Guidelines for Solving Acid/Base Problems

The first step is to **IDENTIFY WHAT YOU HAVE IN SOLUTION**. Possible options include: strong acid, weak acid, strong base, weak base, buffer, or neutral solution. If the problem involves the mixing of a strong acid or strong base with another base or acid, consider any possible neutralization reaction before deciding what is present.

**STRONG ACID (HA)**

\[ [H_3O^+] = [HA] \text{ and } pH = -\log [H_3O^+] \]

**STRONG BASE (B)**

\[ [OH^-] = n [B] \text{ where } n \text{ is the number of } OH^-/ \text{ formula unit of base} \]

\[ pOH = -\log [OH^-] \text{ and } pH = 14 - pOH \]

**WEAK ACID (HA)**

Write the equation for the weak acid dissociation and assign initial and equilibrium concentrations to the reactants and products.

\[
\text{HA} + \text{H}_2\text{O} \rightleftharpoons \text{H}_3\text{O}^+ + \text{A}^- 
\]

Most problems can then be solved by setting the reaction quotient equal to the acid dissociation equilibrium constant (\(K_a\)).

**WEAK BASE (B)**

Write the equation for the weak base hydrolysis reaction and assign initial and equilibrium concentrations to the reactants and products.

\[
\text{B} + \text{H}_2\text{O} \rightleftharpoons \text{BH}^+ + \text{OH}^- 
\]

Most problems can then be solved by setting the reaction quotient equal to the base hydrolysis equilibrium constant (\(K_b\)).

**BUFFER**

Look for the presence of comparable amounts of a weak acid (HA) and its conjugate base (A\(^-\)). Write the equation for the weak acid dissociation and assign initial and equilibrium concentrations to the reactants and products. If \(K_a < 10^{-3}\) and both \([HA]_{\text{init}}\) and \([A^-]_{\text{init}}\) are \(> 10^{-3}\) M, then \([HA]_{\text{eq}} \approx [HA]_{\text{init}}\) and \([A^-]_{\text{eq}} \approx [A^-]_{\text{init}}\).

\[
\text{HA} + \text{H}_2\text{O} \rightleftharpoons \text{H}_3\text{O}^+ + \text{A}^- 
\]

Most problems can then be solved by setting the reaction quotient equal to the acid dissociation equilibrium constant (\(K_a\)).