



## AMERICAN INTERNATIONAL UNIVERSITY – BANGLADESH

Department of Natural Science (Chemistry)

Faculty of Science & Technology

Programs: B.Sc. Eng'g (EEE/CSE/IPE)

CHEM 1101: CHEMISTRY

# Chemistry Lab Report

Semester: Spring

Session: 2022-2023

NO EXPERIMENT, NO REPORT

Experiment No: 3

Name of the Experiment: Standardization of hydrochloric acid (HCl) solution with standard sodium carbonate ( $\text{Na}_2\text{CO}_3$ ) solution.

Date of Performance: 22-02-23

, Date of Submission: 01-03-23

Course-Teacher: Dr. Mohammad Tariqul Islam.

### Instructions:

1. A lab report consists of three parts: a cover page, body of the report and a data and results sheet (lab-sheet).
2. This is the cover page of a report and students will collect and preserve the lab-sheet of a particular experiment to be performed.
3. Body of the report includes-(I) Objective of the Experiment, (2) Theory, (3) Name of the Chemicals, (4) Name of the Apparatus, (5) Percentage of Error (if necessary) and (6) Discussion (I. Precautions taken, II. Possible errors).
4. Use A4-size off-set paper, write on one side of the paper by hand keeping suitable margin.
5. Staple the lab-sheet at the end of the report and cover page on the top.
6. Submit the report in time to avoid deduction of marks.
7. Students working in a group will write and submit the report individually.
8. Copying of the report from others is strictly prohibited.

Name of the Student: TRIDIB SARKAR  
ID No: 22-46499-1, Section: F, Group: 3

FOR FACULTY USE ONLY

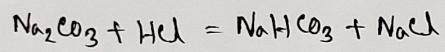
Faculty comments: ..... Signature: .....  
Date: .....

Objective: To know the strength of HCl solution (being a solution made from secondary standard solution) against a weak base like  $\text{Na}_2\text{CO}_3$  by acid-base titration.

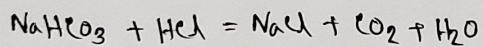
Theory:

i) Method: It is an acid-base titration. In this experiment used a strong acid (HCl) and weak base ( $\text{Na}_2\text{CO}_3$ ).

ii) Reaction:



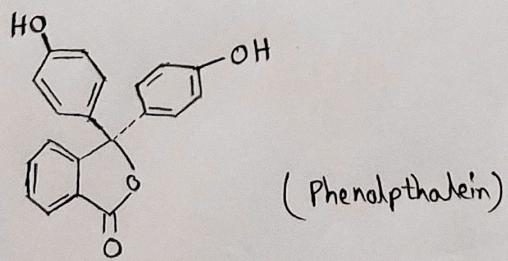
Here 1 mol of weak base ( $\text{Na}_2\text{CO}_3$ ) reacted with 1 mol of HCl which is a strong acid and produce 1 mol of  $\text{NaHCO}_3$  and NaCl (salt).



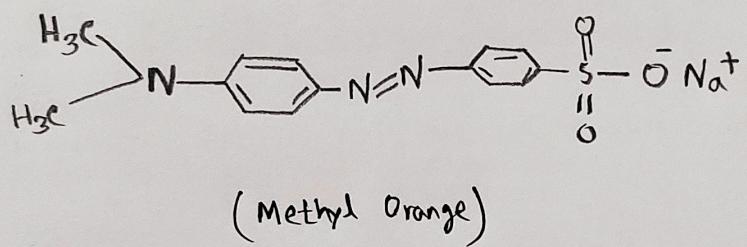
Here  $\text{NaHCO}_3$  reacted with HCl and produce NaCl,  $\text{CO}_2$  and  $\text{H}_2\text{O}$ .

iii) Indicator:

In first reaction  $\text{Na}_2\text{CO}_3$  is a weak base and HCl is a strong acid. So we used phenolphthalein. In acid it is colourless and in base it is pink.



In second reaction  $\text{NaHCO}_3$  is weak base and  $\text{HCl}$  is strong acid. So, methyl orange indicator is preferable.



Name: TRIDIB SARKAR ID No: 22-46444-1, Section (Group): F (3)

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## Experiment 3

CHEM 1101: CHEMISTRY (EEE/CoE/CSE/IPE)

### EXPERIMENT NO. 3: STANDARDIZATION OF HYDROCHLORIC ACID (HCl) SOLUTION WITH STANDARD SODIUM CARBONATE (Na<sub>2</sub>CO<sub>3</sub>) SOLUTION.

#### **OBJECTIVE:**

To know the strength of HCl solution (being a solution made from secondary standard substance) against a weak base like Na<sub>2</sub>CO<sub>3</sub> by acid-base titration.

#### **THEORY:**

- (i) Method: Acid-base titration,
- (ii) Reaction:  $\text{Na}_2\text{CO}_3 + \text{HCl} = \text{NaHCO}_3 + \text{NaCl}$  (pH ~9.0)  
 $\text{NaHCO}_3 + \text{HCl} = \text{NaCl} + \text{CO}_2 + \text{H}_2\text{O}$  (pH ~4.0)
- (iii) Indicator: Phenolphthalein, Methyl orange

**APPARATUS:** Burette (50mL), pipette (10mL), conical flask (250mL), volumetric flask (100mL), watch glass, pipette filler, dropper, Stand and clamp etc.

