

Where does HH equation come from?

- We use HH to calculate pH of a buffer.
- A buffer is composed of a weak acid/base + its conjugate. Let's use WA as example...



If I wanted to solve for the pH of this reaction, I would use ICE + equilibrium expression

$$K_a = \frac{[\text{A}^{-}][\text{H}_3\text{O}^{+}]}{[\text{HA}]}$$

To solve for pH explicitly I will isolate H_3O^{+}

$$[\text{H}_3\text{O}^{+}] = K_a \frac{[\text{HA}]}{[\text{A}^{-}]}$$

Then take the log of the whole formula, remember $-\log[\text{H}_3\text{O}^{+}] = \text{pH}$ and $-\log K_a = \text{p}K_a$
(Remember log rule that $\log A \cdot B = \log A + \log B$)

$$-\log [\text{H}_3\text{O}^{+}] = -\log (K_a) + -\log \frac{[\text{HA}]}{[\text{A}^{-}]}$$

$$\text{pH} = \text{p}K_a - \log \frac{[\text{HA}]}{[\text{A}^{-}]}$$

We always prefer to work with positives so $-\log \frac{x}{y}$ is the same as $+\log \frac{y}{x}$

$$\text{pH} = \text{p}K_a + \log \frac{[\text{A}^{-}]}{[\text{HA}]}$$

Henderson-Hasselbalch equation