

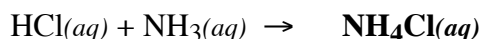
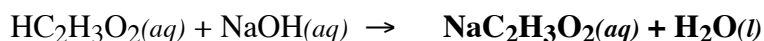
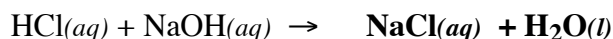
1. Define the term *salt*.

Salts are ionic compounds which are formed in a neutralization reaction between an acid and a base. Salts can be characterized from the type of acid and base which combine in the neutralization reaction. Salts can be formed from the reaction of a strong acid and a strong base, a strong acid and a weak base, a weak acid and a strong base or a weak acid and a weak base.

2. Complete the following table.

Solution	pH	Equilibrium $[H^+]$ or $[OH^-]$	Acidic, basic or neutral
0.100 M NaCl	7	$[H^+] = [OH^-] = 1 \times 10^{-7} \text{ M}$	neutral
0.100 M $\text{NaC}_2\text{H}_3\text{O}_2$	8.9	$[H^+] = 1.34 \times 10^{-9} \text{ M}$	basic
0.100 M NH_4Cl	5.1	$[OH^-] = 7.45 \times 10^{-6} \text{ M}$ $[H^+] = 7.45 \times 10^{-6} \text{ M}$ $[OH^-] = 1.34 \times 10^{-9} \text{ M}$	acidic

3. Predict the product of the neutralization reactions,



4. In general, what is the acid-base property of any salt formed in the reaction between a strong acid and a strong base?

NaCl is a neutral salt. In general, salts formed from the reaction between a strong acid and a strong base are neutral.

5. In general, what is the acid-base property of any salt formed in the reaction between a strong acid and a weak base?

NH_4Cl is an acidic salt. In general, salts formed from the reaction between a strong acid and a weak base are acidic.

6. In general, what is the acid-base property of any salt formed in the reaction between a weak acid and a strong base?

$\text{NaC}_2\text{H}_3\text{O}_2$ is a basic salt. In general, salts formed from the reaction between a weak acid and a strong base are basic.

- 7a. Write the dissociation equation which describes what happens when $\text{NaC}_2\text{H}_3\text{O}_2(s)$ is added to water.



- b. Write the equation which describes the acidic character of $\text{Na}^+(aq)$. Write the equilibrium expression and estimate K_a for $\text{Na}^+(aq)$.



$$K_a = \frac{[\text{NaOH}][\text{H}^+]}{[\text{Na}^+]} = \frac{K_w}{K_b} = \frac{1 \times 10^{-14}}{\text{very large}} = \text{very small}$$

- c. Write the equation which describes the basic character of $\text{C}_2\text{H}_3\text{O}_2^-(aq)$. Write the equilibrium expression and calculate the K_b for $\text{C}_2\text{H}_3\text{O}_2^-(aq)$.



$$K_b = \frac{[\text{HC}_2\text{H}_3\text{O}_2][\text{OH}^-]}{[\text{C}_2\text{H}_3\text{O}_2^-]} = \frac{K_w}{K_a} = \frac{1 \times 10^{-14}}{1.8 \times 10^{-5}} = 5.6 \times 10^{-10}$$

- d. Which of the two ions, $\text{Na}^+(aq)$ or $\text{C}_2\text{H}_3\text{O}_2^-(aq)$, affects the pH of the solution? Explain why.

$\text{C}_2\text{H}_3\text{O}_2^-(aq)$ will affect the pH of the solution. Of the two ions formed when $\text{NaC}_2\text{H}_3\text{O}_2$ is added to water, only the $\text{C}_2\text{H}_3\text{O}_2^-(aq)$ has an equilibrium constant which will change the pH of water. The equilibrium constant for Na^+ is so small that it does not change the pH of water.

- e. Predict the products when $\text{KCN}(s)$ is added to water. Will the pH of the solution formed when the salt is added to water be greater or less than 7?



KCN is the salt of a strong base and a weak acid. The pH of the solution will be greater than 7.

- 15a. Write the dissociation equation which describes what happens when $\text{NH}_4\text{Cl}(s)$ is added to water.



- b. Write the equation which describes the acidic character of $\text{NH}_4^+(aq)$. Write the equilibrium expression and calculate K_a for $\text{NH}_4^+(aq)$.



$$K_a = \frac{[\text{NH}_3][\text{H}^+]}{[\text{NH}_4^+]} = \frac{K_w}{K_b} = \frac{1 \times 10^{-14}}{1.8 \times 10^{-5}} = 5.6 \times 10^{-10}$$

- c. Write the equation which describes the basic character of $\text{Cl}^-(aq)$. Write the equilibrium expression and estimate K_b for $\text{Cl}^-(aq)$.

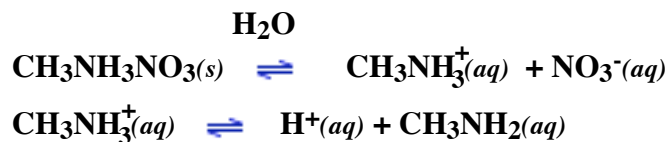


$$K_b = \frac{[\text{HCl}][\text{OH}^-]}{[\text{Cl}^-]} = \frac{K_w}{K_a} = \frac{1 \times 10^{-14}}{\text{very large}} = \text{very small}$$

- d. Which of the two ions, $\text{NH}_4^+(aq)$ or $\text{Cl}^-(aq)$, affects the pH of the solution? Explain why.

Only $\text{NH}_4^+(aq)$ will affect the pH of the solution. Of the two ions formed when NH_4Cl is added to water, only the $\text{NH}_4^+(aq)$ has an equilibrium constant which will change the pH of water. The equilibrium constant for Cl^- is so small it does not change the pH of water.

- e. Predict the products when $\text{CH}_3\text{NH}_3\text{NO}_3(s)$ is added to water. Will the pH of the solution formed when the salt is added to water be greater or less than 7?



$\text{CH}_3\text{NH}_3\text{NO}_3$ is a salt formed from a weak base (CH_3NH_2) and a strong acid (HNO_3). The resulting solution is acidic, pH less than 7.