

## Mathematical Equations for Weak Acid/Base Equilibrium

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

$$10^{-pK_a} = \frac{(x)(10^{-7}+x)}{(M_i - x)}$$

$$x^2 + (10^{-7} + 10^{-pK_a})(x) - (M_i)(10^{-pK_a}) = 0$$

$$x = \frac{-(10^{-7} + 10^{-pK_a}) + \sqrt{(10^{-7} + 10^{-pK_a})^2 + (4)(M_i)(10^{-pK_a})}}{2}$$

$$K_b = \frac{[HA][OH^-]}{[A^-]}$$

$$10^{-pK_b} = \frac{(x)(10^{-7}+x)}{(M_i - x)}$$

$$x^2 + (10^{-7} + 10^{-pK_b})(x) - (M_i)(10^{-pK_b}) = 0$$

$$x = \frac{-(10^{-7} + 10^{-pK_b}) + \sqrt{(10^{-7} + 10^{-pK_b})^2 + (4)(M_i)(10^{-pK_b})}}{2}$$