(a) To study the change in pH of acetic acid (a weak acid) solution by addition of sodium acetate.

(b) To study the change in pH of ammonium hydroxide (a weak base) solution by the addition of ammonium chloride.

Requirements

Test tubes, test tube stand, watch glass, pH paper, glass rod, for experiment
(a) acetic acid and sodium acetate and for experiment
(b) ammonium hydroxide and ammonium chloride.

Theory

(a) **Acetic acid** is a weak acid and is only slightly ionised. On the addition of sodium acetate which is strong electrolyte the concentration of acetate ions increases.

$$CH_3COOH + H_2O \rightleftharpoons CH_3COO^- + H_3O^+$$
$$CH_3COONa \longrightarrow CH_3COO^- + Na^+$$

The increase in concentration of acetate ions shifts the equilibrium (6.3) in backward direction. Due to this, the concentration of H_3O^+ ions decreases and hence pH of solution increases.

(b) **Ammonium hydroxide** is a weak base and is partially dissociated. When ammonium chloride, a strong electrolyte is added to it, the concentration of NH_4^+ ions increases.

$$NH_4OH \rightleftharpoons NH_4^+ + OH^-$$
$$NH_4Cl \longrightarrow NH_4^+ + Cl^-$$

Due to increase in concentration of NH_4^+ ions the equilibrium (6.5) shifts in the backward direction and concentration of OH^- ions falls. This means concentration of H_3O^+ ions increases and hence pH decreases.

Procedure

1. In a dry and clean test tube take 10 ml of acetic acid solution. Put a drop of this solution on a strip of pH paper and note its colour. Compare it with the colour on chart paper and note pH of the acid.
2. Now weigh 1 g of sodium acetate and put it in the tube containing acetic acid. Shake vigorously to dissolve sodium acetate. Determine pH of this solution with pH paper.
3.Weigh again 1 g of sodium acetate, add to test tube and determine pH of this solution.
4. Repeat this with more of sodium acetate, and find out the change in pH value.

Observations

S. No.	Sample solution	Colour produced on pH paper	Approximate pH value
1.	CH_3COOH		
2.	CH_3COOH + 1 g CH_3COONa		
3.	CH_3COOH + 2 g CH_3COONa		
4.	CH_3COOH + 3 g CH_3COONa		

Result

The pH value of solution goes on increasing on adding more and more of sodium acetate.

Procedure

1. Take 10 ml of **ammonium hydroxide solution** in a test tube. Put a drop of this on pH paper and note the colour. Compare the colour produced with the colour on chart paper and note its pH value.
2. Now weigh 1.5 g of NH_4Cl and put in the tube containing NH_4OH. Shake vigorously and note the pH with the help of pH paper.
3. Repeat the experiment by adding two more samples of 1.5 g each of NH_4Cl.
Note if there is any change in pH value.

Observations

S. No.	Sample solution	Colour produced on pH paper	Approximate pH value
1.	NH_4OH		
2.	NH_4OH + 1.5 g NH_4Cl		
3.	NH_4OH + 3.0 g NH_4Cl		
4.	NH_4OH + 4.5 g NH_4Cl		

Result

The pH of NH_4OH decreases with addition of NH_4Cl to it.