Weak Acids & Bases

Weak Acids and Bases

Acid Dissociation Constant

- Weak Acids
  - Most acids (all but 7) are weak acids
  - As a result, they do not completely protonate in water
  - Instead, they reach equilibrium
- Consider a hypothetical weak acid (HA)
  - Write the equation that represents the protonation of this acid
  - Write the K_c expression for this process
    - Check the AP equation sheet
- This is termed the acid-dissociation constant
  - The larger the value of K_a, the stronger the weak acid
- This relationship can be used to convert from K_a to pH and vise-versa.

Weak Acids and Bases

Calculating K_a from pH

- A student prepares a 0.10 M formic acid ($HCHO_2$) solution. If its pH is 2.38, what is the K_a for formic acid? What percentage of the acid is protonated?

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Using K_a to Calculate pH

- What is the pH of a 0.30M CH_3COOH solution ($K_a = 1.8x10^{-5}$)?
- A general rule....
  - If an acid is less than 5% ionized, it is OK mathematically to disregard the concentration change for the acid due to protonation
    - This is generally within the accuracy given by significant figures

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Weak Bases

- Weak bases are compounds which partially protonate water to form OH^-
  - How is this definition different from that of a weak acid?
    - Notice that weak bases must be understood in the context of water
  - What chemical equation represents this process?
  - What, then, is the K_b expression for weak base B?
- We can use this relationship to perform familiar calculations
  - What is the pH of 0.15M solution of NH_3?

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Relating K_a and K_b

- The product of the K_a for a acid and the K_b for its conjugate base is the ion-product constant for water.

$$K_a \times K_b = K_w$$

$$CH_3COOH \rightleftharpoons CH_3COO^- + H^+$$

$$K_a = 1.8 \times 10^{-5} \qquad K_b = 5.6 \times 10^{-10}$$

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Homework

- 16.53 / 16.55 / 16.57 / 16.59 / 16.61 / 16.63a&c / 16.65 / 16.67a&b / 16.71 / 16.73 / 16.75 / 16.77 / 16.79 / 16.81