

BUFFER SOLUTIONS

A pH buffer solution is a mixture of a weak acid and its conjugate base, or, a mixture of a weak base and its conjugate acid.

A buffer solution has a small pH change when strong acid or strong base is added.

pH of buffer solution is determined by ratio of conjugate concentrations in K_a expression.

$$K_a = \frac{[\text{base}] [\text{H}_3\text{O}^+]}{[\text{acid}]}$$

The concentrations of the two conjugates are close to equal, or between 1:10 to 10:1. The buffer molarity equals the sum of the conjugate molarities.

$$\text{Molarity}_{\text{buffer}} = \text{Molarity}_{\text{conj acid}} + \text{Molarity}_{\text{conj base}}$$

The $\text{p}K_a$ of the buffer weak acid should be within one unit of the desired pH of the buffer solution.

PREPARATION OF BUFFER SOLUTIONS

Select an appropriate weak acid and base for the pH desired.

$$\text{p}K_a = \text{pH} \pm 1.0$$

Determine the percentages of the 2 conjugates needed.

$$\% \text{ base} = \frac{10^{(\text{pH} - \text{p}K_a)}}{1 + 10^{(\text{pH} - \text{p}K_a)}} \times 100\%$$

Prepare the solution with the appropriate molarities.

$$[\text{base}] = [\text{buffer}] \times \% \text{base} / 100$$

$$[\text{acid}] = [\text{buffer}] \times \% \text{acid} / 100$$