Buffers
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BUFFERS

Buffers resist large changes in pH resulting from the addition of acids and bases.

- Consists of a weak acid and its conjugate weak base (usually close to equal concentrations of acid and base).
- often added as soluble salts

Eg. CH_3COOH and $NaCH_3COO$
NH_4NO_3 and NH_3
NaH_2PO_4 and Na_2HPO_4

Buffer = solution where the solutes protect it against large changes in pH even when strong acids or bases are added.

Buffers are Bronsted-Lowry equilibria that work by shifting to reduce the effects of adding H_3O^+ or OH^-.

- Consider the equation of a buffer:

$$CH_3COOH_{(aq)} + H_2O_{(l)} \rightleftharpoons CH_3COO^-_{(aq)} + H_3O^+_{(aq)}$$

If H_3O^+ is added, $\uparrow [H_3O^+]$, the eq. shifts ← left.

OH^- is added, $\downarrow [H_3O^+]$, the eq. shifts → right.

A buffer works best when $pKa \approx pH \pm 1$

$$pH \text{ of a buffer} = pK_a + \log \frac{[\text{conjugate base}]}{[\text{acid}]}$$

[conjugate base]

Calculating the pH of a buffer:

A buffer is made by adding 0.11 M $NaC_2H_3O_2$ to 0.90 M $HC_2H_3O_2$. What is the pH of this buffer? Ka of acetic acid is 1.8×10^{-5}.

$$pH = pK_a + \log \frac{[\text{conjugate base}]}{[\text{conjugate acid}]}$$

$$pH = -\log(1.8 \times 10^{-5}) + \log \frac{0.11}{0.090} = 4.82$$

A solution buffered at pH 5.00 is needed in a chemistry experiment. Can acetic acid and sodium acetate be used to make it? If so, what ratio ratio of acetate to acetic acid is needed?