Name

What Is pH?

Sometimes scientists need to how acidic or basic a liquid is. Your blood, for example, should always be slightly basic. If it becomes too basic, however, it cannot perform its functions well. The water in a swimming pool should be kept slightly basic for maximum comfort. The pH of a waterway affects the health of the organisms in it. This lesson will give you information on how to measure the acidity or alkalinity of a liquid.

pH

The letters pH stand for the Latin words *potentia hydrogenii,* meaning concentration of hydrogen ions. Therefore, the acidity and alkalinity of a liquid is a reflection of how many hydrogen ions are in the liquid. To express the concentration of hydronium ions in a liquid, scientists use a numbered scale called the pH scale. The scale generally varies from zero to fourteen, as shown in Figure 2-1. If a liquid has a pH number below 7, the liquid is acidic. If the pH number is greater than 7, the liquid is basic. If the pH number is exactly 7, it is not acid nor basic; it is neutral.

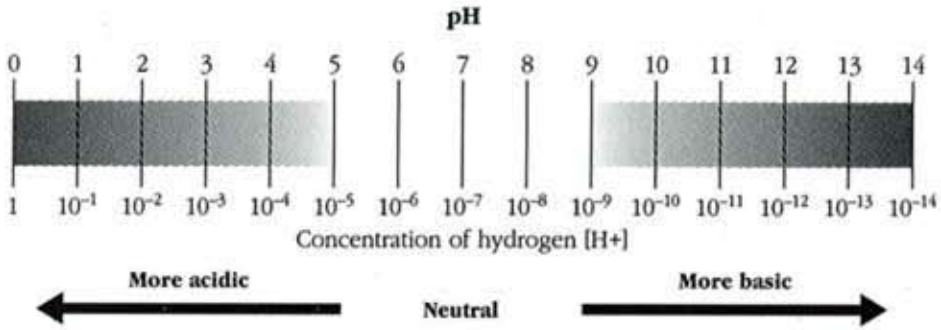

Figure 2-1: pH Scale

The lower the pH number, the more acidic is a liquid. Strong acids have a pH number of 0, 1, or 2. Stomach acid is a strong acid, because its pH number is generally between 1 and 2. Weak acids have pH numbers a little less than 7.

The higher the pH number, the more alkaline is a liquid. Strong bases have a pH number of 12, 13, or 14. Weak bases have pH numbers a little more than 7. Pure, unpolluted water should have a pH number of 7.

Acid-Base Indicators

One way to determine if a liquid is an acid or base is to use an **indicator,** a substance that can determine the presence or absence of a particular chemical. An acid-base indicator is a substance that changes color in response to the pH of the liquid it touches. A common pH indicator is litmus, which is extracted from lichens. Litmus indicator paper is manufactured by allowing strips of paper to absorb litmus. If red paper is used, then a red litmus indicator is produced. Likewise, if blue paper is used, blue litmus indicator is made. If a few drops of an acid are placed on blue litmus paper, the paper turns to a pink-red color. If an acid is placed on red litmus paper, the paper remains red. If a few drops of a base are placed on red litmus paper, the paper turns blue. If the base is placed on blue litmus paper, the paper remains blue.

Litmus paper cannot tell you the pH number of a liquid. It can only tell you if a liquid is an acid or base. However, by using both red and blue litmus paper, you can determine whether a liquid has a pH of 7 (neutral). Have each paper come in contact with the same liquid. If neither paper changes color (red litmus remains red and blue litmus remains blue), that liquid is neutral.

Many types of acid-base indicators have been developed. Some colored fruits, vegetable, and flowers can be used as indicators. Juice extracted from red cabbage, grapes, beets, or red roses turns different colors in acids or bases.

Other indicators can give you more information about the acidity or alkalinity of a liquid. Commercial pH indicator paper can give you a general pH number. Indicator paper is not exact, but it can give more information about pH than can litmus paper.

Electrical devices have been developed to find the pH of a liquid. Investigators use these devices, called pH meters, when they need more exact pH numbers. Like calculators, these meters have become small in size and easy to use.

Buffers

Sometimes maintaining a solution at a constant pH is important. For example, your blood needs to have a pH of (or very close to) 7.4. To keep the pH at this level, your blood contains a buffer. A **buffer** is a substance capable of maintaining a constant pH even when small amounts of acid or base are added to the solution.