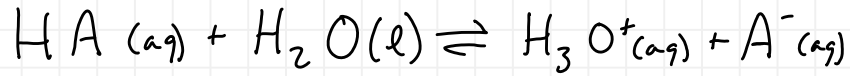


Derivation of Henderson-Hasselbalch Equation

Note Title

7/24/2008

A generic weak acid, HA, reacting with water.



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

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

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

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

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

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

for
Buffers

$$\text{pH} = \text{p}K_a + \log \frac{[\text{base}]}{[\text{acid}]}$$

Henderson-Hasselbalch Equation

used for buffer solutions

must be conjugate pairs

$$\text{pOH} = \text{p}K_b + \log \frac{[\text{acid}]}{[\text{base}]}$$