# Lesson 1: Household Acids and Bases, adapted from Vernier Science Education and the American Chemical Society

## Objective:

The objective of this investigation is for students to explore pH as a property of common household chemicals. This investigation introduces or reinforces the concept of pH as a characteristic of the strength of acids and bases, in the context of household chemicals.

## NGSS:

PS1A: Structure and Properties of Matter PSIB: Chemical Reactions

## Essential Questions:

1. What is an acid that I use in my home?
2. What is a base that I use in my home?

## Suggested materials for this hands-on laboratory activity include:

* 1 Sci-VoiceTM Talking LabQuest connected to 1 Vernier pH Sensor
* Two 250 mL labeled rinse beakers containing distilled water, one 150 mL beaker with sensor soaking solution
* Labeled 100 mL beakers with different chemicals (vinegar; various fruit juices such as lemon/lime/orange/apple; soda pop; milk; solutions made by dissolving solids such as baking soda, detergent, and baking powder).
* Cafeteria trays—labeled beakers need to be placed on more than one cafeteria-style tray to organize the workspace. The labels may be braille or large print based on the needs of the student. It is recommended that numbers are used as labels which students can reference against a braille or large-print legend during the lab activity, which relates numbers and chemicals.
* Goggles for each student
* Laboratory coat
* Chart created in the media best for the student (large print, braille, etc.)

*Note*. If you do not have access to the Sci-VoiceTM Talking LabQuest with a Vernier pH Sensor, pH paper testing strips can be used. Please note that if using the strips, you may need to have the student put the strip under a magnification device to see the results or use a peer with sight to help read the color of the strip.

## Lesson Sequence:

1. Review with students what an acid and a base is. [An acid is a chemical that gives off hydrogen ions in water and forms salts by combining with metals. It has a pH of less than 7 on the pH scale. A base can accept hydrogen ions in water and can neutralize an acid. It has pH of more than 7 on the pH scale.]
2. Review with students the meaning of pH. [The pH is the measure of how acidic or basic a substance or solution is.]
3. Now, tell students they will be testing the pH of a substance found in the home, using the Sci-VoiceTM Talking LabQuest connected to one Vernier pH Sensor. Have them follow these steps for each substance:
4. Remove the pH probe from the sensor solution.
5. Dip the probe into distilled water in the 250 mL rinse beaker.
6. Insert the head of the pH probe completely into the solution in Beaker 1 but not touching the bottom of the beaker.
7. Once the reading has stabilized, record the pH value onto a data table consisting of the beaker number, chemical name, and pH value.
8. Record the pH value into a data table consisting of the beaker number, chemical name, and pH value.
9. Rinse the probe to prevent cross-contamination before testing the next solution, by dipping and swirling the pH probe head into the 250 mL rinse beaker, soaking in sensor solution, and dipping and swirling into the next 250 mL rinse beaker to wash off the sensor solution.
10. Continue this process until all data is collected and all solutions have been tested.
11. Have a discussion with the students about what they learned (e.g., which solutions are acids, and how can you tell? Which solutions are bases and how can you tell?).

## Extension:

Students can explore the effect on pH of a common acid-base neutralization reaction used in cooking—mixing lemon juice or vinegar with baking soda (e.g., measure the pH of 100 mL of baking soda solution in a labeled 150 mL beaker; draw 5 mL of baking soda solution into a syringe notched at the 5 mL mark; measure the pH of a pre-measured volume of 25 mL of lemon juice in a labeled 150 mL beaker, add the 5mL of baking soda solution using the notched syringe, taking care not to contaminate the tip; stir briefly with a glass stirring rod and measure the pH; continue to add 5 mL of baking soda solution and record the pH after each addition and describe the trend). It is recommended that the concentration of baking soda solution for this experiment be teacher tested to ensure that students can neutralize it within a reasonable volume and timeframe.

What did you learn from this exercise?

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| **Beaker Number** | **Chemical Name** | **pH Value** |
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