

Titrating Buffers

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Characteristics of Buffers

- There are two important characteristics of buffers
 - Capacity
 - The amount of acid or base a buffer can absorb without an appreciable change in pH
 - Depends on the amounts of weak electrolyte and salt from which the buffer is made
 - For example.....
 - 1 L of solution composed of 1 M CH_3COOH and 1 M NaCH_3COO
 - 1 L of solution composed of 0.01 M CH_3COOH and 0.01 M NaCH_3COO
 - What will their pH's be?
 - Same pH's
 - Which will have a greater buffering capacity?
 - The first solution

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Characteristics of Buffers

- There are two important characteristics of buffers
 - pH Range
 - The pH range over which a buffer acts effectively
 - Buffers are most effective when the concentration of the weak electrolyte and its conjugate ion are about the same.
 - $[HA] \approx [A^-]$
 - $pH = pK_a$
 - Buffers tend to be less effective if one component is 10 times more concentrated than the other
 - $\log 10 = 1$ and the $\log 1/10 = -1$, so
 - Buffers usually have a usable range of $pH = pK_a \pm 1$

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- Now lets look quantitatively at how a buffer responds to the addition of strong acid or base
- To solve these we need to make two assumptions
 - 1. We have not exceeded the buffering capacity of the system
 - 2. The added acid or base reacts completely with the buffer
 - It's strong, thank goodness
- Then, it becomes a 2 step problem solving process (IRACE Box)
 - 1. Acid-base Neutralization (particle dependent - requires moles)
 - **(I)nitia**
 - **(R)ected**
 - 2. Use K_a and the newly adjusted concentrations of $[HA]$ and $[A^-]$ from step 1 to calculate $[H^+]$, and from that pH. (equilibrium dependent - requires molarity)
 - **(A)djusted** (watch volume changes as you convert to molarity)
 - **(C)hange**
 - **(E)quilibrium**

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- A buffer is made by mixing 100mL of 1.00M acetic acid and 100mL of 1.00M sodium acetate. The K_a of acetic acid 1.8×10^{-5} . Calculate the pH of this solution after...
 - 50mL of 1.00M HCl is added
 - 50mL of 1.00M NaOH is added

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Homework

- 17.23 / 17.24 / 17.25 / 17.27 / 17.28 / 17.29 / 17.30 / 17.31 (first part of question)