

# Acid Base Properties of Salt Solutions

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# pH of Salt Solutions

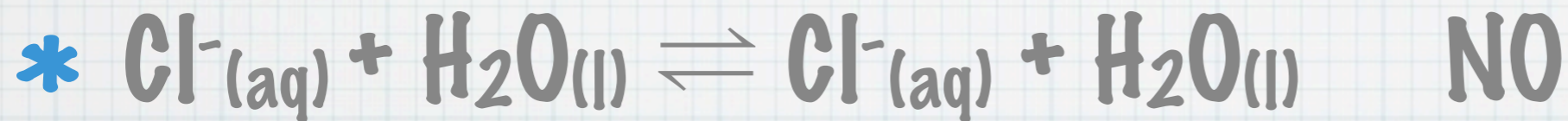


- \* Some dissolved anions and cations react with water. This affects the pH of the solution.
- \* The pH of a salt solution may be neutral, acidic or basic,

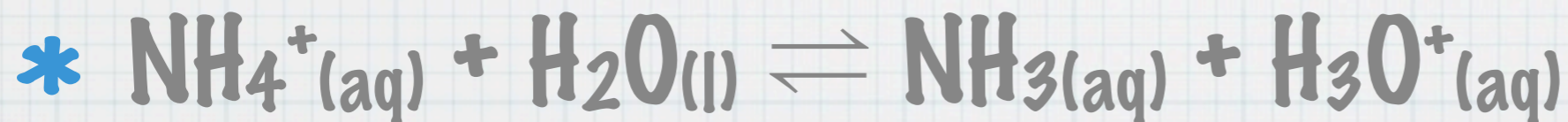
# Example



\* Do  $\text{NH}_4^+$  and  $\text{Cl}^-$  react with water?



REACTION



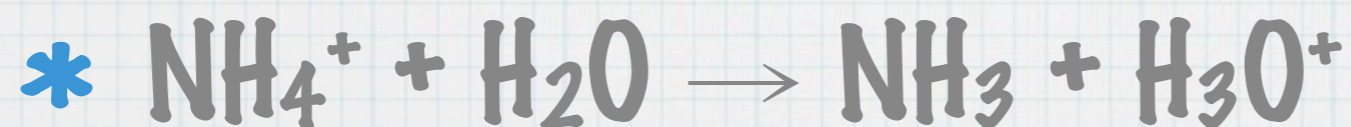
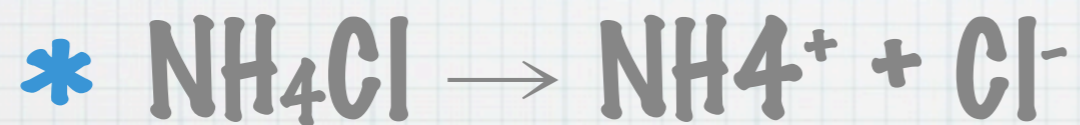
\* New products are formed! ( $\text{NH}_3$  and  $\text{H}_3\text{O}^+$ )

# Hydrolysis

- \* The reaction of the cation or anion of a salt with water to produce a change in the pH of the solution is called hydrolysis.

# Acidic Salt Solutions

\* Occurs when a salt consisting of the anion of a strong acid and the cation of a weak base ionizes in water.

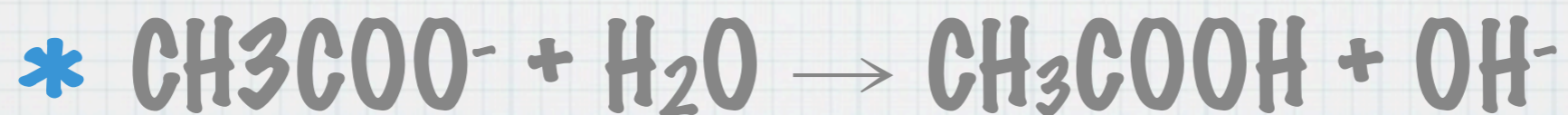
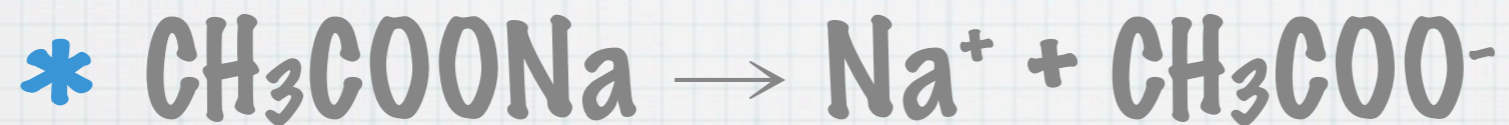


