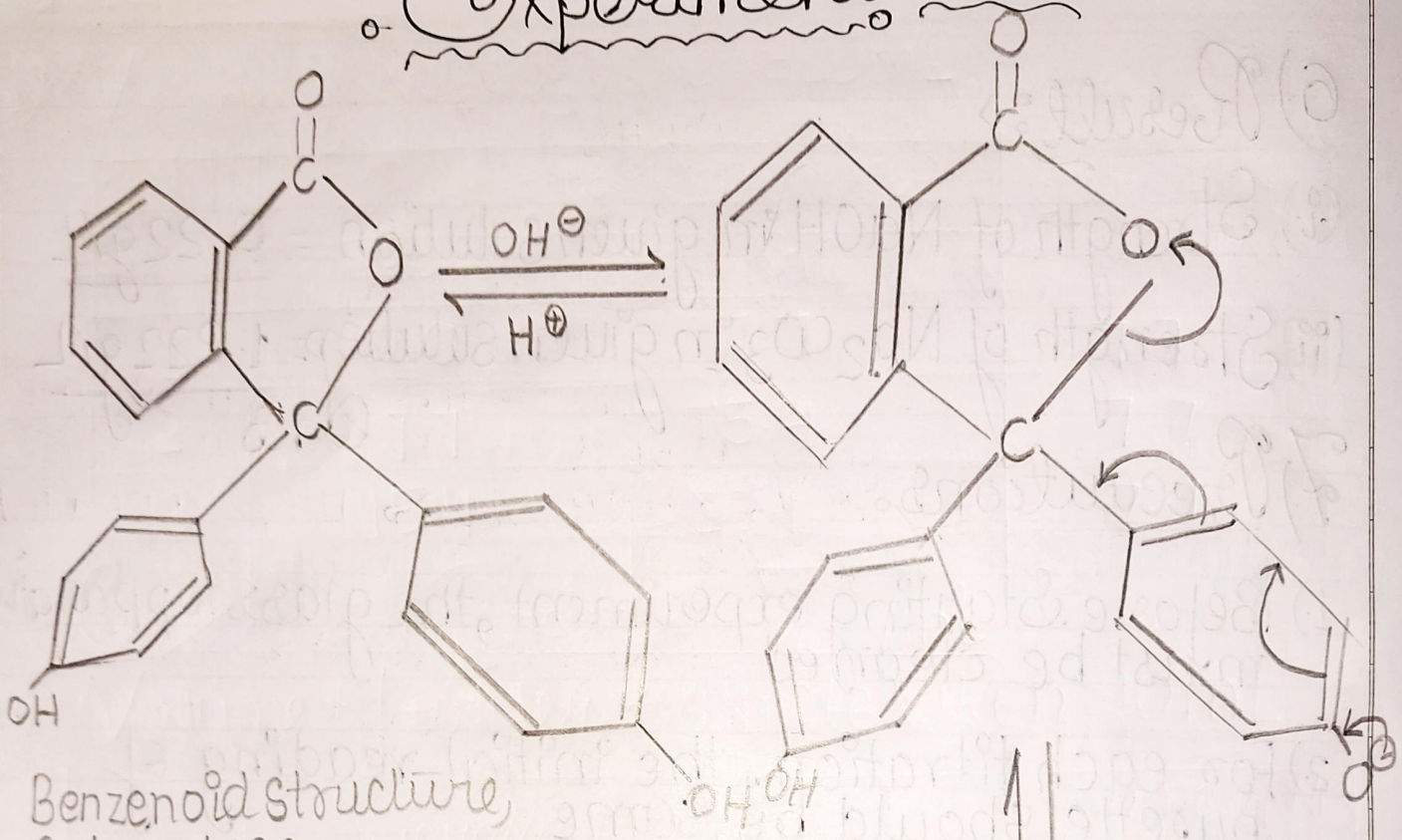
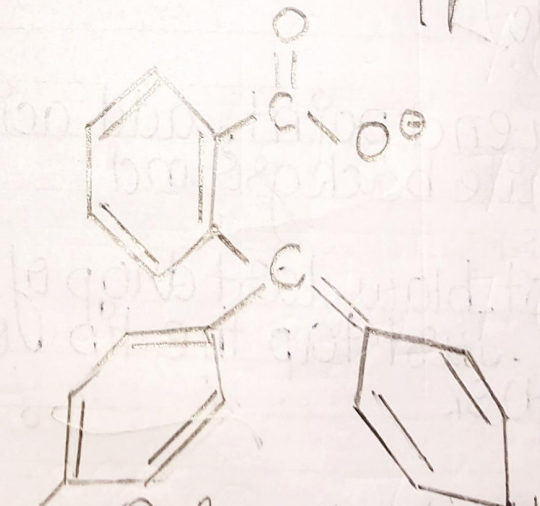
Experiment No: 3



Benzenoid structure
Colourless,
Exists predominantly in acidic medium

OH⊖ ⇌ H⊕



Quinonoid structure
Pink in colour,
Exists predominantely in Basic medium

Structure of Phenolpthalein

Pichri

Date 18/05/21

Expt. No. 03 Page No.

