

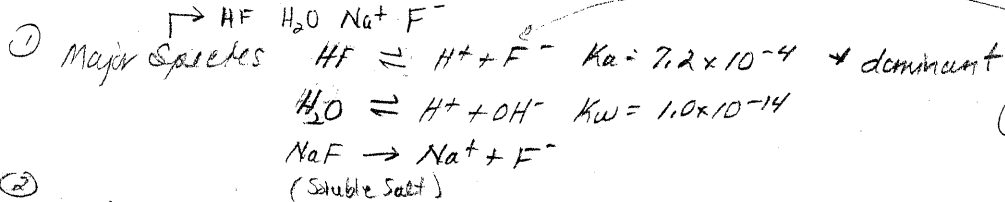
Key

COMMON ION

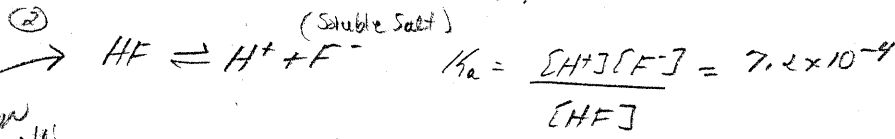
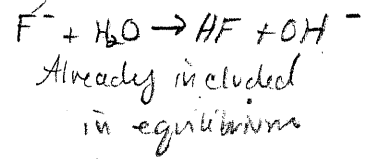
** Encountered with a solution containing a weak acid and a soluble salt containing the anion (conjugate base) of the weak acid.

** The acid and salt have the same anion. Ex: H₂S and K₂S

Ex: Calculate the [H⁺] in a solution containing 1.00 M HF (K_a = 7.2 x 10⁻⁴) and 0.50M sodium fluoride.



could have:



association of F particles

I	1.00M	0	0.50M
C	-x	+x	+x
E	1.00M-x	x	0.50M+x

$7.2 \times 10^{-4} = \frac{(x)(0.50M)}{(1.00M)}$

both insignificant (below 5%)

have to check each one

$1.4 \times 10^{-3} = x$

When can ignore one... usually can ignore the other

significant? (e H⁺ from)

$x = 1.4 \times 10^{-3} M$

pH = 2.95

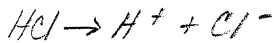
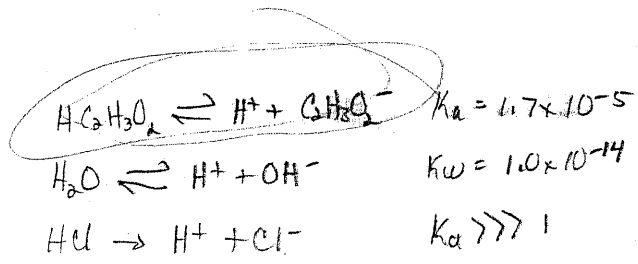
"Common Ion Effect" = when a solution contains a salt having an ion common with one in the equilibrium, the position of the equilibrium is driven away from the side containing that ion.

"... the shift in an ionic equilibrium caused by the addition of a solute that provides an ion that takes part in the equilibrium (Ebbing)."

Ex: The degree of ionization of acetic acid, $\text{HC}_2\text{H}_3\text{O}_2$, in a 0.10 M aqueous solution at 25°C is 0.013. K_a at this temperature is 1.7×10^{-5} . Calculate the degree of ionization of $\text{HC}_2\text{H}_3\text{O}_2$ in a 0.10 M solution at 25°C to which HCl is added to make it 0.010 M HCl. How is the degree of ionization affected?

Major Species

$\text{HC}_2\text{H}_3\text{O}_2$
 H_2O
 HCl



Original Ionization = 0.013

I	0.010M	0	0	$x = 0.010\text{M}$
C	-x	+x	+x	
E	0	0.010M	0.010M	

Creation of H^+ affects eq. of $\text{HC}_2\text{H}_3\text{O}_2$

	$\text{HC}_2\text{H}_3\text{O}_2 \rightleftharpoons \text{H}^+ + \text{C}_2\text{H}_3\text{O}_2^-$	$K_a = 1.7 \times 10^{-5} = \frac{(0.010 + x)(x)}{(0.10 - x)}$	
I	0.10M	0.010M	0
C	-x	+x	+x
E	0.10M - x	0.010 + x	x

$x \rightarrow [\text{H}^+]_{\text{produced}}$
 $= 1.7 \times 10^{-4}\text{M}$

$1.7 \times 10^{-5} = \frac{0.010(x)}{0.10\text{M}}$
 $1.7 \times 10^{-4}\text{M} = x$



$\frac{1.7 \times 10^{-4}}{0.1} = 0.0017$

Degree of Ionization

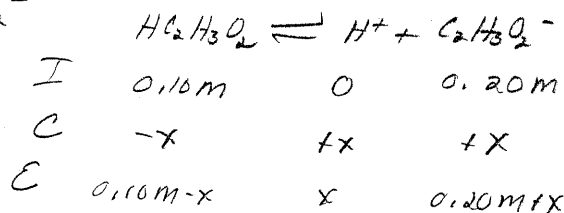
Ex: A solution is prepared to be 0.10 acetic acid, and 0.20 M sodium acetate. What is the pH of this solution at 25°C? K_a for acetic acid at 25°C is 1.7×10^{-5} .

$\text{HC}_2\text{H}_3\text{O}_2$ & dominant

H_2O

Na^+

$\text{C}_2\text{H}_3\text{O}_2^-$



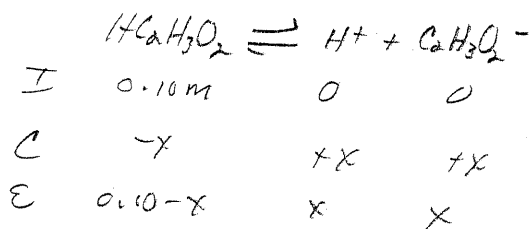
$$K_a = \frac{[\text{H}^+][\text{C}_2\text{H}_3\text{O}_2^-]}{[\text{HC}_2\text{H}_3\text{O}_2]}$$

$$1.7 \times 10^{-5} = \frac{(x)(0.20 \text{ M})}{(0.10 \text{ M})}$$

$$8.5 \times 10^{-6} \text{ M} = x = [\text{H}^+]$$

$$\text{pH} = 5.07$$

Without $\text{C}_2\text{H}_3\text{O}_2^-$ from $\text{NaC}_2\text{H}_3\text{O}_2$



$$K_a = \frac{[\text{H}^+][\text{C}_2\text{H}_3\text{O}_2^-]}{[\text{HC}_2\text{H}_3\text{O}_2]}$$

$$1.7 \times 10^{-5} = \frac{(x^2)}{(0.10)}$$

$$0.0013 = x$$

$$\text{pH} = 2.89$$

Le Chat.
Principle Shows!