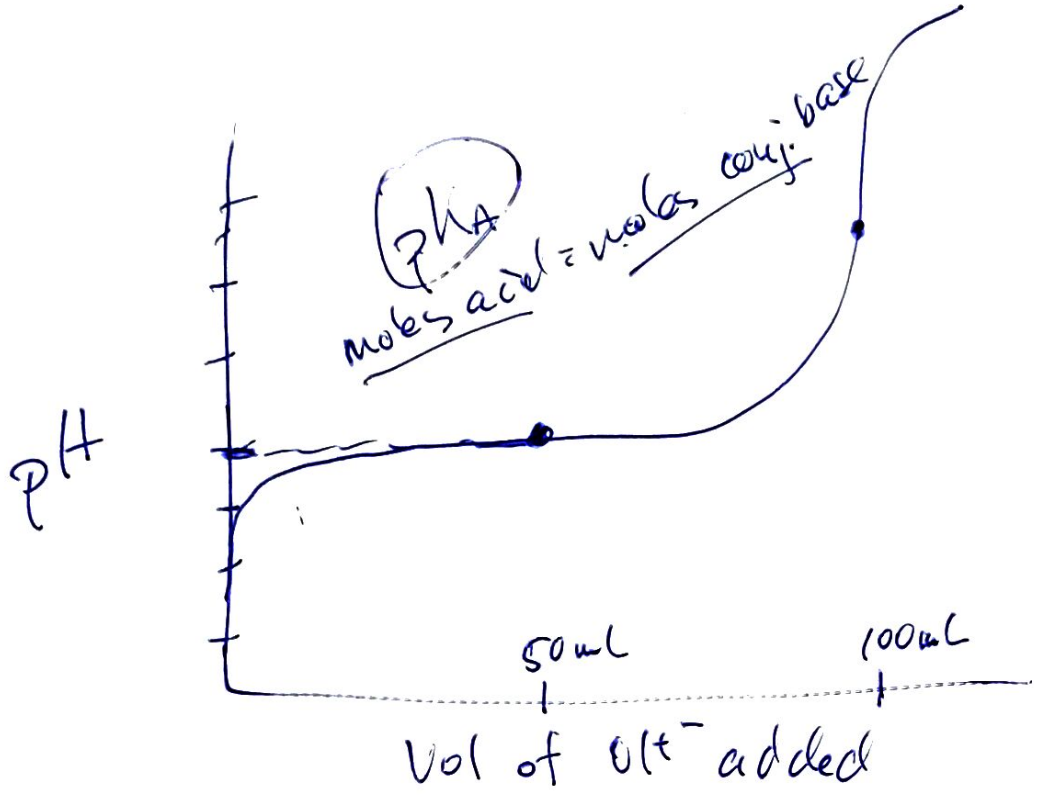
## 11 Sept 2019 CHEM106 ##



Equivalence point?

Added equivalent number of moles of OH⁻ as there were moles of acid @ start

$HA + OH^- \longrightarrow A^- + H_2O$

Buffers to maintain the pH of a system

① Take the dissociation reaction of a weak acid

$$HA + H_2O \rightleftharpoons A^- + H_3O^+$$

② The dissociation constant ($K_A$) for the weak acid is

$$K_A = \frac{[\text{Products}]}{[\text{Reactants}]} = \frac{[H_3O^+][A^-]}{[HA]}$$

③ Let's rearrange the equation to isolate $[H_3O^+]$

$$[H_3O^+] = K_A \left(\frac{[HA]}{[A^-]}\right)$$

④ Take the negative log of both sides

$$-\log[H_3O^+] = -\log K_A + \left(-\log \frac{[HA]}{[A^-]}\right)$$

$$pH = pK_A - \log\left(\frac{[HA]}{[A^-]}\right)$$

$$\boxed{pH = pK_A + \log\left(\frac{[A^-]}{[HA]}\right)}$$

Henderson - Hasselbach equation

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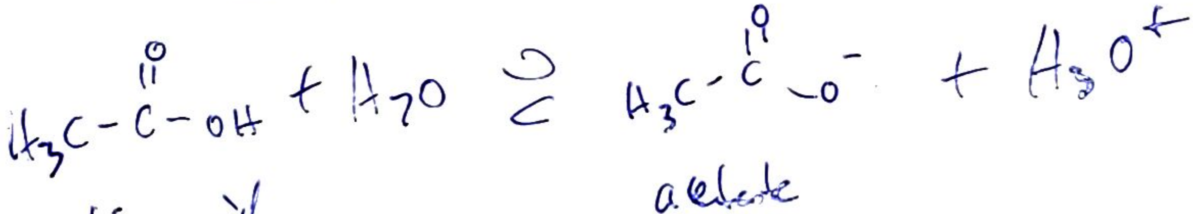
Example: A mixture of 0.2M Acetic acid and 0.3M Sodium acetate is given to you. Calculate the pH of the system if the $pK_A$ of acetic acid is 4.76



$$H_3C-\overset{O}{\overset{\|}{C}}-OH + H_2O \rightleftharpoons H_3C-\overset{O}{\overset{\|}{C}}-O^- + H_3O^+$$

acetic acid

acetate

$$pH = pK_A + \log\left(\frac{[\text{Acetate}]}{[\text{Acetic Acid}]}\right)$$

$$pH = 4.76 + \log\left(\frac{0.3\,M}{0.2\,M}\right)$$

$$pH = 4.76 + 0.67$$

$$\boxed{pH = 5.43}$$

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Example 2 The pH of a solution of lactic acid and lactate is 4.30. Calculate the pKA of lactic acid when the concentrations of lactic acid and lactate are 0.02M and 0.073M respectively.

HA = lactic acid

$A^-$ = lactate

$$pH = pK_A + \log\left(\frac{[A^-]}{[HA]}\right)$$

$pK_A = pH - \log$ ( [illegible] / [illegible] )

$$pK_A = pH - \log\left(\frac{0.073}{0.02}\right)$$

$$pK_A = 4.3 - 0.56$$

$$\boxed{pK_A = 3.74}$$