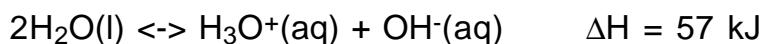
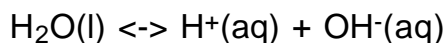


## Chem12 Acid-Base Reactions-40

Pure water is often considered a non-electrolyte. It is actually a weak electrolyte. A few water molecules do break apart to form ions. This is called self-ionization. The equations below represent this process.



The second equation is considered more accurate as water is now known to be a proton acceptor as well as a proton donor. This is an equilibrium endothermic reaction. This reaction occurs in all aqueous solutions. In pure water  $[\text{H}_3\text{O}^+] = [\text{OH}^-]$ . If an acid is added to the water the equilibrium shifts left and  $[\text{OH}^-]$  decreases. If a base is added the equilibrium shifts left and  $[\text{H}_3\text{O}^+]$  decreases. The equilibrium expression for the reaction is given below.

$$K_{\text{eq}} = K_{\text{w}} = [\text{H}_3\text{O}^+][\text{OH}^-] = 1.00 \times 10^{-14} \text{ at } 25^\circ\text{C}$$

This relationship is true for all aqueous solutions.

Exercise 1: Find  $[\text{H}_3\text{O}^+]$  and  $[\text{OH}^-]$  in a 1.00 L beaker of pure water.

Exercise 2 : What is the value of  $[\text{H}_3\text{O}^+]$  and  $[\text{OH}^-]$  in

- a) 0.010M HBr
- b) 5.0M NaOH

Exercise 3 : Calculate the  $[\text{H}_3\text{O}^+]$  and  $[\text{OH}^-]$  in a  $2.0 \times 10^{-3}$  M solution of  $\text{HClO}_4$ .

Exercise 4 : If 1.00g of KOH is dissolved in 2.00L of water, find the  $[\text{H}_3\text{O}^+]$  and  $[\text{OH}^-]$  for this solution.

Exercise 5 : If 0.100 mol of HCl are dissolved in 1.5L of water, find  $[\text{H}_3\text{O}^+]$  and  $[\text{OH}^-]$ .

Answers : 1)  $1.00 \times 10^{-7}$ ,  $1.00 \times 10^{-7}$ , 2)a) 0.010,  $1.00 \times 10^{-12}$ , b)  $2.00 \times 10^{-15}$ , 5.0, 3)  $2.0 \times 10^{-3}$ ,  $5.0 \times 10^{-12}$ , 4)  $1.12 \times 10^{-12}$ ,  $8.91 \times 10^{-3}$ , 5) 0.0667 M,  $1.5 \times 10^{-13}$  M.