# EXPERIMENT

AIM

To determine the strength of a given solution of hydrochloric acid by titrating it against standard $\frac{N}{10}$ sodium carbonate solution.

MATERIAL REQUIRED

Sodium carbonate solution $\frac{N}{10}$ OR $\frac{M}{20}$, Hydrochloric acid (approx. $\frac{N}{10}$ OR $\frac{M}{20}$) Methyl orange., burette, pipette, conical flask, funnel.

PROCEDURE

1. The molarity of hydrochloric acid is determined by titrating it against the standard solution of sodium carbonate using methyl orange as an indicator.
2. The strength of the acid is determined by multiplying its molarity with its molecular mass which is 36.5

$$Na_2CO_3(aq) + 2HCl(aq) \longrightarrow 2NaCl(aq) + CO_2(g) + H_2O(l)$$
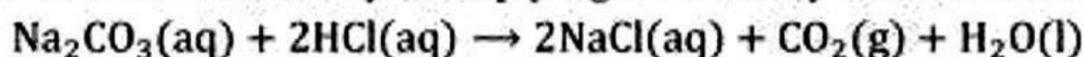
Indicator: Methyl orange.
Endpoint: Yellow to pink (acid in burette).

(i) Take a burette and wash it with water.
(ii) Rinse the burette with the given solution of hydrochloric acid and fill it with it.
(iii) Rinse the pipette with the given sodium carbonate solution and pipette out 20 ml of this solution in a washed titration flask.
(iv) Add 2-3 drops of methyl orange indicator to the titration flask and place it just below the nozzle of the burette over a white-glazed tile.
(v) Note down the initial reading of the burette and run the acid solution slowly and
(vi) dropwise to the titration flask till the colour of the solution changes from yellow to light pink.
(vii) Note the final reading and find the volume of hydrochloric acid used.
(viii) Repeat the procedure to take a set of at least three concordant readings.

OBSERVATIONS

Molarity of Na_2CO_3 solution = 0.05 M
The volume of Na_2CO_3 solution taken in each titration = 20.0 ml.

S. No.	The initial reading of the burette	Final reading of the burette	Volume of the sodium hydroxide solution used
1.	—	—	— ml
2.	—	—	— ml
3.	—	—	— ml

CALCULATION

$$N_1 V_1 = N_2 V_2 \text{ or } n_1 M_1 V_1 = n_2 M_2 V_2$$

$$N_{HCl} \times V_{HCl} = N_{Na_2CO_3} \times V_{Na_2CO_3}$$

$$N_{HCl} = \frac{N_{Na_2CO_3} \times V_{Na_2CO_3}}{V_{HCl}} = \frac{0.1 \times 10}{V_{HCl}} = \text{------------} N$$

Strength of HCl solution = N_{HCl} × Equivalent weight of HCl = N_{HCl} × 36.5 g/L = ---------- gL

RESULT

The strength of the given solution of HCl is .... g/L

PRECAUTIONS

(i) Do not rinse the conical flask.

(ii) Wash the conical flask with water after each titration.

(iii) Rinse the burette and pipette with the solution to be taken in it.

(iv) Note down the lower meniscus of the colourless solution of NaOH and oxalic acid. All the precautions given in the handling of apparatus under the 'introduction'. of this unit should be observed.

VIVA VOCE

Q 1. What is the primary objective of titrating a solution of hydrochloric acid against N/10 sodium carbonate solution?

Ans. The primary objective is to determine the concentration (strength) of the hydrochloric acid solution by measuring the volume of sodium carbonate solution required for neutralization.

Q 2. Explain the chemical reaction involved in the titration process.

Ans. The reaction involves the neutralization of hydrochloric acid (HCl) with sodium carbonate (Na_2CO_3), resulting in the formation of water, carbon dioxide, and sodium chloride.

Q 3. Why is sodium carbonate chosen as the titrant in this titration?

Ans. Sodium carbonate is used because it reacts stoichiometrically with hydrochloric acid and is stable as a primary standard, making it suitable for accurately determining the concentration of the acid.

Q 4. What indicator would be suitable for this titration, and why?

Ans. Methyl orange is a suitable indicator for this titration as it undergoes a color change around the pH range of 3.1 to 4.4, which corresponds to the endpoint of the titration.

Q 5. Can you directly prepare the standard solutions of HCl, HNO_3 and H_2SO_4?

Ans. No, the standard solutions of HCl, HNO_3, and H_2SO_4, cannot be prepared directly because all of these are used as secondary standard solutions.

Q 6. Can we titrate Na_2CO_3 the solution against oxalic acid?

Ans. No, because no indicator gives a definite change in color at the endpoint

Q 7. On what principle, is weighing by using rider based?

Ans. The principle of the moment is applied for weighing chemicals by using a rider.