

Lab 2

Quantitative analysis

Quantitative analysis is the part of analytical chemistry that deals with of amount or concentration of constituents it is divided in to three types :-

- 1- Volumetric anslysis (Titration)
- 2- Gravimetric analysis
- 3- Instrumental analysis

Titration :- it is the process of a slowly adding of the standard solution (burette) to unknown concentration solution (conical flask) until the reaction between the two solutions is just complete . The solution known concentration is called **Titrant** or **Titrator** while the solution unknown concentration is called **Titrand** or **analyte** .The point at which the reation is just complete is called the **End point** while the **Equivalence point** is the point at which the number of moles for titrant is equals to the number of titrand , **Indicator** is a colored compound whose change in color signals the end point of a titration. As an example the indicator used in the neutralization titration of hydrochloric acid with sodium hydroxide is phenolphthalein which causes the solution to change from colorless to a pink color . **Standard Solution** is a solution known concentration is prepare by dissolving an material called a primary standard and diluting to an accurately known volume , in a volumetric flask .

Requirement of primary standard solution :-

- 1- It is must be of the highest purity .
- 2- It should be stable and not attacked by atmosphere.
- 3- It should not be hygroscopic.
- 4- it should be available and not too expensive.
- 5- It should have high equivalent to minimize weighing errors.

Classification of Titrimetric :-

- 1- Acid –Base titrations
- 2- Oxidation –reductions titrations
- 3- Complex metric titrations
- 4- Precipitations titrations

Experiment N0. (2)

Preparation and standardization of approximately (0.1N) HCl

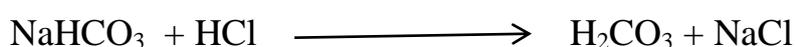
Theory :-

The acid–base titrations (neutralization) is a titration in which an acidic or basic titrant reacts with an analyte that is a base or an acid. The end points of these titrations are easy to detect, either by an indicator or by the change in pH with a pH meter.

The laboratory solution of hydrochloric acid is not primary standard solution (P.S.S.) because it is volatile and not has equivalent weight so it usually standardized agent borax or sodium carbonate .

Borax is the more convenient , and it is easily obtained in a chemically pure state ($\text{Na}_2\text{B}_4\text{O}_7$) it is quite stable and it has high gram – equivalent ,while sodium carbonate is more difficult obtained in pure state and has low gram – equivalent than borax and is anhydrous .

Sodium carbonate react completely with HCl as the following equation



Sodium carbonate is hygroscopic , so that it must be heated before use to remove water .

The Requirement Materials

- 1- 0.1 N Sodium carbonate .
- 2- Hydrochloric acid (unknown concentration) .
- 3- Indicator .

Procedure :-

1- Prepare (0.1N) sodium carbonate in (250ml) D.W .

$$N = \text{wt/ eq.wt} * 1000/v \text{ ml}$$

2- Prepare (0.1N) hydrochloric acid in (250ml) D.W

$$N = \text{sp. gr.} * \% * 1000 / \text{Eq.wt}$$

$$\text{Then } N_1V_1 = N_2V_2$$

3- Take 10 ml of hydrochloric acid (unknown solution) and put it in the conical flask .

4- Add (2-3) drops of methyl orange (M.O) .

5- Fill the burette with sodium carbonate (known solution) .

6- Titrate until the change of the color of indicator

7- Calculate the concentration of hydrochloric solution by :

$$N_1V_1 = N_2V_2$$

Note :- The HCl solution now became known concentration and called standardized solution so it can used to determine of another alkaline solution.

Questions :-

1- Why HCl solution in lab. Is not P.S.S. ?

2- Prepare (0.1N) HCl in (250ml) D.W ?

3- Write the reaction equation between HCl and Borax ?

4- Which indicator can be used in titration HCl against Borax and why ?