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EXPERIMENT NO. 1

AIM :

Determine the strength of commercial HCl, 10mL of which has been dissolved per litre of given solution.

APPARATUS :

Burette, Pipette, Conical flasks, Beakers and glazed tile.

CHEMICAL REQUIRED :

Hydrochloric acid (HCl), N/10 solution of sodium carbonate (Na_2CO_3), Methyl Orange (indicator).

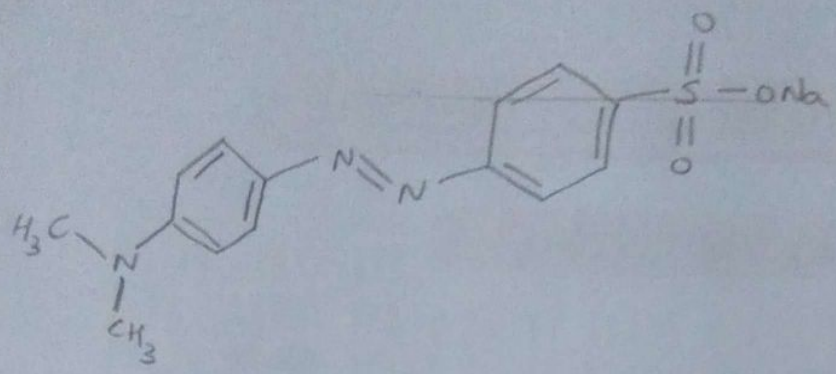
THEORY :

- Titration process involved between HCl and Na_2CO_3 is acid - base titration.
- Methyl Orange is used as indicator in the given titration.
- At pH value less than 3.1, methyl orange is red and at a pH value greater than 4.4, it will be yellow. In the range between 3.1 and 4.4, a mixture of red and yellow colours are obtained. In the middle of this orange, solution appears to be orange in colour.
- Reactions involved :

$$HCl + Na_2CO_3 \longrightarrow NaHCO_3 + NaCl$$

$$NaHCO_3 + HCl \longrightarrow NaCl + H_2O + CO_2$$

Teacher's Signature :



• Methyl Orange

Reaction :

$$HCl + Na_2CO_3 \longrightarrow NaHCO_3 + NaCl$$

$$NaHCO_3 + HCl \longrightarrow NaCl + H_2O + CO_2$$

Ionically :

$$CO_3^{2-} + H^+ \longrightarrow HCO_3^-$$

$$HCO_3^- + H^+ \longrightarrow H_2O + CO_2$$

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- End point is achieved when solution turns red from yellow.

PROCEDURE :

1. Rinse and fill the burette with given HCl solution.
2. Remove the air bubbles and set it at zero mark.
3. Pipette out 10mL of the standard Na_2CO_3 solution into a 100mL titration flask and add 1 or 2 drops of Methyl Orange.
4. Titrate with the HCl to a sharp colour change, i.e. till red colour is obtained.
5. Repeat the titration with 10mL of Na_2CO_3 solution until two concordant readings are obtained.

RESULT :

Strength of commercial HCl is 278.62 g/L.

PRECAUTIONS :

1. Usually an air bubble is present in the nozzle of the burette, it must be removed before taking the initial reading.
2. Always read lower meniscus in case of colourless solution and upper meniscus in case of coloured solutions.
3. Do not blow through the pipette to expel the last drop of solution from it, simply touch the inner surface of the titration flask with the nozzle of the pipette for this process.
4. Shaking of the titration flask should be continuous during adding the solution from the burette.
5. The funnel must be removed before starting with the titration.

Teacher's Signature :

OBSERVATIONS :

S.No.	Initial Reading	Final Reading	Volume of HCl used (mL)
1.	0	13.1	13.1
2.	13.1	26.2	13.1
3	26.2	39.2	13.0

Concordant Reading = 13.1mL

CALCULATIONS :

Normality of $Na_2CO_3 = \frac{N}{10}$

Using Normality Eqn.;

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

$$N_{HCl} \times (13.1) = \frac{1}{10} \times 10$$

$$N_{HCl} = \frac{1}{13.1} N = \underline{0.07633\,N}$$

Strength of HCl (used) $= \frac{1}{13.1} \times 36.5 = \underline{2.7862}$ g/L

Strength of commercial HCl $= 2.7862 \times 100$ g/L

$= \underline{278.62}$ g/L