AP CHEMISTRY

TOPIC 7: ACIDS & BASES, PART E, EXAMPLES, PART III   Day 87:

- Buffers

Let's try one from the examples from part I

Example #1, part 1: A buffered solution (at equilibrium) contains 0.75 *M* acetic acid ($HC_2H_3O_2$, K_a = 1.8 x 10^{-5}) and 0.75 *M* sodium acetate, $NaC_2H_3O_2$. Calculate the pH of this solution.

	[$HC_2H_3O_2$]	$\rightleftharpoons$	[$C_2H_3O_2^{-1}$]	+	[H^{+1}]
I	0.75 *M*		0.75 *M*		~ 0
C	- x		+ x		+ x
E	0.75 *M* - x		0.75 *M* + x		x

$$pH = pK_a + \log \frac{[\ A^{-1}\ ]}{[\ HA\ ]} = -\log\left(1.8\times10^{-5}\right) + \log \frac{[\ 0.75\ ]}{[\ 0.75\ ]} = 4.74 + \log(1) = 4.74$$

Example #1, part 2: Calculate the change in pH that occurs when 0.010 mol of gaseous hydrochloric acid, HCl, is added to 1.0 liter of the buffered solution (from part 1). Compare the above pH with the pH when the hydrochloric acid is added.

$$0.010\ M\ \text{HCl} \rightarrow 0.010\ M\ \text{H}^{+1} + 0.010\ M\ \text{Cl}^{-1}$$

	[$HC_2H_3O_2$]	$\leftarrow$	[$C_2H_3O_2^{-1}$]	+	[H^{+1}]
I	0.75 *M*		0.75 *M*		0.010
C	+ 0.010		- 0.010		- 0.010
E	0.75 + 0.010 = 0.760		0.75 - 0.010 = 0.740		~ 0

$$pH = pK_a + \log \frac{[\ A^{-1}\ ]}{[\ HA\ ]} = -\log\left(1.8\times10^{-5}\right) + \log \frac{[\ 0.74\ ]}{[\ 0.76\ ]} = 4.74 + \log(0.974) = 4.73$$

Keep in mind, you may use the Henderson-Hasselbalch method or the "old fashion" way …