Preparation of different types of solutions

Experiment (7)

An analysis of a mixture of Na_2CO_3 and NaOH using two indicators and a standard HCl solution

Theory:

1- When a known volume of the mixture is titrated with HCl in presence of ph. ph., the acid reacts with all the sodium hydroxide and with only half of the carbonate.

V1 = all hydroxide + 1/2 the carbonate

2- When a known volume of the mixture is titrated with HCl in presence of M.O., the acid reacts with all the hydroxide and all the carbonate.

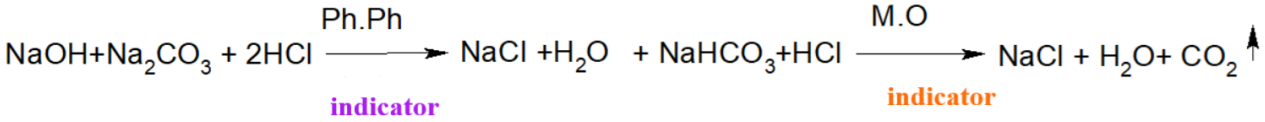
V2 = all hydroxide + all carbonate

Volume of HCl = 1/2 carbonate = V2 – V1 = V ml

Volume of HCl = all carbonate = 2V ml

Volume of HCl = NaOH = V2 - 2V ml

General interaction



Materials and method:

1- Fill the burette with 0.1N (HCl) solution.

2- Transfer with a pipette 10 ml of the mixture ($NaOH + Na_2CO_3$) to a conical flask, and add one or two drops of ph. ph.

3- Add the acid from the burette till the solution becomes colorless.

4- Repeat the experiment twice or three times and tabulate your results.

- The volume of acid in the case is V_X and is equivalent to all the hydroxide and half the carbonate ($NaOH + ½ Na_2CO_3$).

5- Repeat the experiment with methyl orange (M.O) until the color of the solution is changed to faint red.

6- Repeat the experiment twice or three times and tabulate your results.

- The volume of acid in the case is V_y and is equivalent to all the hydroxide and all the carbonate ($NaOH + Na_2CO_3$), which represents the volume of the acid, which is equivalent to ($1/2 Na_2CO_3$).

7- Calculate the strength of the sodium hydroxide and the sodium carbonate in the mixture.

Calculations:

- **In the case of Na_2CO_3:**

- Calculate the concentration of (Na_2CO_3).

- Calculate the volume of acid (HCl) that is equivalent to (Na_2CO_3)

$V_1=2Vy$

$N_{HCl} \times V_{HCl} = N_{Na2CO3} \times V_{Na2CO3}$

- **In the case of NaOH:**

  - Calculate the volume of acid equivalent (NaOH).

$V_2 = V_X - V_y$

$V_2 = V_X$ (1/2 Na_2CO_3 + NaOH) - V_y (1/2 Na_2CO_3)

$N_{HCI} \times V_{HCl} = N_{NaOH} \times V_{NaOH}$

Experiment (8)

Precipitation titration

Determination of chloride ion by Mohr method

Precipitation titration: is titration depend upon the combination of ions to form a simple precipitate. Mohr method is a method depend upon formation a colored precipitate for the determination of chloride ion.

Chloride ion, is reacted with silver nitrate solution to form AgCl precipitate.

$AgNO_3+NaCl \longleftrightarrow AgCl + NaNO_3$ Ksp AgCl=1.2×10^{-10}

A small quantity of potassium chromate (K_2CrO_4) solution is added to serve as indicator. The first excess of titrant results in the formation of a red silver chromate precipitate which signal the end point.

$2AgNO_3+K_2CrO_4 \longleftrightarrow Ag_2CrO_4+2KNO$ Ksp $Ag_2CrO_4=1.7\times10^{-12}$

Procedure:

1-Clean the burette and fill it with silver nitrate (0.1N).

2-Pipet 10mL of chloride ion solution into 250mL conical flask, add 5drops of potassium chromate.

3-Titrate chloride solution against silver nitrate until arrive to equivalent point(the point in which the number of moles of $AgNO_3$ equal to the number of moles of chloride ion)[Notice a white precipitate in the yellow solution].

After this point the excess of $AgNO_3$ will react with potassium chromate leading to formation of red precipitate Ag_2CrO_4 (the end point). The difference between equivalent and end point is the volume of AgNO3 reacted with the indicator.

4- Repeat the titration and calculate the average and subtract the indicator blank (equal to 0.1mL). Calculate the normality.

$N_{Cl^-} \times V_{Cl^-} = N_{Ag^+} \times V_{Ag^+}$

Concentration of [Cl-](ppm) = $N_{Cl^-} \times$ eq.wt $\times 1000$