

plastics, dyes, and pharmaceuticals. Initially, nitric acid solutions are colorless; however, upon standing, they gradually become yellow because of slight decomposition to brown nitrogen dioxide gas.

## Phosphoric Acid

Phosphorus, along with nitrogen and potassium, is an essential element for plants and animals. The bulk of phosphoric acid produced each year is used directly for manufacturing fertilizers and animal feed. Dilute phosphoric acid has a pleasant but sour taste and is not toxic. It is used as a flavoring agent in beverages and as a cleaning agent for dairy equipment. Phosphoric acid is also important in the manufacture of detergents and ceramics.

## Hydrochloric Acid

The stomach produces HCl to aid in digestion. Industrially, hydrochloric acid is important for “pickling” iron and steel. Pickling is the immersion of metals in acid solutions to remove surface impurities. This acid is also used in industry as a general cleaning agent, in food processing, in the activation of oil wells, in the recovery of magnesium from sea water, and in the production of other chemicals.

Concentrated solutions of hydrochloric acid, commonly referred to as *muratic acid*, can be found in hardware stores. It is used to maintain the correct acidity in swimming pools and to clean masonry.

## Acetic Acid

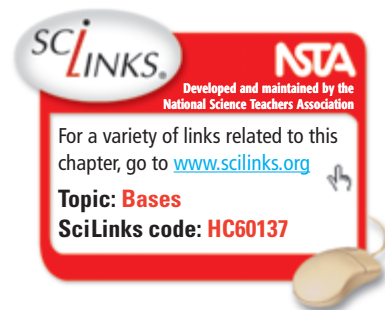
Pure acetic acid is a clear, colorless, and pungent-smelling liquid known as *glacial acetic acid*. This name is derived from the fact that pure acetic acid has a freezing point of 17°C. It can form crystals in a cold room. The fermentation of certain plants produces vinegars containing acetic acid. White vinegar contains 4% to 8% acetic acid.

Acetic acid is important industrially in synthesizing chemicals used in the manufacture of plastics. It is a raw material in the production of food supplements—for example, lysine, an essential amino acid. Acetic acid is also used as a fungicide.

## Bases

How do bases differ from acids? You can answer this question by comparing the following properties of bases with those of acids.

1. *Aqueous solutions of bases taste bitter.* You may have noticed this fact if you have ever gotten soap, a basic substance, in your mouth. As with acids, taste should NEVER be used to test a substance to see if it is a base. Many bases are caustic; they attack the skin and tissues, causing severe burns.
2. *Bases change the color of acid-base indicators.* As **Figure 5** shows, an indicator will be a different color in a basic solution than it would be in an acidic solution.



**FIGURE 5** pH paper turns blue in the presence of this solution of sodium hydroxide.