

# How to Make Red Cabbage pH Indicator

## Acid-Base Chemistry

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### Introduction

Red cabbage contains a pigment molecule called flavin (an anthocyanin). This water-soluble pigment is also found in apple skin, plums, poppies, cornflowers, and grapes. Very acidic solutions will turn anthocyanin a red color. Neutral solutions result in a purplish color. Basic solutions appear in greenish-yellow. Therefore, it is possible to determine the pH of a solution based on the color it turns the anthocyanin pigments in red cabbage juice.

Here is a table of approximate colors of red cabbage indicator solution at different pH's. If you wish, make your own chart, using chemicals of known pH.

<b>pH</b>	2	4	6	8	10	12
<b>Color</b>	Red	Purple	Violet	Blue	Blue-Green	Greenish Yellow

### Materials

- red cabbage
- blender or knife
- boiling water
- filter paper (coffee filters work well)
- One large glass beaker or other glass container
- Six 250 mL beakers or other small glass containers
- household ammonia ( $\text{NH}_3$ )
- baking soda (sodium bicarbonate,  $\text{NaHCO}_3$ )
- washing soda (sodium carbonate,  $\text{Na}_2\text{CO}_3$ )
- lemon juice (citric acid,  $\text{C}_6\text{H}_8\text{O}_7$ )
- vinegar (acetic acid,  $\text{CH}_3\text{COOH}$ )
- cream of tartar (Potassium bitartrate,  $\text{KHC}_4\text{H}_4\text{O}_6$ )
- antacids (calcium carbonate, calcium hydroxide, magnesium hydroxide)
- seltzer water (carbonic acid,  $\text{H}_2\text{CO}_3$ )
- muriatic acid or masonry's cleaner (hydrochloric acid,  $\text{HCl}$ )
- lye (potassium hydroxide,  $\text{KOH}$  or sodium hydroxide,  $\text{NaOH}$ )

### Procedure

- Chop the cabbage into small pieces until you have about 2 cups of chopped cabbage. Place the cabbage in a large beaker or other glass container and add boiling water to cover the cabbage. Allow at least ten minutes for the color to leach out of the cabbage. (Alternatively, you can place about 2 cups of cabbage in a blender, cover it with boiling water, and blend it.)
- Filter out the plant material to obtain a red-purple-bluish colored liquid. This liquid is at about pH 7. (The exact color you get depends on the pH of the water.)
- Pour about 50 - 100 mL of your red cabbage indicator into each 250 mL beaker.
- Add various household solutions to your indicator until a color change is obtained. Use separate containers for each household solution - you don't want to mix chemicals that don't go well together!

## Notes

- This demo uses acids and bases, so please make certain to use safety goggles and gloves, particularly when handling strong acids (HCl) and strong bases (NaOH or KOH).
- Chemicals used in this demo may be safely washed down the drain with water.
- A neutralization experiment could be performed using cabbage juice indicator. First add an acidic solution such as vinegar or lemon juice until a reddish color is obtained. Then add baking soda or antacids to return the pH towards a neutral 7.
- You can make your own pH paper strips using red cabbage indicator. Take filter paper (or coffee filter) and soak it in a **concentrated** red cabbage juice solution. After a few hours, remove the paper and allow it to dry (hang it by a clothespin or string). Cut the filter into strips and use them to test the pH of various solutions.