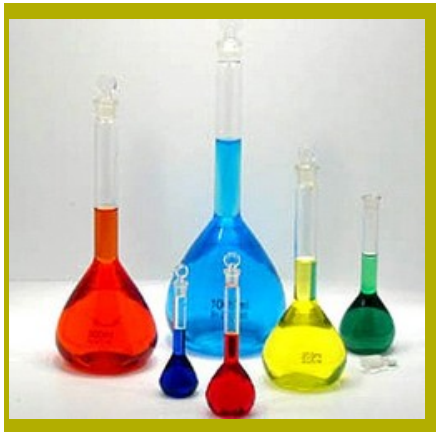
BCH 312
Experiment (7)

Buffer Capacity



Objectives

- To understand the concept of buffer capacity.
- To determine the maximum buffer capacity of a number of buffer solutions.
- To establish the relationship between buffer capacity and buffer concentration.

Introduction

- Common buffer mixtures contain two substances, a conjugate acid and a conjugate base .

- Together the two species (conjugate acid and conjugate base) resist large changes in pH by absorbing the H+ ions or OH- ions added to the system.
  - When H+ ions are added to the system they will react with the conjugate base in the buffer .
  - When OH- ions are added they will react with the conjugate acid in the buffer

→ **Thus the buffer is effective as long as it does not run out of one of its components.**

Buffer Capacity

- Quantitative measure of this resistance to pH changes is called buffer capacity.
- **Buffer capacity** can be defined as the number of moles of H+/OH- ions that must be added to one liter of the buffer in order to decrease /increase the pH by one unit respectively.

$$\beta = \frac{2.3\, K_a [H^+][C]}{(K_a + [H^+])^2}$$

- Where $[H^+]$ = the hydrogen ion concentration of the buffer , β is the buffer capacity , [C] is buffer concentration .
- From the equation that the buffer capacity ***is directly proportional*** to the buffer concentration.

Method

- You are provided with 2 acetate buffers, pH=5. Each with different concentrations ; 0.1 M and 0.2 M .
  - Transfer 8 ml of each buffer into a 50 ml beaker.
  - Add 0.5 ml of (0.1 M) HCl from the burette and determine the pH of the solution after each addition
  - Continue adding acid in until pH falls to about 2 pH units from your starting pH .

- Plot a Curve of pH versus ml of HCl added and calculate the Buffer capacity
- Then compare between two buffer which one has higher buffer capacity and why?