration (neutralization)

A sample of unknown concentration of acid is estimated with a known concentrated base or vice-verse.

In this experiment, we will quantitatively study an acid-base reaction. **Strong acids and strong bases dissociate completely in water.**

Determination normality of sodium hydroxide solution by a standard solution of hydrochloric acid.

HCl reacts with sodium hydroxide according to the following equation:



The eq.wt. of both the HCl and NaOH is equal to their molecular weights.

Note// Both the acid and base are **strong**, any **indicator** may be used.

Glassware

- Burette
- Stand
- Conical flask
- Funnel
- Beaker
- Pipette
- Graduated Cylinder
- Dropper
- Washing bottle.

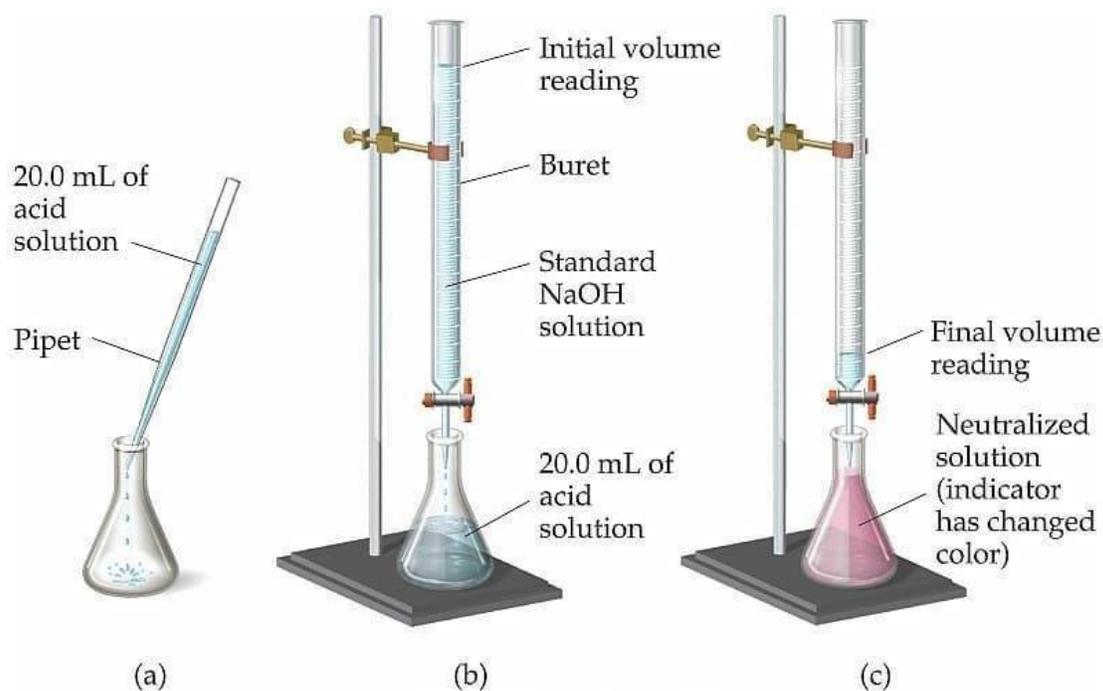
Materials

- HCl solution (standard) known normality.
- NaOH solution of **unknown** normality.
- Phenol naphthalene indicator.

Procedure

Standardization of the NaOH solution by titrating with standard of HCl solution:

- 1- Transfer by a pipette **5 ml** of unknown **NaOH** solution to a conical flask.
- 2- Add to the conical flask two or three drops of phenol naphthalene indicator.
- 3- Fill the burette with **HCl** solution to zero mark.
- 4- Titrate NaOH against HCl until the color of solution changes from **colorless to pink**.
- 5- Repeat the experiment **three** times and record your results.





Calculations

1. Titrations results

Titrations	1(trial)	2	3
Final burette reading(ml)			
Initial burette reading(ml)			
Volume of HCl (ml)			

The volume of NaOH used in three times is **5 ml**.

2. Average volume of HCl used = (calculated from burette).

$$V_{average} = \frac{V_1 + V_2 + V_3}{3}$$

3. Then the unknown concentration calculated by using the law:

