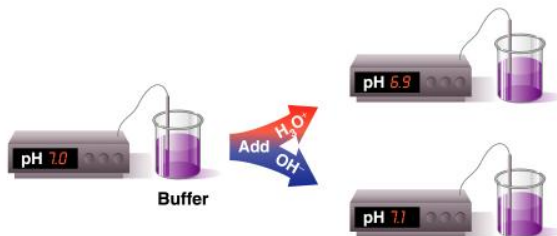


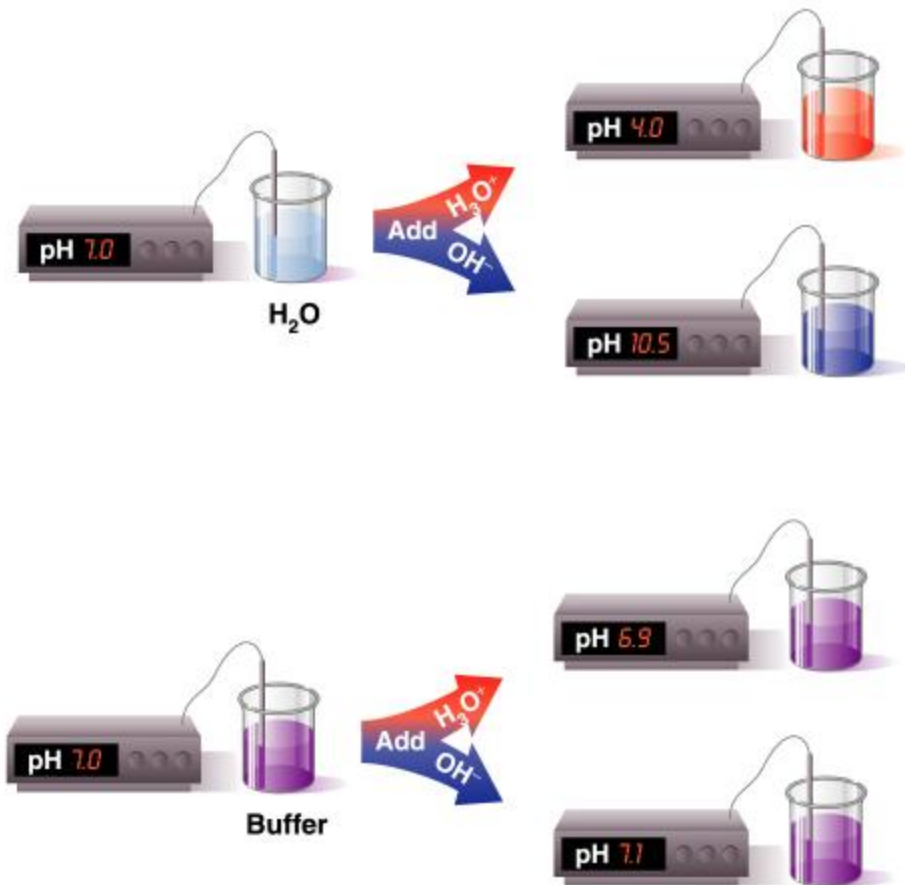
Acids and Bases

Buffers



Buffers

- When an acid or base is added to water, the pH changes drastically.
- A buffer solution resists a change in pH when an acid or base is added.





Buffers

Buffers

- Absorb H_3O^+ or OH^- from foods and cellular processes to maintain pH.
- Are important in the proper functioning of cells and blood.
- In blood maintain a pH close to 7.4. A change in the pH of the blood affects the uptake of oxygen and cellular processes.



Components of a Buffer

A buffer solution

- **Contains a combination of acid-base conjugate pairs.**
- **Contains a weak acid and a salt of the conjugate base of that acid.**
- **Typically has equal concentrations of a weak acid and its salt.**
- **May also contain a weak base and a salt with the conjugate acid.**



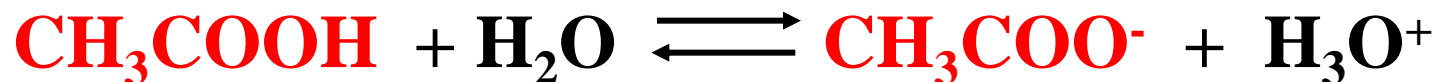
Buffer Action

- The acetic acid/acetate buffer contains acetic acid (CH_3COOH) and sodium acetate (CH_3COONa).

- The salt produces sodium and acetate ions.



- The salt provides a higher concentration of the conjugate base CH_3COO^- than the weak acid.

