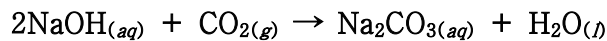


# 이산화탄소 흡수관에 흡수된 CO<sub>2</sub> 부피 측정방법

## How to calculation of CO<sub>2</sub> volume

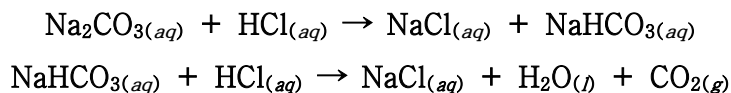
There are many techniques for analyzing CO<sub>2</sub>, such as gas chromatography, spectrophotometry, gravimetric absorption, etc., but this lab is supposed to be about titrations, so we will focus on an analysis involving a titration.

Carbon dioxide readily reacts with aqueous hydroxides to make carbonates and water.



So if someone bubbles air through a solution of NaOH, the CO<sub>2</sub> in the air will rapidly react with the NaOH to make Na<sub>2</sub>CO<sub>3</sub>, which can then be easily analyzed by a titration.

During the titration, Na<sub>2</sub>CO<sub>3(aq)</sub> will react with HCl<sub>(aq)</sub> in two steps as described below.



It is as though there are two bases for the HCl to react with, Na<sub>2</sub>CO<sub>3</sub> then NaHCO<sub>3</sub>. Not surprisingly, the overall reaction with HCl (an acid) basically reverses the reaction in which the CO<sub>2(g)</sub> was originally captured in the NaOH (a base) solution.

You can determine the moles of CO<sub>2</sub> associated with the titration sample, knowing the volume and concentration of the HCl solution needed to complete either one of the steps in the reaction. That is...

moles CO<sub>2</sub> =

$$\text{vol HCl} \times \frac{\text{moles HCl}}{\text{L}} \times \frac{1 \text{ mole Na}_2\text{CO}_3}{1 \text{ mole HCl}} \times \frac{1 \text{ mole NaHCO}_3}{1 \text{ mole Na}_2\text{CO}_3} \times \frac{1 \text{ mole CO}_2}{1 \text{ mole NaHCO}_3}$$

or

moles CO<sub>2</sub> =

$$\text{vol HCl} \times \frac{\text{moles HCl}}{\text{L}} \times \frac{1 \text{ mole NaHCO}_3}{1 \text{ mole HCl}} \times \frac{1 \text{ mole CO}_2}{1 \text{ mole NaHCO}_3}$$

이산화탄소 흡수관에 있는 2 M NaOH 용액 8 mL 중 1 mL를 취하여 100 mL 비이커에 넣고 49 mL의 증류수를 넣어 희석한다. 0.1 M HCl 용액을 준비하여 비이커에 적정하고 pH 8.3에서 pH 4.3까지 들어간 HCl 용액의 부피를 측정한다. 예를 들어 pH 8.3까지 64.3 mL의 염산이 소요되고 pH 4.3까

지 59.8 mL의 염산이 들어갔다면

$$(64.3-59.8) \text{ mL HCl} \times \frac{0.1 \text{ moles HCl}}{1000 \text{ mL}} \times \frac{1 \text{ mole HCO}_3^-}{1 \text{ mole HCl}} \times \frac{1 \text{ mole CO}_2}{1 \text{ mole NaHCO}_3} \\ = 0.00045 \text{ moles CO}_2$$

흡수관에 들어있던 NaOH용액은 8 mL 이므로 0.0036 moles CO<sub>2</sub>가 흡수되었음을 알 수 있다. 이를 100% 이산화탄소 부피로 계산을 하면

$$0.0036 \text{ moles CO}_2 \times \frac{22.4 \text{ L}}{1 \text{ mole}} \times \frac{(273+20)}{273} = 86.5 \text{ mL of 100\% CO}_2$$

86.5mL of 100% CO<sub>2</sub>가 된다.