Date 21-09-21

Expt. No. 1 Page No.

DETERMINATION OF Na_2CO_3 AND NaOH IN A MIXTURE BY TITRATION

★ AIM:

To determine the amount of Na_2CO_3 and NaOH in a mixture using hydrochloric acid.

★ PRINCIPLE:

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

(2) When the titration is continued with methyl orange indicator, the remaining half of CO_3^{2-} ions will be neutralised with HCl at the end point.

A = all hydroxide ions + half of carbonate ions.

B = half of carbonate ions after phenolphthalein end point.

2B = all carbonate ions.

A - B = all hydroxide ions.

★ PROCEDURE:

(1) TITRATION 1: Standardization of HCl.

→ 20 ml of 0.1 N Na_2CO_3 solution is pipetted into a clean conical flask and two or three drops of methyl orange indicator is added to the solution.

→ The solution is the titrated against hydrochloric acid taken in the burette.

→ The end point is change of colour from yellow to orange. The titrations are repeated to get concordant values.

Teacher's Signature

Expt. No. _____ Date _____

Page No. _____

(2) TITRATION 2: Estimation of Na_2CO_3 and NaOH.

→ The given unknown solution is made upto 100 ml in a standard flask using distilled water.

→ 20 ml of this made up solution is pipetted into a clean conical flask.

→ Add 2 to 3 drops of phenolpthalein indicator and titrate against standard HCl.

→ The disappearance of pink colour is observed as end point and note down the titre value. Let it be A ml.

→ To the same solution, add 2 or 3 drops of methyl orange indicator and continue the titration till the colour changes from yellow to orange and note down the titre value after the phenolphthalein end point. Let it be B ml.

→ The titration is repeated to get concordant values of both A and B.

★ OBSERVATIONS AND CALCULATIONS:

→ KNOWN VALUES:

Volume of HCl (V_1) = 24.4 ml

Normality of HCl (N_1) = ?

Volume of Na_2CO_3 (V_2) = 20 ml

Normality of Na_2CO_3 (N_2) = 0.1 N

Volume of HCl required for neutralization of Na_2CO_3 = 18 ml

∴ Normality of HCl, $N_1 = \frac{20 \times 0.1}{V_1} = \frac{20 \times 0.1}{24.4} \Rightarrow 0.081967\ N$

∴ Normality of $Na_2CO_3 = \frac{18 \times 0.081967}{20} \Rightarrow 0.07377\ N$

Teacher's Signature _____

Date _____

Expt. No. _____ Page No. _____

→ TITRATION 1 :

S.No.	Volume of Na_2CO_3 (ml)	Burette Reading		Concordant Value	Indicater
		Initial	Final		
1	20	0	24.4	24.4	Methyl Orange
2	20	0	24.4	24.4	Methyl Orange
3	20	0	24.4	24.4	Methyl Orange

→ TITRATION 2 :

S.No.	Volume of unknown solution (ml)	Burette Reading (ml)		
		Initial	Volume consumed for phenolphthalien end point (A)	Volume consumed for methyl orange end point (B).
1	20	0	26.3	35.3
2	20	0	26.3	35.3
3	20	0	26.3	35.3
Concordant Value			(A) 26.3	(B) 35.3

★ CALCULATIONS :

(1) Estimation of amount of Na_2CO_3 :

Volume of HCl (V_1) = 2B

Normality of HCl = N_1

Volume of mixture (V_2) = 20 ml

Normality of mixture (N_2) = $\frac{2B \times N_1}{20} \Rightarrow 0.07377\,N$

∴ Amount of Na_2CO_3 present in the given mixture =

Teacher's Signature _____

Date

Expt. No. Page No.

$N_2 \times 50 \times 1000 \Rightarrow 0.39098$ mg/L or ppm.

(2) Estimation of amount of NaOH:

Volume of HCl (V_1) = A-B ml

Normality of HCl (N_1) = N_1

Volume of mixture (V_2) = 20 ml

Normality of mixture (N_2) = $\frac{(A-B) \times N_1}{20} \Rightarrow \frac{0.081967 \times 17.3}{20}$

$\Rightarrow 0.0709$ N.

∴ Amount of NaOH present in given solution = $N_2 \times 50 \times 1000 \Rightarrow 0.2836$ mg/L or ppm.

★ RESULT:

→ Amount of Na_2CO_3 present in the given sol = 0.39098 ppm

→ Amount of NaOH present in the given sol = 0.2836 ppm

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