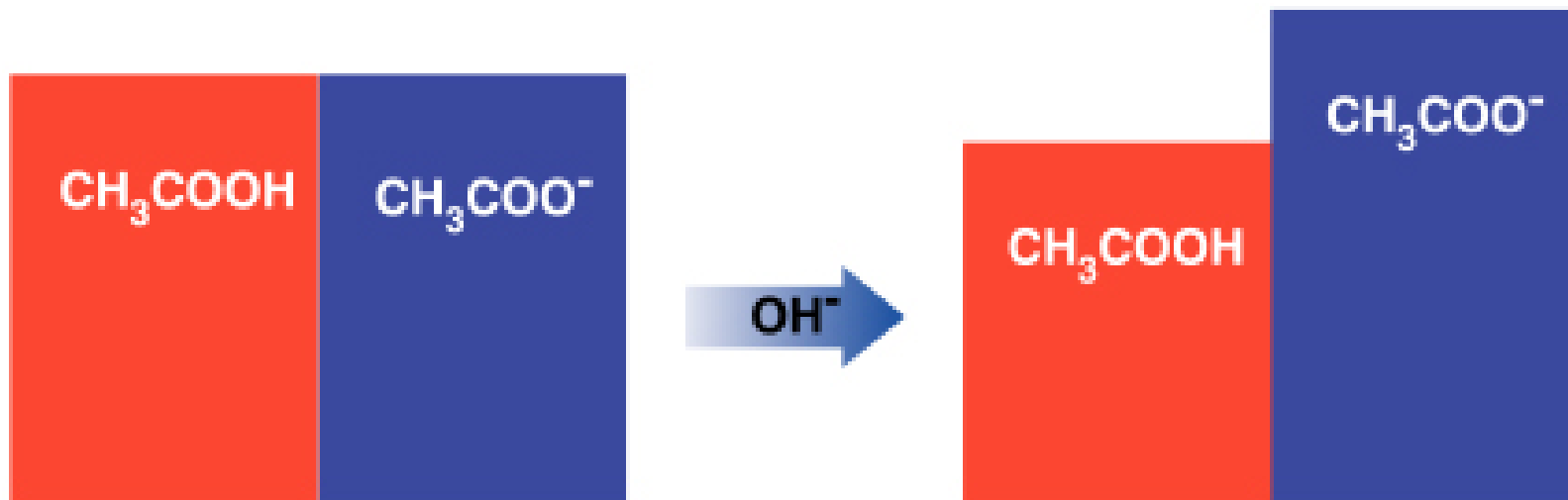


Large amount

Large amount

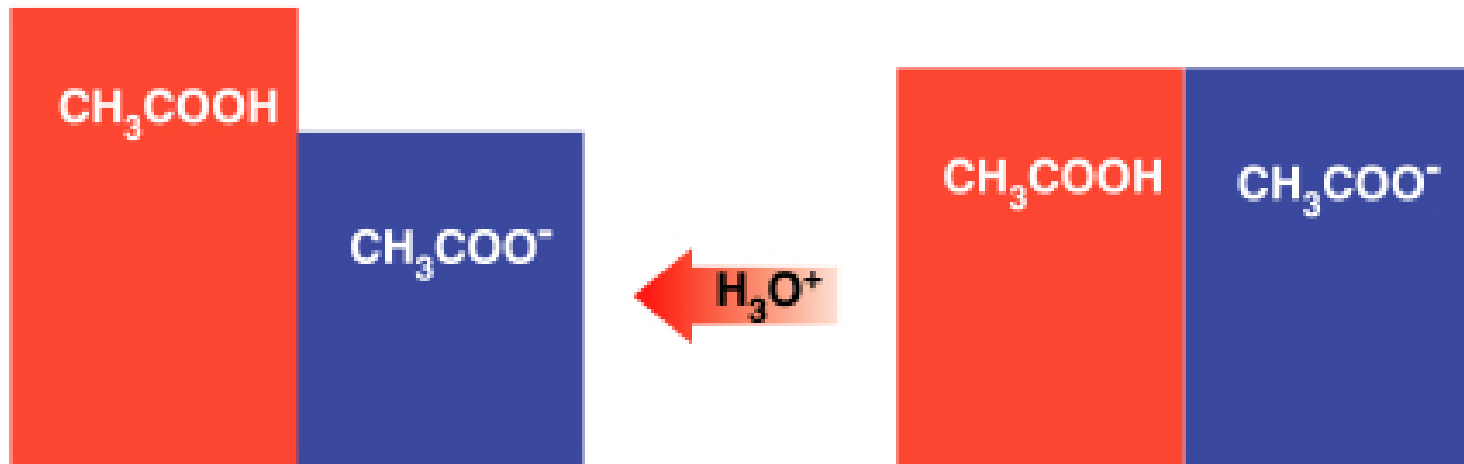
Function of the Weak Acid

- The function of the weak acid is to neutralize a base. The acetate ion in the product adds to the available acetate.



Function of the Conjugate Base

- The function of the acetate ion CH_3COO^- (conjugate base) is to neutralize H_3O^+ from acids. The weak acid product adds to the weak acid available.



Summary of Buffer Action

- The weak acid in a buffer neutralizes base.
- The conjugate base in the buffer neutralizes acid.
- The pH of the solution is maintained.



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pH of a Buffer

- The $[\text{H}_3\text{O}^+]$ in the K_a expression is used to determine the pH of a buffer.



$$K_a = \frac{[\text{H}_3\text{O}^+][\text{conjugate base}]}{[\text{weak acid}]}$$

$$[\text{H}_3\text{O}^+] = K_a \times \frac{[\text{weak acid}]}{[\text{conjugate base}]}$$

$$\text{pH} = -\log [\text{H}_3\text{O}^+]$$



Calculation of Buffer pH

The weak acid H_2PO_4^- in a blood buffer $\text{H}_2\text{PO}_4^-/\text{HPO}_4^{2-}$ has $K_a = 6.2 \times 10^{-8}$. What is the pH of the buffer if it is 0.20 M in both H_2PO_4^- and HPO_4^{2-} ?

$$[\text{H}_3\text{O}^+] = K_a \times \frac{[\text{H}_2\text{PO}_4^-]}{[\text{HPO}_4^{2-}]}$$

$$[\text{H}_3\text{O}^+] = 6.2 \times 10^{-8} \times \frac{[0.20 \text{ M}]}{[0.20 \text{ M}]} = 6.2 \times 10^{-8}$$

$$\text{pH} = -\log [6.2 \times 10^{-8}] = 7.21$$