MONOPROTIC ACIDS & BASES

CHEM 251 SDSU

ACIDS AND BASES

- An acid is a proton donor - forms H_3O^+
  $HA + H_2O \rightleftharpoons A^- + H_3O^+$

- A base is a proton acceptor - forms OH^-
  $B + H_2O \rightleftharpoons BH^+ + OH^-$

- Vinegar:
  $CH_3CO_2H + H_2O \rightleftharpoons CH_3CO_2^- + H_3O^+$

- Ethylamine:
  $CH_3CH_2NH_2 + H_2O \rightleftharpoons CH_3CH_2NH_3^+ + OH^-$

PH

- $pH = -\log[H^+]$ & $pOH = -\log[OH^-]$
- $H_2O \rightleftharpoons H^+ + OH^-$
- $K_w = 1 \times 10^{-14} = [H^+]\times[OH^-]$
- $-\log(K_w) = -\log[H^+] \times -\log[OH^-]$
- $14 = pH + pOH$
- $HA + H_2O \rightleftharpoons H_3O^+ + A^-$ $K_a = [H^+][A^-]/[HA]$
- $B + H_2O \rightleftharpoons BH^+ + OH^-$ $K_b = [BH^+][OH^-]/[B]$

STRONG ACIDS AND BASES

Most acids/bases are considered **weak** - they do not dissociate fully in water.

Only these select few dissociate fully and are **strong**

Strong Acids:	Strong Bases:	"Not Weak" Bases:
HCl	$LiOH$	$Mg(OH)_2$
HBr	$NaOH$	$Ca(OH)_2$
HI	KOH	$Sr(OH)_2$
H_2SO_4	$RbOH$	$Ba(OH)_2$
HNO_3	$CsOH$	
$HClO_4$	R_4NOH	

WEAK ACIDS AND BASES

- All weak acids and bases have dissociation constants, strong acids and bases do not have tabulated values.

- Weak acids/bases do not dissociate fully in solution - some HA or B remain.

- The smaller the dissociation constant the weaker the acid/base - the closer the pH of the solution is to being 7.

ACID/BASE DISSOCIATION CALCULATIONS

- $HA \rightleftharpoons H^+ + A^-$

- The dissociation reactions always proceed stoichiometrically. So if one mole of **HA** dissociates, you get one mole of **H^+** and one mole of **A^-**.

- When doing calculations you must account for the lose of moles of **HA** and the increase in moles of **H^+** and **A^-**.

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

$$K_a = \frac{[x][x]}{[HA-x]}$$

KNOWING TO USE K_A OR K_B

- Depending on what species you have in solution you may need to use K_a or K_b to determine the pH of a solution.
- If the species you have produces **H^+** as a product you need to use **K_a**.
- If the species you have produces **OH^-** as the product of the reaction you need to use **K_b**.

$$HA + H_2O \rightleftharpoons H_3O^+ + A^-$$

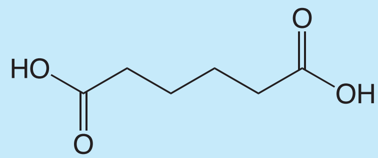
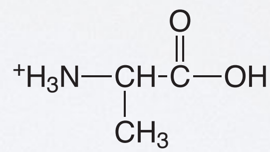
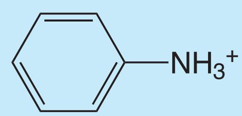
$$K_a = \frac{[H^+][A^-]}{[HA]}$$

$$B + H_2O \rightleftharpoons BH^+ + OH^-$$

$$K_b = \frac{[BH^+][OH^-]}{[B]}$$

SAMPLE PROBLEM

What is the pH of a solution prepared by dissolving 0.458 g of aminobenzene into 200 mL of water?

Compound	Conjugate Acid	pK_a
acetic acid	CH_3COOH	4.757
adipic acid		4.42 5.42
alanine		2.348 (COOH) 9.867 (NH_3)
aminobenzene		4.601