



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: Summer

Session: 2021-2022

NO EXPERIMENT, NO REPORT

Experiment No: 03

Name of the Experiment: Standardization of Hydrochloric Acid (HCl) solution with standard Sodium carbonate (Na_2CO_3) solution.Date of Performance: 14-06-22Date of Submission: 21-06-22Course-Teacher: Dr. Saiful 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-(1) 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: Khondaker Md. Sabit HasanID No: 21-45306-2Section: M, Group: 9

FOR FACULTY USE ONLY

Faculty comments:

Signature:

Date:

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 titration.

Theory:

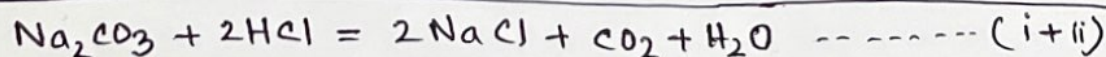
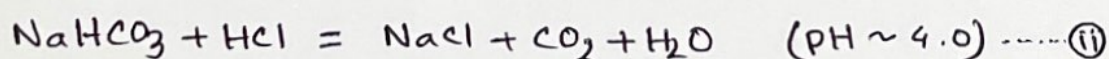
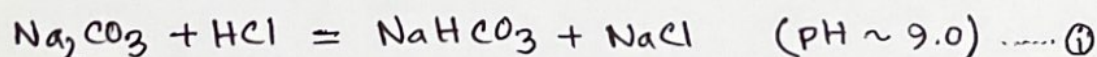
(i) Method:

An acid-base titration is a method in chemistry that allows quantitative analysis of the concentration of an unknown acid or base solution.

Quantitative analysis is concerned with the determination of concentration or the amount of a known substance quantitatively by volumetric analysis (Titration).

(ii) Reaction:

HCl is a secondary standard substance, a strong acid, colorless gas and available in water solution. Na_2CO_3 is a primary standard substance, a weak base, white solid and colorless in water solution. The balanced reaction between Na_2CO_3 and HCl is as follows:



(iii) Indicator:

In the first reaction one mole Na_2CO_3 is reacted with one mole of HCl to produce NaHCO_3 and NaCl with a pH range ~ 9.0 . So, the choice of indicator is phenolphthalein ($\text{C}_{20}\text{H}_{14}\text{O}_4$) since it works within pH 8.3-10.

In the second reaction one mole NaHCO_3 is reacted with another mole of HCl to produce NaCl , CO_2 and H_2O with a pH range ~ 4.0 . So, the choice of indicator is methyl orange ($\text{C}_{14}\text{H}_{14}\text{N}_3\text{NaO}_3\text{S}$) since it works within pH 3.1-4.4.

Apparatus:

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

Required chemicals:

1. Sodium carbonate. $[\text{Na}_2\text{CO}_3]$
2. Hydrochloric acid. $[\text{HCl}]$
3. Phenolphthalein. $[\text{C}_{20}\text{H}_{14}\text{O}_4]$
4. Methyl orange. $[\text{C}_{14}\text{H}_{14}\text{N}_3\text{NaO}_3\text{S}]$

Name: Khondoker Md. Sabit Hasan ID No: 21-45306-2 Section (Group): M (9)

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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_2CO_3) SOLUTION.

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 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_2CO_3 solution,
3. Phenolphthalein indicator
4. Methyl Orange indicator

PREPARATION OF APPROX. 0.1N Na_2CO_3 SOLUTION: Transfer approx. 0.53 gm of anhydrous Na_2CO_3 in a 100 mL measuring flask and then dissolve it with distilled water up to the mark.

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

$$= \frac{0.529 \times 0.1}{0.53} = 0.0998$$

PROCEDURE: Take 10 mL of Na_2CO_3 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

May, 2022

(Expt. 3 contd.)

EXPERIMENTAL DATA:

Table: Standardization of supplied HCl solution against standard Na_2CO_3 solution by acid-base titration.

No. of reading	Vol. of Na_2CO_3 (in mL)	Vol. of HCl (in mL)			Difference between (a) and (c) (in mL)	Mean (in mL)
		Initial (a)	1 st End-point (b)	2 nd End-point (c)		
1	10	0	3.8	9.6	9.6	9.375
2	10	9.6	13.2	18.9	9.3	
3	10	18.9	22.8	28.3	9.4	
4*	10	28.3	---	37.5	9.2	

*4th reading with methyl orange only

CALCULATIONS:

(A) Strength of supplied dil. HCl solution:

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

$$\Rightarrow 10 \times 0.0998 = 9.375 \times N_{\text{dil. HCl}}$$

$$\Rightarrow N_{\text{dil. HCl}} = 0.10645$$

(B) Strength of conc. HCl solution:

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

$$\Rightarrow 1000 \times 0.10645 = 10 \times N_{\text{conc. HCl}}$$

$$\Rightarrow N_{\text{conc. HCl}} = 10.645$$

RESULTS:

The strength of supplied dil. HCl solution is 0.10645 N
& The strength of conc. HCl solution is 10.645 N

Student should know:

- Is Na_2CO_3 a primary standard substance?
- Tell atomic weight, molecular weight and gram equivalent weight of HCl and Na_2CO_3 .
- Can you use methyl orange first instead of phenolphthalein? If not why?
- Can you calculate the normality and molarity of HCl and Na_2CO_3 ?

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

Discussion:

(a) Precautions taken:

1. Avoid skin and eye contact with the chemicals.
2. Identify the safety equipment.
3. Wear clothing that covers torso and legs.

(b) Possible errors:

1. Might added more than 100 mL distilled water in the HCl acid solution.
2. Error might be occurred while taking the burette reading.
3. Using the equipment incorrectly.