

Chem 151. R. Corn

Monoprotic Weak Acid

Constants:  $K_a$ ,  $K_w$ ,  $C_0$

Four species:  $[HA]$ ,  $[A^-]$ ,  $[H^+]$ ,  $[OH^-]$

$K_a = [H^+][A^-]/[HA]$  acid dissociation

$K_w = [H^+][OH^-]$  water dissociation

$[H^+] = [A^-] + [OH^-]$  charge balance

$C_0 = [HA] + [A^-]$  mass balance

Full Cubic for  $[H^+]$

$[H^+][A^-] = K_a[HA]$

$[H^+]([H^+] - [OH^-]) = K_a(C_0 - [A^-])$

$[H^+]^2 - K_w = K_a(C_0 - [H^+] + K_w/[H^+])$

$[H^+]^2 = K_a(C_0 - [H^+] + K_w/[H^+]) + K_w$

Iterative Equations:

$[HA] = C_0(1 + K_a/[H^+])^{-1}$

$[H^+] = \sqrt{K_a[HA] + K_w}$