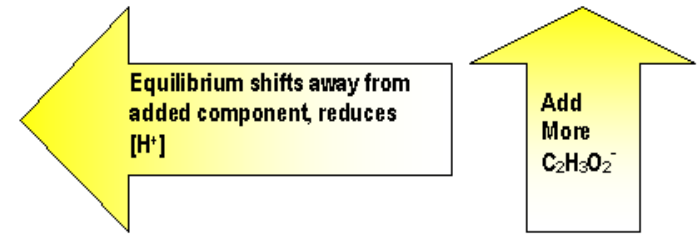
Common Ion—ion that appears in an acid (or a base) and a salt solution

Common Ion Effect—shift in equilibrium position because of the addition of an ion already involved in the equilibrium reaction

the additional ion causes the equilibrium position to shift (left) away from the $[H^+]$ or the $[OH^-]$

$$NaC_2H_3O_2\,(s) \rightarrow Na^+\,(aq) + C_2H_3O_2^-\,(aq)$$

$$HC_2H_3O_2\,(aq) \leftrightarrows H^+\,(aq) + C_2H_3O_2^-\,(aq)$$



LeChatelier's Principle-increase conc. Shifts in opposite direction from the increase

result is acid is less acidic with salt added in than it originally was

$NH_4Cl\,(s) \longrightarrow NH_4^+\,(aq) + Cl^-\,(aq)$

$NH_3\,(aq) \leftrightarrows NH_4^+\,(aq) + OH^-\,(aq)$

Calculations must include salt concentrations

Examples:

1. What is the pH of solution made by adding 0.30 mol $HC_2H_3O_2$ and 0.30 mol of $NaC_2H_3O_2$ to enough water to make a 1.0 L of solution?

$HC_2H_3O_2 \rightleftharpoons H^+ + C_2H_3O_2^-$ (K_a)

$NaC_2H_3O_2 \rightleftharpoons Na^+ + C_2H_3O_2^-$

	$HC_2H_3O_2$	H^+	$C_2H_3O_2^-$
I	.30	0	.30
C	$-x$	$+x$	$+x$
E	$.30-x$	x	$.30+x$

$$K_a = \frac{[H^+][C_2H_3O_2^-]}{[HC_2H_3O_2]}$$

$$1.8\times10^{-5} = \frac{(x)(.30+x)}{(.30-x)} \approx \frac{(x)(.30)}{(.30)}$$

AXIS

$.30-x \approx .30$

$.30+x \approx .30$

$[H^+] = x = 1.8\times10^{-5}$

$pH = -\log[H^+]$

$= -\log(1.8\times10^{-5})$

$= 4.74$

2. Calculate the pH of a solution containing 0.085 M nitrous acid ($K_a = 4.5 \times 10^{-4}$) and 0.10 M KNO_2.

3. Calculate the F^- concentration and pH of a solution that is 0.20 M HF and 0.10 M HCl.