

## Laboratory of Analytical chemistry

### Acid-base titrations:

Acid-base reactions are familiar reactions in chemistry, usually concerned with the production of water and salts. The indicators usually used in acid- base titrations are the followings:

	<b>The indicator</b>	<b>The pH range for the work of the indicator</b>	<b>The color change</b>
1	Methyl orange	3.2-4.5	From pink to yellow.
2	Methyl red	4.4-6.5	From red to yellow.
3	Litmus	5.5-7.5	From red to blue.
4	Phenol red	6.8-8.4	From yellow to red.
5	Phenolphthalein	8.3-10.5	From colorless to pink.

In our laboratory, we will take three acid- base titration experiments:

- a)  $\text{Na}_2\text{CO}_3$  and HCl.
- b) HCl and NaOH.
- c) NaOH and acetic acid ( $\text{CH}_3\text{COOH}$ ).

The work in these experiments will follow a sequence in standardization similar to the sequence above (standardization: is the process of determining the exact concentration of a solution). This means we will use the primary standard  $\text{Na}_2\text{CO}_3$  solution in standardization of HCl solution , then we use the secondary standard HCl solution to standardize the NaOH solution , and finally we use secondary standard NaOH solution to determine the weight of acetic acid in its solution (in vinegar).

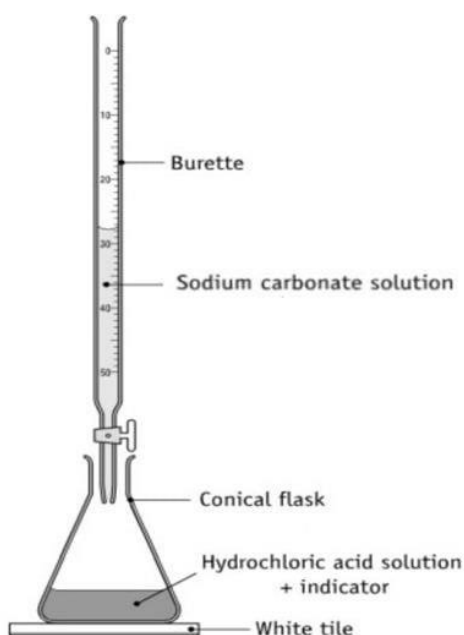
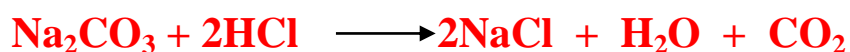
## Experiment No. (1):

### Standardization of Hydrochloric acid with standard Sodium Carbonate solution

Objective of experiment: To determine the exact concentration of HCl solution.

In this experiment, a standard solution of sodium carbonate ( $\text{Na}_2\text{CO}_3$ ) is used to determine the exact concentration of a hydrochloric acid solution.

**The ultimate reaction:**



### **Tools**

1. Conical flask
2. Volumetric flask
3. Beaker
4. Burette
5. Stand and Clamp
6. Funnel
7. Pipette
8. White tile

## Chemicals

1. Standardized  $\text{Na}_2\text{CO}_3$  solution
2.  $\text{HCl}$  solution
3. Distilled water
4. Phenolphthalein indicator.

## Procedure

- 1) Wash, rinse, and fill the burette with 0.1 N  $\text{Na}_2\text{CO}_3$  solution. Be sure that there are no air bubbles in the tip of the burette. Notice the initial reading of the volume.
- 2) Take 10 ml of  $\text{HCl}$  solution by a pipette and transfer it into a clean washed conical flask.
- 3) Add 2 drops of Phenolphthalein indicator into the conical flask.
- 4) Start titration by the adding the sodium carbonate solution from the burette gradually into the titration medium ( the solution in the conical flask) with continuous stirring for the titration medium till the color changes from colorless to pink. Notice the final volume reading and find out the volume of sodium carbonate solution used to neutralize the  $\text{HCl}$  solution.
- 5) Repeat the experiment ( at least 3 times), till you get concordant readings, and then take the average volume.

Data	Trial 1	Trial 2	Trial 3
Initial burette volume reading (ml)			
Final burette reading volume (ml)			
Volume of $\text{Na}_2\text{CO}_3$ consumed (ml)			
Average of the volume $\text{Na}_2\text{CO}_3$ (ml)			

- 6) Calculate the normality of  $\text{HCl}$ :

➤ At end point



$$(N * V)_{\text{acid}} = (N * V)_{\text{base}}$$

## **H.W:**

- 1- Why is more than one titration carried out?
- 2- Explain why hydrochloric acid is not used as a primary standard.
- 3- Can any of the following be used as primary standards:  
NaOH, H<sub>2</sub>SO<sub>4</sub>, HNO<sub>3</sub>? Explain your answer.

*Lecturer*

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