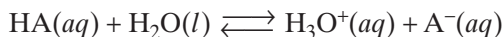tons from some water molecules, proton donors, to form OH^- ions. An equilibrium is established in which the net effect of the anion hydrolysis is an increase in the hydroxide ion concentration, $[OH^-]$, of the solution.

The equilibrium equation for a typical weak acid in water, HA, forming hydronium ion and an anion, A^-, is as follows.

$$HA(aq) + H_2O(l) \rightleftharpoons H_3O^+(aq) + A^-(aq)$$

From this equation, the generalized expression for K_a can be written. Note that as before, water does not appear in the general equilibrium equation.

$$K_a = \frac{[H_3O^+][A^-]}{[HA]}$$

The hydrolysis reaction between water and the anion, A^-, that is produced by the dissociation of the weak acid, HA, is represented by the general equilibrium equation that follows.

$$A^-(aq) + H_2O(l) \rightleftharpoons HA(aq) + OH^-(aq)$$
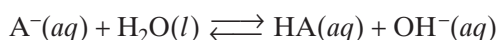
In the forward reaction, the anion, A^-, acquires a proton from the water molecule to form the weak acid, HA, and hydroxide ion, OH^-. The extent of OH^- ion formation and the position of the equilibrium depends on the relative strength of the anion, A^-. The lower the K_a value of HA, the stronger the attraction for protons that A^- will have compared with OH^-, and the greater the production of OH^- ion will be. In other words, the weaker the acid, HA, the stronger its conjugate base, A^-.

Aqueous solutions of sodium carbonate are strongly basic. The sodium ions, Na^+, in sodium carbonate do not undergo hydrolysis in aqueous solution, but the carbonate ions, CO_3^{2-}, react as a Brønsted base. A CO_3^{2-} anion acquires a proton from a water molecule to form the weak Brønsted acid, HCO_3^-, and the OH^- ion.

$$CO_3^{2-}(aq) + H_2O(l) \rightleftharpoons HCO_3^-(aq) + OH^-(aq)$$
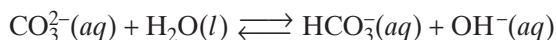
The OH^- ion concentration increases until equilibrium is established. Consequently, the H_3O^+ ion concentration decreases so that the product $[H_3O^+][OH^-]$ remains equal to the ionization constant, K_w, of water at the temperature of the solution. Thus, the pH is *higher* than 7, and the solution is basic.

Cation Hydrolysis

In the Brønsted sense, the cation of the salt is the conjugate acid of the base from which it was formed. It is also a proton donor. If the base is weak, the cation is an acid strong enough to donate a proton to a water molecule, a proton acceptor, to form H_3O^+ ions. An equilibrium is established in which the net effect of the cation hydrolysis is an increase in the hydronium ion concentration, $[H_3O^+]$, of the solution.