Experiment No: 3

1.) Aim: To determine the Strength of sodiumhydroxide (NaOH) & sodium carbonate (Na_2CO_3) from given water sample. Given standard N/40 sodium carbonate to standardise given HCl solution

2.) Apparatus Required:

Burette, pipette, conical flask, funnel, measuring cylinders.

3.) Material Required:

Sodium carbonate (N/40) soln, HCl soln, phenolpth-alein, Methyl Orange & Water.

4.) Theory:

The ionic equations involved for this reaction are:-

(i) $OH^{\ominus} + H^{\oplus} \longrightarrow H_2O$ } Phenolpthalein

(ii) $CO_3^{2-} + H^{\oplus} \longrightarrow HCO_3^{\ominus}$

(iii) $HCO_3^{\ominus} + H^{\oplus} \longrightarrow H_2O + CO_2$ ~> Methyl Orange.

The titration is based upon the specific pH range for each indicator. The phenolpthalein indicator

Teacher's Signature pjohn

Date 18/05/21

Expt. No. 03 Page No.

given pink colour in pH range 8.2-10 while methylorange gives pink colour in pH range 4.4-3.0. It has been observed that the presence of NaOH & Na_2CO_3 always provide a pH higher than 8.2 to the solution. Initially when standard HCl is added, the $OH^{\ominus}$ ions are first converted to H_2O then CO_3^{2-} ions are converted to $HCO_3^{\ominus}$. When first two steps completed the pH of soln becomes less than 8.2 & pink colour of phenolpthalein disappears. At this pt. Methyl Orange is added as indicator to find the complete neutralization on addition of further acid, the $HCO_3^{\ominus}$ ions are converted to CO_2 and H_2O. When all the $HCO_3^{\ominus}$ ions are used up the pH of soln becomes less than 4.4 instantaneously. At this point methyl orange gives pink colour.

4) Chemical Reactions

$$HCl + NaOH \longrightarrow NaCl + H_2O$$
$$HCl + Na_2CO_3 \longrightarrow NaHCO_3 + NaCl$$ } Phenolpthalein
$$NaHCO_3 + HCl \longrightarrow NaCl + H_2O + CO_2$$

5) Procedure.

1. Standardization of given HCl solution.

Teacher's Signature

Date 18/08/21

Expt. No. 03 Page No.

(i) Take 10ml 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 drop wise with constant shaking of solution. Find the end point.

When light yellow colour soln turns pink. Note volume of acid used. Repeat this step 4-5 times till you get atleast two concordant readings.

II. Titration of given water sample with the solution

(i) Pipette out 10ml of given water sample into a conical flask. Add 1-2 drops of phenolphthalein indicator.

(ii) Add HCl soln into a conical flask till pink colour disappears.

(iii) After discolouration, add 1-2 drops of methyl orange into the solution.

(iv) Titrate now again with acid till yellow coloured solution turns pink. Note the volume of acid used.

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Observations

i) Volume of Na_2CO_3 taken = 10mL

S.No.	Burette Readings		Vol. of HCl used (ml)
	Initial	Final	
1	0.0	7.7	7.7
2	7.7	15.4	7.7
3	15.4	23.1	7.7

Concordant Readings = 7.7mL

ii) Volume of water sample taken = 10mL

Sr No	Burette Readings			Volume of HCl used in ml	
	Initial (V_1)	Final V_2 P	M V_3	P $V_4 = (V_2 - V_1)$	M $V_5 = V_3 + V_4$
1	0.0	7.0	12.3	7.0	5.3
2	12.3	19.3	24.6	7.0	5.3
3	24.6	31.6	36.9	7.0	5.3

Concordant Readings = P = 7.0mL

M = 5.3mL

Pichai

Calculations

Normality of given HCl solution

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

$$\Rightarrow N_{HCl} = N_{Na_2CO_3} \times 10 / N_{HCl}$$

$$= \frac{10}{40 \times 7.7}$$

$$= 0.032N$$

Normality of NaOH & Na_2CO_3 from given water sample.

$$N_{NaOH} = (N_{HCl} \times V_4 - V_5)/10$$

$$= \frac{0.032 \times (2.3)}{10}$$

$$= 0.00746N.$$

$$N_{Na_2CO_3} = N_{HCl} \times 2V_5 / 10$$

$$= 0.0344$$

- Strength of NaOH = $N_{NaOH} \times$ Eq.Wt of NaOH g/L
  $= 0.298$ g/L Ans
- Strength of Na_2CO_3 = $N_{Na_2CO_3} \times$ Eq.Wt of Na_2CO_3 g/L
  $= 3.64$ g/L Ans

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Expt. No. 03 Date

Page No.

6) Result:

Strength of NaOH in given soln = 0.298 g/L Ans

Strength of Na_2CO_3 in given soln = 3.64 g/L Ans

7. Precautions:

i) The glass apparatus must be perfectly cleaned

ii) Always read lower meniscus of soln level.

iii) Do not blow last drop of solution from pipette

iv) Near the end point, add acid soln dropwise and after addition of each drop, see the colour.

Lipika