

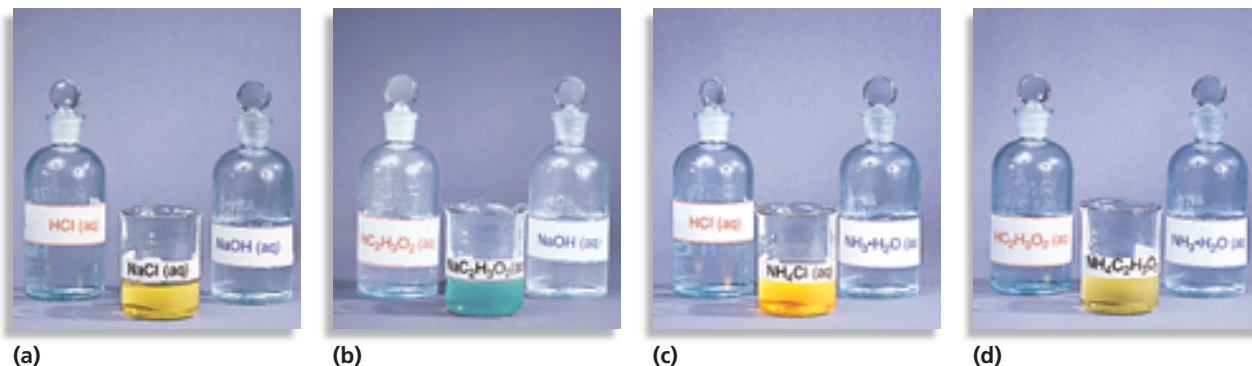
## Hydrolysis of Salts

Salts are formed during neutralization reactions between acids and bases. When a salt dissolves in water, it produces positive ions (cations) of the base from which it was formed and negative ions (anions) of the acid from which it was formed. Therefore, the solution might be expected to be neutral. The aqueous solutions of some salts, such as  $\text{NaCl}$  and  $\text{KNO}_3$ , are neutral, having a pH of 7. However, when sodium carbonate dissolves in water, the resulting solution turns red litmus paper blue, indicating a pH greater than 7. Ammonium chloride produces an aqueous solution that turns blue litmus paper red, indicating a pH less than 7. Salts formed from the combination of strong or weak acids and bases are shown in **Figure 10**.

The variation in pH values can be accounted for by examining the ions formed when each of these salts dissociates. If the ions formed are from weak acids or bases, they react chemically with the water molecules, and the pH of the solution will have a value other than 7. A reaction between water molecules and ions of a dissolved salt is **hydrolysis**. If the anions react with water, the process is anion hydrolysis and results in a more basic solution. If the cations react with water molecules, the process is cation hydrolysis and results in a more acidic solution.

### Anion Hydrolysis

In the Brønsted sense, the anion of the salt is the conjugate base of the acid from which it was formed. It is also a proton acceptor. If the acid is weak, its conjugate base (the anion) will be strong enough to remove pro-



**FIGURE 10** The universal indicator shows that the pH of salt solutions varies, depending on the strength of the acid and the base that formed the salt. (a)  $\text{NaCl}$  is formed from a strong acid and a strong base; the color of the indicator shows the pH is neutral. (b) The indicator shows the pH of the sodium acetate solution is basic. This was formed from a strong base and a weak acid. (c) The strong acid and weak base combination in ammonium chloride produces an acidic solution, as shown by the reddish tint of the indicator. (d) The weak acid and weak base that form ammonium acetate are of comparable strength. A solution of ammonium acetate is essentially neutral.