Objective :-

To know the strength of HCl solution (being a solution made from secondary standard substance) against a weak base like Na_2CO_3 by acid-base tritation.

Theory :-

(i) Method :-

In presence of suitable indicator the volumetric analysis in which a standard sdution is added in another solution (whose strength is not know) to reach its end point to determined the strenth of that solution is called tritation. A solution of known concentration is called a standard solution. A secondary standard is a substance which may be used for- standardizations and whose content of active substance has been found by comparison- against a primary standard. On the other- hand primary standard is a compound of sufficient purity from which a standard- solution can be prepared by direct weighting

of a quantity if it, followed by dilution to give a defined volume of solution.

Reaction :-

Neutrilization reaction between HCl and Na_2CO_3 is

$$Na_2CO_3 + HCl \rightarrow NaHCO_3 + NaCl$$

$$NaHCO_3 + HCl \rightarrow NaCl + H_2CO_3$$

In the first step, the solution is basic due to information of a salt where the basic part is stronger than the acidic part ($NaHCO_3$). So in order to determine the equivalent point of the reaction phenolphthalein is used. As the salt that form due to the neutralization reaction, produces more OH^- so the solution becomes a basic one and thus it have a pH range above 7. we know - that the working enviroment needed for - phenolpthalein is basic. Thus it becomes the perfect indicator for determining the end point of first step of the reaction. In the second reaction Nacl and carbonic acid is

formed. Because of the presence of carbonic acid in the solution, it becomes acidic so Methyl orrange (pH 2·94) is used as indicator to determined the equivalent point.

(iii) Indicator:-

In our acid base ~~tai~~titration there is an important use of indicator. we are using two indicator like phenolpthalien and Methyl orange. An indicator is a chemical substance that detects the equivalent - pont of reaction by changing it's colore. Indicator have different structures in acidic and basic solution.

Apparatus:-

Burette (50 ml), pipette (10ml), conical flask (250 ml), volumetric flask (100 ml) w

Required chemicals :-

1. Hcl acid solution.
2. Na_2CO_3 solution.
3. Phenolpthalien indicator
4. Methyl Orange indicator.

Preparation of approx. N/10 Na_2CO_3 Solution :-

Transfer approx.

0.540 gm of anthydrous Na_2CO_3 was transferred in a 100ml measuring flask and then ~~diss~~ it was dissolved with distilled water up to the mark.

Strength of sodium carbonate solution

$$= \frac{\text{weight taken} \times 0.1}{0.53}$$

$$= \frac{0.540 \times 0.1}{0.53}$$

$$= 0.1018 \ (N)$$

Procedure :-

10 ml of Na_2CO_3 solution was taken in a conical flask and it was diluted to about 60 ml. 1-2 drops of phenolphthalein was added and titrated against dilute HCl solution contained in a ~~brown~~ burette. ~~Then~~ Then the burette reading was noted when just one drop of HCl discharges the pink color of the solution. This is the first end point. Then 2-3 drops of methyl orange was added inside the same conical flask and continue titration against the same HCl solution. The end point was reached when the yellow color of the solution just change to pink. The burette reading was noted. This was the second end point. The difference of the burette reading from initial to second end point will be the volume of the acid required for titration.

The whole experement was ~~reapte~~ repeated 2-3 times and took the mean reading initial

to second end point. Last reading was taken without using phenolpthalein. The strength was calculated of the dil. HCl solution and then found out the strength of commercial or concentrated HCl.

Experimental Data:-

No of reading	vol. of Na_2CO_3 ml	Vol. of HCl (ml) Initial (a)	1st end point (b)	2nd end point (c)	Difference between (a) and (b) ml	Mean ml
1	10	0.00	5.06	10.01	10.01	
2	10	10.01	14.03	20.07	10.06	10.175
3	10	20.07	24.07	30.09	10.02	
4	10	30.09	——	40.07	9.8	

Caculations:-

(A) $V_{base} \times N_{base} = V_{dilute\ acid} \times N_{dil\ acid\ determined}$

$\Rightarrow 10 \times 0.1018 = 10.175 \times N_{dil\ acid\ deter.}$

$\Rightarrow N_{dil.\ acid\ deter.} = 0.10004$

(B) $V_{dil\ acid} \times N_{dil\ acid\ deter.} = V_{cone.\ acid\ taken} \times N_{cone.\ acid\ to\ be\ deter.}$

$\Rightarrow 1000 \times 0.10004 = 10 \times N_{cone.\ acid}$.

$\Rightarrow N_{cone.\ acid} = 10.004$

Results:-

(A) The strength of supplied dil HCl solution is 0.10004 (N)

(B) The strength of cone. HCl solution is 10.004 (N)