

EXPERIMENT: pH Strips vs. pH Meter for Testing Household Products

GOAL: To determine the pH of household items and compare the accuracy of a pH strip to a pH meter.

INTRODUCTION/THEORY/QUESTIONS TO BE ADDRESSED:

An acid is a substance that frees hydrogen ions (H^+) when mixed with water. A base is a substance that frees hydroxide ions (OH^-) when mixed with water. Acids and bases react with each other to produce a salt and water (H_2O). The pH of a substance is a measure of the concentration of H^+ in solution.

$$pH = -\log[H^+]$$

When pH is low, the concentration of hydrogen ions, or $[H^+]$, is high. When pH is high, the $[H^+]$ is low. Therefore, solutions that are rich in H^+ are acidic, and solutions poor in H^+ are basic. In summary, **low pH = acidic** and **high pH = basic**. Water is neutral pH (pH 7) because it dissociates as follows: $H_2O \leftrightarrow H^+ + OH^-$. There are various ways to determine the pH of a substance. Papers embedded with indicators change colors based on the reaction of the substance with the indicator, and the resulting color indicates the acidity or basicity of the substance. A pH meter is another way of measuring pH. A pH meter includes a glass electrode that is submersed in the substance to be measured. A potential difference builds on the walls of the electrode, and the resulting voltage is related to the presence of hydrogen ions (H^+). The reading on the pH meter is pH. A pH meter requires calibration with pH standards prior to testing a substance to assure its accuracy.

PROCEDURE:

Measure the pH of various household items with the pH strips and the pH meter. Follow the pH meter standard operating procedure to take substance measurements with the meter.

Example Solutions to test:

SUBSTANCES	pH by Strip	pH by Meter
Distilled water		
Tap water		
Vinegar		
Lemon juice		
Milk		
Baking soda in water		

DISCUSSION:

Discuss the differences in the readings for each substance and the accuracy of the strips versus the pH meter. When would pH strips be sufficient for measuring the pH? When would a pH meter be required?

MATERIALS:

- pH strips
- pH meter
- Substances to test
- Beakers
- Lint-free wipes
- pH 4, pH 7, and pH 10 calibration standards