

Cabbage Patch Indicator

Create an Inexpensive pH Test Solution



This activity is an experiment using “kitchen chemistry”. It is a simple procedure for making a solution, derived from red cabbage, that can indicate whether another solution is an acid or a base.

Activity Challenge

Make a pH indicator solution from red cabbage juice. The color of the indicator can reveal how acidic or basic (**alkaline**) another solution is using a number called **pH**. Measure and record the pH of different foods. Experiment with mixing acidic and basic foods.

Preparation

Note: Adult supervision required - hot liquids

Cabbage can be smelly when boiled! Wash up all utensils when done.

1. Gather the materials needed.
2. Clear a workspace in the kitchen (if possible).
3. Chop a small red cabbage into approximately 1 inch pieces or chop up several outer leaves from a large cabbage into small pieces.
4. Bring 1 to 2 quarts of water to a boil in a pot on top of a stove. Turn off the heat, then stir in the chopped cabbage. Allow to cool for about 30 minutes, or until the liquid is dark purple and at room temperature.
5. Place the storage bottle in the sink and fit the small end of the funnel securely into the bottle opening. With someone to help you, hold the strainer over the large end of the funnel and carefully pour the cabbage mixture into the bottle through the strainer to separate the leaves from the solution. Discard the leaves or eat them with your next meal. (Note: you may store the bottle of solution in the refrigerator for a few days or freeze for use later).
6. Make a data table like the one on the next page.

To Do

1. Record the color of the prepared cabbage solution.
2. Fill each of 2 cups or glasses halfway with cabbage solution.
3. Add 5 drops of distilled white vinegar (dilute **acetic acid**) to one cup and record your observations.
4. Mix 1 teaspoon of baking soda into 1 cup of water.
5. Add 5 drops of baking soda solution (sodium bicarbonate) to the 2nd half-cup of cabbage juice. Record your observations.
6. Mix some of the vinegar/cabbage juice solution with some of the baking soda/cabbage juice solution. Record your observations.
7. Optional: Use pH paper to measure the pH value for each solution.

Material Needed

- O Red cabbage, one small head
- O Knife
- O Pot (1 to 2 quarts)
- O Water
- O Large spoon
- O Strainer
- O Storage bottle (1 to 2 quarts) with lid
- O Funnel
- O Baking soda (sodium bicarbonate)
- O Vinegar (distilled white)
- O Eye dropper or equivalent
- O Cups, glasses, (plastic or glass)
- O Pen/pencil
- O Crayons/colored pencils
- O Writing paper
- O Optional: pH paper

Grade Range

3-5
6-8

Topics/Skills

Acids and Bases
Chemical Reactions
Properties of Matter

Learning Standards

NGSS: [Structure and Properties of matter](#); [Chemical Reactions](#)

Duration

60 - 80 minutes

Prep Time

45 - 55 minutes

Observations

- Record the color of the prepared cabbage solution in the data table (using crayons or colored pencils).
- Record the color of the vinegar plus cabbage juice.
- Record the color of the baking soda plus cabbage juice.
- Record the color for various mixtures of vinegar/cabbage juice mixed with baking soda/cabbage juice.
- Optional: Record the pH values of each solution using pH paper.

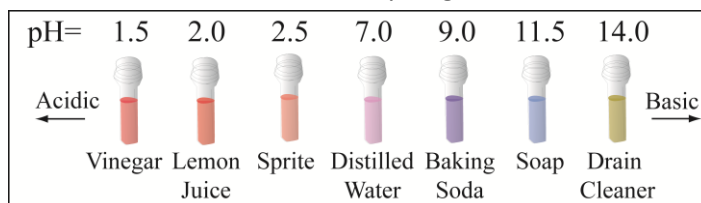
Extensions

- Test the pH of common drinks using the cabbage indicator solution, such as:
 - Variety of juices (lemon, orange, cranberry, apple, prune, etc.)
 - Carbonated beverages (soda)
 - Tea
 - Milk
 - Soap solution
- Use beet juice instead of cabbage juice as an indicator. Repeat the experiment and record the results.

DANGER: DO NOT MIX TOGETHER ANY HOUSEHOLD CLEANING PRODUCTS. HARMFUL FUMES CAN BE PRODUCED!

The Science behind the Activity

An **acid** is a substance that can release hydrogen ions (H^+) in a solution. A **base** is a substance that can accept hydrogen ions released by acids in a solution. Indicators are used to detect the relative concentrations of hydrogen ions in a solution. This concentration of hydrogen ions is usually expressed in terms of a value called **pH**, represented on a scale from 1 (strong acid) to 14 (strong base). 7 is neutral. Less than 7 is acidic, greater than 7 is basic. Vinegar is a weak acid (pH between 2 - 3). Baking soda is also called sodium bicarbonate, a weak base (pH is about 8).



Cabbage juice contains **anthocyanins**, a naturally occurring pigment responsible for the red-blue color of several grains, fruits, and vegetables. Anthocyanins have healthful properties. Anthocyanins are highly sensitive to pH and reflect red light in the presence of acids and blue light when mixed with bases. Adding vinegar to the cabbage juice results in a slight pink color. The result of adding baking soda solution to cabbage juice is usually bluish green. When vinegar reacts with baking soda, the resulting reaction neutralizes both the acid and the base to form a salt (sodium acetate). The reaction also produces carbon dioxide (CO_2) gas. The neutralization of the cabbage juice turns it back to its original purple color.

Data Table: Cabbage Indicator Investigation

Solution	Color	Optional: pH Value
Cabbage Juice		
Vinegar + Cabbage Juice		
Baking Soda + Cabbage Juice		
Vinegar/Cabbage Juice + Baking Soda/Cabbage Juice		