

## Quadrant II – Transcript and Related Materials

Programme: Bachelor of Science (First year)

Subject: Chemistry

Paper Code: CHC102

Paper Title: Physical Chemistry and Organic Chemistry

Unit: 03

Module Name: Free Energy change in a chemical reaction.

Module No: 05

Name of the Presenter: Ms. Aparna Anant Sinai Juwarkar

**Notes:**

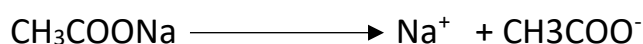
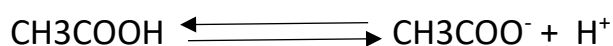
### COMMON ION EFFECT

The common ion effect is an effect that suppresses the ionization of a weak electrolyte when another electrolyte (which contains an ion which is also present in the first electrolyte, i.e. a common ion) is added.

Example:

If sodium acetate is added to the solution, it being more ionizable, ionizes to a greater extent and concentration of  $\text{CH}_3\text{COO}^-$  ions increases considerably.

According to Le' Chatelier's principle, equilibrium of first reaction shifts to the left and thus ionization of acetic acid suppresses and becomes more weak acid.



Equilibrium is driven toward reactant

## **BUFFER SOLUTION**

A buffer solution is defined as a solution whose pH remains practically constant even when a small amount of an acid or base is added to it.

Types of Buffer solutions

Generally buffers are of two types;

- Acidic Buffer
- Basic Buffer

Acidic Buffers:

An acidic buffer is a combination of weak acid and its salt with a strong base.

i.e. Weak acid & salt with strong base( conjugate base)

EXAMPLES:

- $\text{CH}_3\text{COOH} / \text{CH}_3\text{COONa}$
- $\text{H}_2\text{CO}_3 / \text{NaHCO}_3$
- $\text{H}_3\text{PO}_4 / \text{NaH}_2\text{PO}_4$
- $\text{HCOOH} / \text{HCOONa}$

Basic Buffers:

A basic buffer is a combination of weak base and its salt with strong acid.

i.e. Weak base & salt with strong acid( conjugate acid)

EXAMPLES:

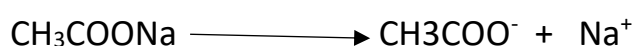
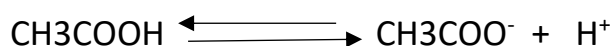
- $\text{NH}_4\text{OH} / \text{NH}_4\text{Cl}$
- $\text{NH}_3 / \text{NH}_4\text{Cl}$

## Buffer Action:

The resistance of a buffer solution to a change in pH is known as buffer action.

Mechanism of action of acidic buffers:

Consider a buffer system of  $\text{CH}_3\text{COOH}$  ( Weak electrolyte) and  $\text{CH}_3\text{COONa}$  (Strong electrolyte). There will be a large concentration of  $\text{Na}^+$  ions,  $\text{CH}_3\text{COO}^-$  ions, and un-dissociated  $\text{CH}_3\text{COOH}$  molecules.



### When an acid is added

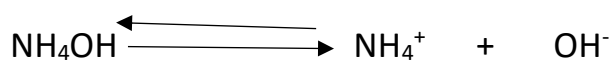
If a strong acid (  $\text{HCl}$  ) is added in  $\text{CH}_3\text{COOH} / \text{CH}_3\text{COONa}$  buffer , The hydrogen ions yielded by the strong acid (  $\text{HCl}$ ) are quickly removed as unionized acetic acid, and the hydrogen ion concentration is therefore only slightly affected ( because acetic acid produced is very weak as compared to  $\text{HCl}$  added)

### When a base is added

If a strong base (  $\text{NaOH}$ ) is added in in  $\text{CH}_3\text{COOH} / \text{CH}_3\text{COONa}$  buffer , The hydroxyl ion yielded by the  $\text{NaOH}$  are therefore removed as water. The supply of hydrogen ions needed for this purpose being constantly provide by the dissociation of acetic acid.

Mechanism of action of basic buffers:

Consider a buffer system of  $\text{NH}_4\text{OH}$  ( Weak electrolyte) and  $\text{NH}_4\text{Cl}$  (Strong electrolyte). There will be a large concentration of  $\text{NH}_4^+$  ions,  $\text{Cl}^-$  ions, and un-dissociated  $\text{NH}_4\text{OH}$  molecules.



### When an acid is added

If a strong acid (  $\text{HCl}$  ) is added in  $\text{NH}_4\text{OH} / \text{NH}_4\text{Cl}$  buffer , The hydrogen ions yielded by the strong acid (  $\text{HCl}$ ) are quickly removed as water. The supply of  $\text{OH}^-$  ions needed for this purpose being constantly provide by the dissociation of Ammonium hydroxide.

### When a base is added

If a strong base ( NaOH) is added in in  $\text{NH}_4\text{OH} / \text{NH}_4\text{Cl}$  buffer , The hydroxyl ions yielded by NaOH are therefore quickly removed as unionized ammonium hydroxide as the pH of the solution is only slightly affected.