Experiment No :-> 06

$(CH_3)_2N$—⬡—$N=N$—⬡—$SO_3^{\ominus} Na^{\oplus}$

Benzenoid structure, yellow in colour (fig i)

$OH^{\ominus}$ ↕ $H^{\oplus}$

H

$CH_3N^{\oplus}$≡⬡=N—N—⬡—$SO_3^- Na^+$
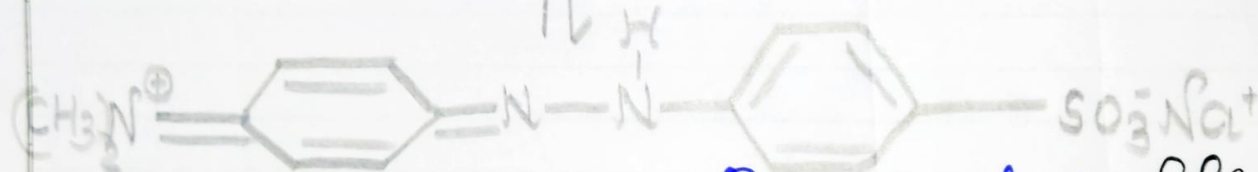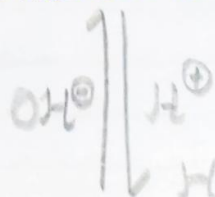
Quinonoid structure, Red in colour (fig ii)

Resonance Structure of Methyl Orange

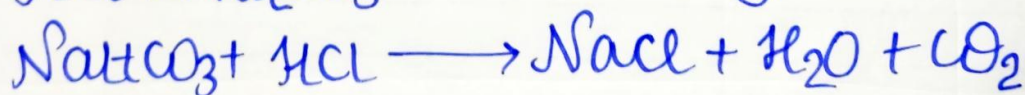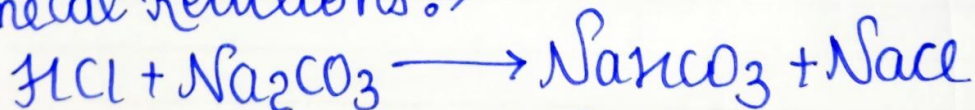## Reactions Involved

• **Chemical Reactions :->**

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

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

• **Ionic Reactions**

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

$$HCO_3^- + H^+ \longrightarrow H_2O + CO_2$$
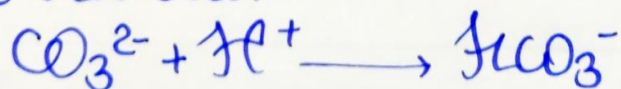
✦ Experiment No :- 06 ✦

1) **Aim:-** To determine the total alkalinity of given water sample.

2) **Apparatus Required:-** Pipette, burette stand, HCl sol^n, white paper, measuring cylinder

Chemicals Required:-
$\frac{N}{40}$ Sodium carbonate sol^n, HCl sol^n, Distilled water, Alkaline water sample, Methyl orange

3) **Theory:** This is an example of neutralization titration is based upon the specific pH range of the indicator. Methyl orange gives red colour in pH range 4.4 - 3.0. Initially, when standard of HCl is added, CO_3^{2-} ions are converted to HCO_3^-. On addition of further acid the HCO_3^- ions are converted to CO_2 and & H_2O. When all HCO_3^- ions are used up, the pH of sol^n becomes less than 4.4 instantaneously At this point methyl orange gives red colour Based on the end point, total alkalinity of given water sample is determined in terms of $CaCO_3$.

Part I: Standard $\frac{N}{40}$ Na_2CO_3 sol^n is used to standardize the given HCl sol^n in presence of

7) Observations.

Titration of given HCl soln vs std. $\underline{N}$ Na$_2$CO$_3$
$\underline{40}$

Sr.No	Volume of Na$_2$CO$_3$ taken (in mL)	Burette Readings		Volume of HCl used (in mL)
		Initial	final	
1	10	0.0	7.7	7.7
2	10	7.7	15.4	7.7
3	10	15.4	23.1	7.7

Concordant Readings = 7.7 mL

Titration of std HCl vs given Alkaline water sample

Sr.No	Volume of water sample taken (mL)	Burette Reading		Volume of HCl used (in mL)
		Initial	final	
1	10	0.0	5.3	5.5
2	10	5.3	10.6	5.3
3	10	10.6	15.9	5.3

Concordant Readings = 5.3 mL

Methyl orange as an indicator.

A) Procedure:

I) Standardization of given HCl soln.

i) Take 10 ml of standard Na_2CO_3 with help of pipette into a conical flask. Add 1-2 drops of methyl orange.

ii) Run the acid soln from the burette into conical flask dropwise with constant shaking of soln.

iii) Find the end point when light yellow colour soln turns red. Note volume of acid used. Repeat this step 4-5 times till you get two concordant readings

Part II:

Determination of total alkalinity of given water sample using the standardize HCl solution in presence of methyl orange as indicator.

Procedure:

Calculations:→

1.) To calculate Normality of given HCl soln

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

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

$$\Rightarrow N_{HCl} = \frac{1}{40} \times \left(\frac{10}{7.7}\right)$$

$$\Rightarrow N_{HCl} = \frac{1}{30.8} N$$

2.) To calculate Normality of given water sample

$$\Rightarrow N_{sample} \times V_{sample} = N_{HCl} \times V_{HCl}$$

$$\Rightarrow N_{sample} = \frac{N_{HCl} \times V_{HCl}}{V_{sample}}$$

$$\Rightarrow N_{sample} = \frac{1}{30.8} \times \frac{5.3}{10}$$

$$\Rightarrow N_{sample} = 0.0172 \, N$$

Total Alkalinity of given water sample (g/L)

$$= N_{sample} \times Eq.Wt \text{ of } CaCO_3$$

$$= 0.0172 \times 50$$

$$= \underline{0.86 \, g/L} \, Ans$$

4.) Procedure

II. Titration of water sample with HCl soln.
i) Pipette out 10ml of given water sample into a conical flask. Add 2-3 drops of methyl orange indicator
ii) Add HCl soln from the burette into the conical flask with constant shaking.
iii) Titrate with acid till yellow coloured soln aci turns red (end point). Note the volume of acid used (M). Repeat the step to get concordant readings.

5.) Result:
Total alkalinity of given water sample (in terms of $CaCO_3$) =
    $0.86 g/L$ Ans

6.) Precautions:
(i) Before starting the experiment, the glass apparatus must be perfectly cleaned.
(ii) Always rinse the burette & pipette with the soln which is to be taken in them.
(iii) Remove the air gap if any, from the burette after titration
(iv) Never forget to remove the funnel from the burette before noting the initial reading of the burette & ensure that no last drop is hanging from the nozzle.

Jenesh