SECTION 2

Determining pH and Titrations

Objectives

- Describe how an acid-base indicator functions.
- Explain how to carry out an acid-base titration.
- Calculate the molarity of a solution from titration data.

Indicators and pH Meters

An approximate value for the pH of a solution can be obtained using acid-base indicators. **Acid-base indicators** *are compounds whose colors are sensitive to pH.* In other words, the color of an indicator changes as the pH of a solution changes.

Indicators change colors because they are either weak acids or weak bases. In solution, the equilibrium of an indicator that is a weak acid can be represented by the equation below, which is modeled in **Figure 4.**

$$\mathrm{H}In \rightleftharpoons \mathrm{H}^+ + In^-$$

(In^- is the symbol of the anion part of the indicator.) The colors that an indicator displays result from the fact that HIn and In^- are different colors.

In acidic solutions, any In^- ions that are present act as Brønsted bases and accept protons from the acid. The indicator is then present in largely nonionized form, HIn. The indicator has its acid-indicating color, as shown for litmus in **Figure 4.**

In basic solutions, the OH^- ions from the base combine with the H^+ ions produced by the indicator. The indicator molecules further ionize to offset the loss of H^+ ions. The indicator is thus present largely in the form of its anion, In^-. The solution now displays the base-indicating color, which for litmus is blue.

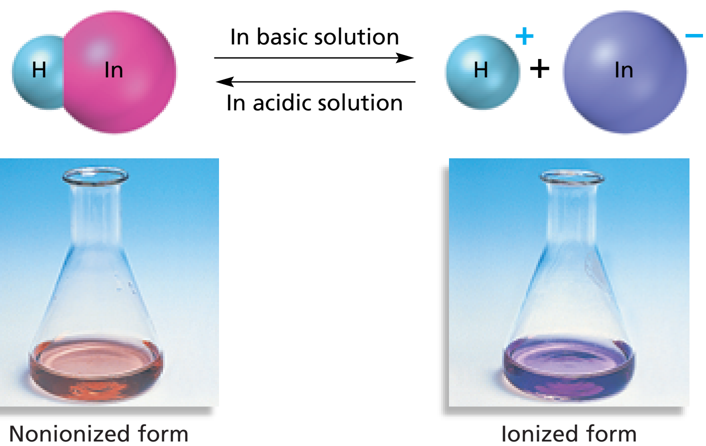

FIGURE 4 Basic solutions shift the equilibrium of litmus to the right. The ionized form, In^-, then predominates, and the litmus turns blue. Acidic solutions shift the equilibrium of the indicator litmus to the left. The nonionized form, HIn, predominates, and the litmus turns red.