

Colorful Acids and Bases

Introduction

Why are some foods bitter and others sour?! Test household substances using red cabbage indicator and discover the colorful world of pH!

Think About This

What makes a substance an acid or base?

Materials

- Red Cabbage Indicator
 - 1/2 Head of red cabbage
 - Cutting Board
 - Knife
 - Blender (optional)
 - Water
 - Kettle or pot
 - Strainer
 - Container, such as a large cup, glass, or pitcher
- 7- 2 oz. clear containers, such as medicine cups, sandwich bags, tupperware
- Substances to test, such as:
 - 1 Tablespoon water
 - 1 Tablespoon clear soda
 - 1 Tablespoon baking soda and water mixture
 - 1 Tablespoon vinegar
 - 1 Tablespoon toothpaste and water mixture
 - 1 Tablespoon soap and water mixture
 - 1 Tablespoon lemon juice
- Pouring Device such as a spoon, eyedropper, straw, or pipette
- Paper
- Pencil
- Colored pencils, markers, or crayons

Do Ahead of Time

- Make the cabbage juice indicator. **Adult supervision is required.**
 - a. With adult assistance, chop the red cabbage into about 1-inch pieces. Fill the blender* half way with cabbage.
**If you do not have a blender, finely chop the red cabbage. With adult assistance, place the cabbage in a pot with 5 cups of water on medium heat and bring to a boil. Take the pot off the heat and allow mixture to cool. Strain the cabbage and collect the liquid in a container.*
 - b. Bring the water to a boil.
 - c. With adult assistance, pour the hot water into the blender and fill it about halfway to 2/3 full. Allow the mixture to sit and cool for about 10 minutes.
 - d. Blend the mixture.
 - e. Pour the contents of the blender through the strainer and collect the liquid in the 1/2 gallon container.
 - f. Allow the red cabbage indicator mixture to cool before using.

Directions

Test common household products to determine if they are an acid or a base. Red cabbage indicator is added to each substance and will show where each one lands on the pH scale. The pH scale ranges from 0-14. Substances between 0-7 are acids, while bases have a pH of 7-14. A perfect 7 is a neutral substance, which means it is not an acid or a base.

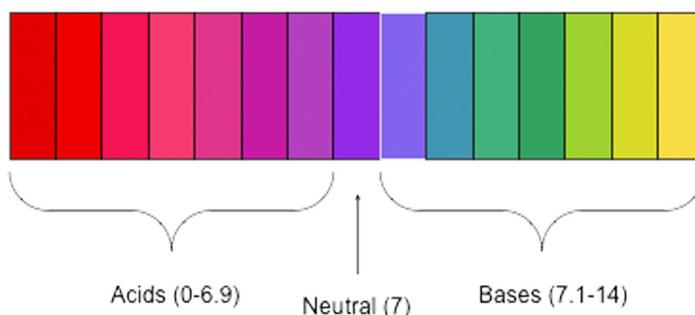
Colorful Acids and Bases Continued

Acids Characteristics

- Tastes Sour
- Reacts with metal
- Red on the pH Scale

Bases Characteristics

- Tastes bitter
- Feels slippery
- Blue, green and yellow on the pH scale



1 Place a tablespoon of each substance into its own clear 2 oz container.



2 Use a pencil and paper to create a table like the one below to record your experiment. Make four columns. Write the household item in the column on the left. In the next column, guess whether it's an acid or base. You can use colored pencils, markers, or crayons to guess the shade on the pH scale.

ITEM	ACID OR BASE	OBSERVATION	ACTUAL pH
Example: Vinegar	Example: Acid/red	Example: It turned red.	Example: Acid

3 Using a pouring device, put 1 teaspoon of red cabbage indicator into each clear container.

4 What do you notice? Write in or draw your observations in the third column.

5 Using the pH scale above, match the color of the substances to the pH scale. Write in the actual pH of each substance in the fourth column on the table.



Colorful Acids and Bases Continued

What's Happening?

Red cabbage gets its color from anthocyanin, a pigment that makes plants blue, violet, or red. Foods like eggplant, grapes, and cherries all have anthocyanin in them. The anthocyanin in red cabbage is an indicator, a chemical that changes color when it interacts with an acidic or basic substance. We can use indicators, such as red cabbage, to test substances and learn if they are acids or bases.

Acids and bases are an important part of our everyday life. The pH of foods can change a food's flavor, texture, and how long it lasts. Acids, like lemon juice, can break down fibers in food to make them more tender, and can add flavor. Bases, like baking soda, can help foods brown and develop flavor, but also react with acids in food to create bubbles.

The pH of soil can impact how plants grow, affecting how well a plant can absorb nutrients. Some plants, like potatoes and blueberries, need acidic soil to grow. Other foods, like asparagus and peas, need a higher pH soil in order to grow.

The pH of the soil can also change the color of some plants. The color of a hydrangea flower depends on the pH of the soil. Blue hydrangea grow in acidic soil while pink hydrangea grow in basic soil.



DEEP BLUE			PURPLE -PINK			DEEP PINK
4.5	5	5.5	6	6.5	6.8	7

Take it Further

Test the pH of your soil! Collect a half a cup of soil from outside Place two heaping spoonfuls of soil into two separate containers. In one container, add 1/2 cup of vinegar. If it fizzes, this indicates basic soil. In the second container, add water until it is muddy. Then add a 1/2 cup of baking soda. If it fizzes, this means the soil is acidic.

Photo reference: <https://www.espoma.com/learn-grow/gardening-projects/hydrangeas-true-blue-or-tickled-pink/>