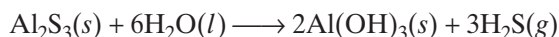


the water solvent, and the pH of the solution is lowered, indicating that the hydronium ion concentration has increased. In this case, the cations of the salt undergo hydrolysis because they are the positive ions from a weak base. The anions of the salt are the negative ions from a strong acid and do not hydrolyze appreciably. Ammonium chloride, NH_4Cl , is a salt that produces an acidic solution.

Salts of weak acids and weak bases can produce either acidic, neutral, or basic aqueous solutions, depending on the salt dissolved. This is because both ions of the dissolved salt are hydrolyzed extensively. If both ions are hydrolyzed equally, the solution remains neutral. The ions in ammonium acetate, $\text{NH}_4\text{CH}_3\text{COO}$, hydrolyze equally, producing a neutral solution, as shown in **Figure 10d** on page 608.

In cases in which both the acid and the base are very weak, the salt may undergo essentially complete decomposition to the products of hydrolysis. For example, when aluminum sulfide is placed in water, both a precipitate and a gas are formed. The reaction is symbolized by the following chemical equation.



Both products are sparingly soluble in water and are removed from solution.

SECTION REVIEW

- What is meant by an *acid ionization constant*?
- How is an acid ionization equilibrium expression written?
- What is meant by the term *buffered solution*?
- Which of the following combinations of solutions would form buffers when they are mixed?
 - 50 mL of 1.0 M HCl and 50 mL of 1.0 M NaCl
 - 25 mL of 0.5 M HNO_2 and 50 mL of 1.0 M NaNO_2
 - 25 mL of 1.0 M HNO_2 and 25 mL of 1.0 M NaCl
- What is meant by the *ion product constant* for water? What is the value of this constant?
- For each of the following reactions, identify each conjugate acid-base pair.
 - $\text{H}_2\text{CO}_3 + \text{H}_2\text{O} \rightleftharpoons \text{HCO}_3^- + \text{H}_3\text{O}^+$
 - $\text{H}_2\text{O} + \text{H}_2\text{O} \rightleftharpoons \text{H}_3\text{O}^+ + \text{OH}^-$
 - $\text{H}_2\text{S} + \text{NH}_3 \rightleftharpoons \text{HS}^- + \text{NH}_4^+$
 - $\text{H}_2\text{PO}_4^- + \text{H}_2\text{O} \rightleftharpoons \text{H}_3\text{PO}_4 + \text{OH}^-$
- What is hydrolysis? Compare cation and anion hydrolysis.
- Which of the following ions hydrolyze in aqueous solution?

a. NO_3^-	d. K^+	g. CO_3^{2-}
b. F^-	e. CH_3COO^-	h. PO_4^{3-}
c. NH_4^+	f. SO_4^{2-}	
- Identify the following solutions as acidic, basic, or neutral.

a. 0.5 M KI	c. 0.25 M NH_4NO_3
b. 0.10 M $\text{Ba}(\text{OH})_2$	d. 0.05 M K_2CO_3
- Identify the acid and base from which each of the following salts was formed.

a. K_2CrO_4	c. CaF_2
b. $\text{Ca}(\text{CH}_3\text{COO})_2$	d. $(\text{NH}_4)_2\text{SO}_4$

Critical Thinking

- RELATING IDEAS** Describe how to make a buffer solution using a strong base and one other reagent.