# Acidic Salt Solutions

- \* Charged metal ions will also produce hydronium ions in water
- \*  $\text{Al}^{3+}$ ,  $\text{Fe}^{3+}$ ,  $\text{Be}^{2+}$

# Basic Salt Solutions

\* When a salt consisting of the anion of a weak acid and the cation of a strong base ionize in water, a base is created.



# Summary

Salt Solution	pH	Example
Neutral NaCl, KBr, Ba(NO <sub>3</sub> ) <sub>2</sub>	7	None
Acidic NH <sub>4</sub> Cl	<7	$\text{NH}_4^+ + \text{H}_2\text{O} \rightarrow \text{NH}_3 + \text{H}_3\text{O}^+$
Acidic Al(NO <sub>3</sub> ) <sub>3</sub> , FeCl <sub>3</sub>	<7	$\text{Al}(\text{H}_2\text{O})_6^{3+} + \text{H}_2\text{O} \rightarrow \text{AlH}_2\text{O}_5\text{OH}_2^+ + \text{H}_3\text{O}^+$
Acidic/Basic NH <sub>4</sub> ClO <sub>2</sub> , NH <sub>4</sub> CN	<7 K <sub>a</sub> (cation) > K <sub>b</sub> (anion) >7 K <sub>b</sub> (anion) > K <sub>a</sub> (cation)	$\text{NH}_4^+ + \text{H}_2\text{O} \rightarrow \text{NH}_3 + \text{H}_3\text{O}^+$ $\text{CN}^- + \text{H}_2\text{O} \rightarrow \text{HCN} + \text{OH}^-$
Acidic/Basic NaH <sub>2</sub> PO <sub>4</sub>	<7 K <sub>a</sub> (cation) > K <sub>b</sub> (anion) >7 K <sub>b</sub> (anion) > K <sub>a</sub> (cation)	$\text{HSO}_3^- + \text{H}_2\text{O} \rightarrow \text{SO}_3^{2-} + \text{H}_3\text{O}^+$ $\text{HSO}_3^- + \text{H}_2\text{O} \rightarrow \text{H}_2\text{SO}_3 + \text{OH}^-$



# Buffer Solutions

# Buffer Solutions

- \* **Buffer:** Resists the change to pH when limited amounts of an acid or a base are added

# Buffer Solution

- \* Must contain a large amount of acid and base without reacting in a neutralization reaction.**

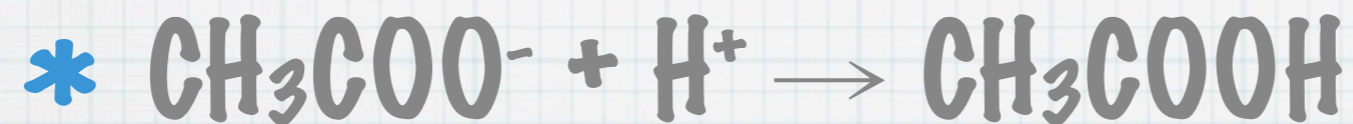
# Buffer Solution

- \* Consist of a mixture of weak acid and its conjugate base (supplied by a salt) or a weak base and its conjugate acid (supplied by a salt).

# Example

- \* A buffer solution where both  $\text{CH}_3\text{COOH}$  and  $\text{CH}_3\text{COO}^-$  are high

- \* When an acid is added



- \* When a base is added

