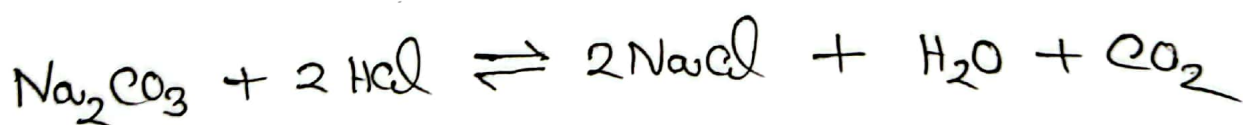


Experiment No:

Experiment Name: Standardization of hydrochloric (HCl) with standard Sodium carbonate (Na_2CO_3) solution.

Theory: Sodium carbonate is a primary and hydrochloric acid is a secondary standard substance. Hydrochloric acid is standardized by titrating it against standard Sodium carbonate solution using Methyl orange indicator. The reaction between sodium carbonate and hydrochloric acid is as follows;



Here, by measuring the volume of the HCl solution required to react completely with a solution of a weighed sample of sodium carbonate the exact concentration of HCl solution is determined.

Apparatus: Conical flask, Pipette, Burette, Beaker, Funnel, Volumetric flask, Electric balance.

Reagents and Chemicals: (i) Sodium carbonate
(ii) Hydrochloric acid.

Indicator: Methyl orange.

Procedure:

Step-1: Molecular weight of $\text{Na}_2\text{CO}_3 = 23 \times 2 + 12 + 16 \times 3$
 $= 106$

\therefore 1000 mL 1M Na_2CO_3 solutions contains 106 g Na_2CO_3 .

\therefore 100 mL 0.25M " " " = $\frac{106 \times 100 \times 0.25}{1000}$

$= 2.65 \text{ g } \text{Na}_2\text{CO}_3$

Step-2: Standardization of supplied HCl solution

in a conical flask by the prepared Na_2CO_3 solution

1. 10 mL of Na_2CO_3 solution was supplied in a conical flask by means of a pipette.
2. 2-3 drops of Methyl Orange indicator was added to the solution.
3. The acid solution was added drop by drop from a burette into the sodium carbonate solution. The flask was shaken frequently while adding the acid solution. The addition continued until the solution becomes red or faint pink. That was the end of the titration.
4. The burette reading was noted. The difference between initial and final reading is the volume of the acid added.

5. The steps were repeated at least 3 times.
6. Finally the concentration of the supplied HCl was calculated.

Experimental Data:

No. of Observation	Volume of Na_2CO_3 V_{base} (mL)	Burette reading (Volume of HCl)			Mean V_{acid} (mL)
		Initial (mL)	Final (mL)	Difference (mL)	
1	10	0	80	80	85
2	10	0	85	85	
3	10	0	90	90	

Calculation: Using equation (1) we get,

$$\frac{V_A S_A}{2} = V_B S_B$$

$$\Rightarrow S_A = \frac{2V_B S_B}{V_A} = \frac{2 \times 10 \times 0.25}{85}$$

$$\therefore S_A = 0.059 \text{ mol L}^{-1}$$

Result: The strength of the supplied HCl solution was calculated as 0.059 M.

$$\therefore m = 1, 2$$

Precautions:

1. While weighing do not spill the substance on balance pan.
2. Rotate the knob of balance gently.
3. Wash the watch glass carefully so that even a single crystal is not left on the watch glass.
4. Bring the watch glass close to funnel while transferring weighed substance and transfer it gently.
5. Wash the burette with water after ~~the~~ titration is over.