Buffer Solutions

A buffer solution is one that resist a change in pH on the addition of acid (H^+) or base (OH^-). Most commonly the buffer solution consists of a mixture of a weak Bronstead acid and its conjugate base; for example a mixture of acetic acid and sodium acetate or of ammonium hydroxide and ammonium chloride are buffer solutions.

Acidic Buffer Solutions- An acidic buffer solution is simply one which has a pH less than 7. Acidic buffer solutions are commonly made from a weak acid and one of its salts-often a sodium salt. A common example would be a mixture of equal molar concentrations of acetic acid and sodium acetate in solutions. It would yield a pH of 4.76. The pH of the buffer solution can be changed by changing the ratio of the acid to salt.

If an acid is added to the acidic buffer solution, the new hydrogen ions produced are removed by combining with the acetate ions to make acetic acid and hence the pH won't change very much.

$CH_3COO^- + H^+_{(aq)} \leftrightharpoons CH_3COOH_{(aq)}$

Again, if alkaline solution is added to acidic buffer solution, the OH ions produced can be removed by two process. Either the OH ions collide with acidic acid molecules to form acetate ions and water, or they combine with the H^+ ions present from the ionisation of acetic acid to produce water.

$CH_3COOH + OH^-_{(aq)} \leftrightharpoons CH_3COO^-_{(aq)} + H_2O$

Alkaline buffer solution- An alkaline buffer solution has a pH greater than 7 and commonly made up from a weak base and one of its salts. The most common example is a mixture of ammonia solution and ammonium chloride solution in equal molar proportions. The solution would have a pH of 9.25.

If acid is added to alkaline buffer solution the hydrogen ion generated can be removed by two processes. Either it collide with ammonia to produce ammonium ions; or it will combine with the hydroxyl ions generated from the reaction between ammonia and water.

$NH_{3(aq)} + H^+ \leftrightharpoons NH4^+_{(aq)}$

Again, if alkali is added to this solution the hydroxyl ions react with ammonium ions to form water.

$NH_4^+{}_{(aq)} + OH^-_{(aq)} \leftrightharpoons NH_{3(aq)} + H_2O$