

Chem 151. R. Corn

Monoprotic Weak Acid And Salt

Constants:  $K_a$ ,  $K_w$ ,  $C_{OHA}$ ,  $C_{OA}$

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

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

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

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

$C_{OHA} + C_{OA} = [HA] + [A^-]$               mass balance 1

$C_{OA} = [Na^+]$                                   mass balance 2

Full Formal Equation for  $[H^+]$

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

$[A^-] = C_{OA} + [H^+] - [OH^-]$

$[HA] = C_{OHA} - [H^+] + [OH^-]$

$[H^+] = K_a(C_{OHA} - [H^+] + [OH^-]) / (C_{OA} + [H^+] - [OH^-])$

Equations for  $C_{OHA}$  and  $C_{OA}$  bigger than  $K_a$ :

Initial guess:  $[H^+] = K_a * C_{OHA} / C_{OA}$

Acidic Solution:  $[H^+] = K_a(C_{OHA} - [H^+]) / (C_{OA} + [H^+])$

Basic Solution:  $[OH^-] = K_b(C_{OA} - [OH^-]) / (C_{OHA} + [OH^-])$

Can either iterate or solve quadratic