Determine the strength and molarity of the given solution of hydrochloric acid. Given is 0.05 M Na_2CO_3 solution.

Theory

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

Chemical Equation :

$$Na_2CO_3(aq) + 2HCl(aq) \longrightarrow 2NaCl(aq) + CO_2(g) + H_2O(l)$$

Indicator. Methyl orange.
End Point. Yellow to pink (Acid in burette).

Procedure

1. Take a burette and wash it with water.
2. Rinse the burette with the given solution of hydrochloric acid and fill it with it.
3. Rinse the pipette with the given sodium carbonate solution and pipette out 20 ml of this solution in a washed titration flask.
4. 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.
5. Note down the initial reading of the burette and run the acid solution slowly and dropwise to the titration flask till the colour of the solution changes from yellow to light pink. .
6. Note the final reading and find the volume of hydrochloric acid used.
7. Repeat the procedure to take a set of at least three concordant readings.

Observations

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

S.No.	Initial reading of the burette	Final reading of the burette	Volume of the sodium hydroxide solution used
1.	—	–	— ml
2.	—	—	— ml
3.	—	—	— ml
4.	—	—	— ml

Calculations

Volume of HCl solution used for neutralising 20.0 mL of 0.05 M Na_2C0_3 solution = x mL

$$\frac{M_1V_1 \quad (HCl)}{M_2V_2 \quad (Na_2CO_3)} = \frac{Stoichiometric \quad coefficient \quad of \quad HCl}{Stoichiometric \quad coefficient \quad of \quad Na_2CO_3}$$

$$\frac{M_1 \times x}{0.05 \times 20.0} = \frac{2}{1}$$

$$M_1 = \frac{2 \times 20.0 \times 0.05}{x} = \frac{2}{x}$$

Molar mass of HC1 = 36.5 g mol^{-1}

Strength of hydrochloric acid = $\frac{2}{x} \times 36.5 \quad gL^{-1}$

Result

The strength of the given solution of hydrochloric acid is $\frac{73}{x} gL^{-1}$