#### **REQUIRED CHEMICALS:**

1. HCl acid solution,
2. Na<sub>2</sub>CO<sub>3</sub> solution,
3. Phenolphthalein indicator
4. Methyl Orange indicator

**PREPARATION OF APPROX. 0.1N Na<sub>2</sub>CO<sub>3</sub> SOLUTION:** Transfer approx. 0.53 gm of anhydrous Na<sub>2</sub>CO<sub>3</sub> in a 100 mL measuring flask and then dissolve it with distilled water up to the mark.

$$\text{Strength of sodium carbonate solution} = \frac{\text{Weight taken (in gm)} \times 0.1}{0.53} (\text{N})$$

$$= 0.10377 \text{ N}$$

**PROCEDURE:** Take 10 mL of Na<sub>2</sub>CO<sub>3</sub> solution in a conical flask and dilute it to about 50 mL. Add 1-2 drops of phenolphthalein and titrate against dilute HCl solution (prepared as expt. no.2) contained in a burette. Now note the burette reading when just one drop of HCl discharges the pink color of the solution. This is the first end point. Then add 2-3 drops of methyl orange inside the same conical flask and continue titration against the same HCl solution. The end point reached when the yellow color of the solution just changes to faint pink (or orange). Note the burette reading. This is 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. Repeat the whole experiment 2-3 times and take the mean reading initial to second end point. *Take last reading without using phenolphthalein.* Calculate the strength of supplied dilute HCl solution and then find out the strength of concentrated HCl.

Chemistry Lab Sheet

TRIDIB SARKAR  
 Name: ..... ID No: 22-46444-1, Section (Group): F (3)

(Expt. 3 contd.)

### EXPERIMENTAL DATA:

Table: Standardization of supplied HCl solution against standard  $\text{Na}_2\text{CO}_3$  solution by acid-base titration.

No. of reading	Vol. of $\text{Na}_2\text{CO}_3$ (in mL)	Vol. of HCl (in mL)			Difference between (a) and (c) (in mL)	Mean (in mL)
		Initial (a)	1 <sup>st</sup> End-point (b)	2 <sup>nd</sup> End-point (c)		
1	10	0	5.00	10.60	10.60	
2	10	10.60	16.00	21.60	11.00	
3	10	21.60	26.60	32.20	10.60	10.675
4*	10	35.00	45.50	45.50	10.50	

\*4<sup>th</sup> reading with methyl orange only

### CALCULATIONS:

#### (A) Strength of supplied dil. HCl solution:

$$V_{\text{Na}_2\text{CO}_3} \times N_{\text{Na}_2\text{CO}_3} = V_{\text{dil. HCl}} \times N_{\text{dil. HCl}} \text{ to be determined}$$

$$\Rightarrow 10 \times 0.10377 = 10.675 \times N_{\text{dil.}}$$

$$\Rightarrow N_{\text{dil.}} = 0.09721 \text{ N}$$

#### (B) Strength of conc. HCl solution:

$$V_{\text{dil. HCl}} \times N_{\text{dil. HCl determined}} = V_{\text{conc. HCl taken}} \times N_{\text{conc. HCl to be determined}}$$

$$\Rightarrow 1000 \times 0.09721 = 10 \times N_{\text{conc.}}$$

$$\Rightarrow N_{\text{conc.}} = 9.721 \text{ N}$$

### RESULTS:

a) The strength of supplied dil. HCl solution is ~~approx~~ 0.10 N

b) The strength of conc. HCl solution is 9.721 N

### Student should know:

- Is  $\text{Na}_2\text{CO}_3$  a primary standard substance?
- Tell atomic weight, molecular weight and gram equivalent weight of HCl and  $\text{Na}_2\text{CO}_3$ .
- Can you use methyl orange first instead of phenolphthalein? If not why?
- Can you calculate the normality and molarity of HCl and  $\text{Na}_2\text{CO}_3$ ?

Text: M. Mahbubul Huque and A. Jabber Mian, "Practical Chemistry", 2<sup>nd</sup> ed. (1972)

Group:  
P  
G

### Required Chemicals:

<u>Name of the chemicals</u>	<u>Chemical Formula</u>
1. Hydrochloric acid solution	HCl
2. Sodium carbonate solution	$\text{Na}_2\text{CO}_3$
3. Phenolphthalein indicator	$\text{C}_{20}\text{H}_{14}\text{O}_4$
4. Methyl Orange indicator	$\text{C}_{19}\text{H}_{14}\text{N}_3\text{NaO}_2\text{S}$

### Apparatus:

- |                               |                            |
|-------------------------------|----------------------------|
| i) Burette (50 ml)            | v) watch glass             |
| ii) Pipette (10 ml)           | vi) Pipette filler         |
| iii) Conical flask (250 ml)   | vii) Dropper               |
| iv) Volumetric flask (100 ml) | viii) Stand and clamp etc. |

Discussion:

Precautions:

1. First of all cleaned all glass carefully with distil water.
2. Then added HCl into the Burette carefully.
3. Calculated all data properly.

Possible errors:

1. End point error.
2. Misreading the volume.
3. Calibration errors in balance burette.