

# DETERMINING pH WITH RED CABBAGE PAPER

## Teacher Preparation Information

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### Materials needed

Red cabbage paper (see procedure for preparing red cabbage paper)  
Red cabbage  
Ethyl alcohol, either ethyl rubbing alcohol (70% ethyl alcohol) or a 50% solution of ethyl alcohol in water  
Knife to cut red cabbage  
Filter paper circles (use laboratory filter paper, coffee filters, etc.)  
2 Pots or large beakers  
Blender  
Cheesecloth  
Large funnel or strainer  
Hot plate or burner  
Buffer solutions. Note: pH values of 1, 2, 4, 6, 7, 8, 10, 12, and 14 are recommended. (These can be purchased as solutions or prepared from buffer capsules. Buffer capsules have long shelf lives. Each buffer capsule makes 100 mL of solution. These are available from laboratory supply companies such as Flinn Scientific.)  
Stirring rods (plastic coffee stirrers work well for this)  
Small beakers or 3 oz plastic cups  
Permanent black marker  
Household materials such as soap, laundry detergent, shampoo, baking soda, vinegar, lemon juice, vitamin C tablets, toothpaste, soda, etc.

### Procedure

#### 1. Make red cabbage paper

Place pieces of red cabbage in a blender with ethyl rubbing alcohol (70% ethyl alcohol in water) or a 50% mixture of denatured alcohol with water. **DO NOT FILL BLENDER JAR MORE THAN 1/3 FULL.** Blend until smooth. Strain the liquid through several layers of cheesecloth.

**Safety Note:** Ethyl alcohol is flammable. Keep it away from flames. Do not fill the blender more than one-third full to avoid splashing any alcohol from the blender. Sparks from the blender motor can ignite any spilled or splashed alcohol.

Obtain filter paper circles or coffee filter circles. Dip in the red cabbage juice. Lay out in a single layer on clean table tops, or tables covered with clean plastic, to dry. Store in a Ziploc type bag in a cool dark place. The red cabbage paper will keep for 6 months or longer with no odor or spoilage.

### Alternative Procedure

If the alcohol is not available, place pieces of red cabbage in a blender with some water. Blend to produce a thick slurry. Pour the red cabbage mixture into a large pot or beaker and heat to boiling. (This kills most of the bacteria that causes the red cabbage to spoil.)

Strain the mixture through cheesecloth into a clean container. Discard the solids. Allow the liquid to cool.

Soak filter paper circles in the red cabbage liquid. Place the filter paper circles in a single layer on a clean table top and allow them to dry completely. This will take several hours or they can be left overnight.

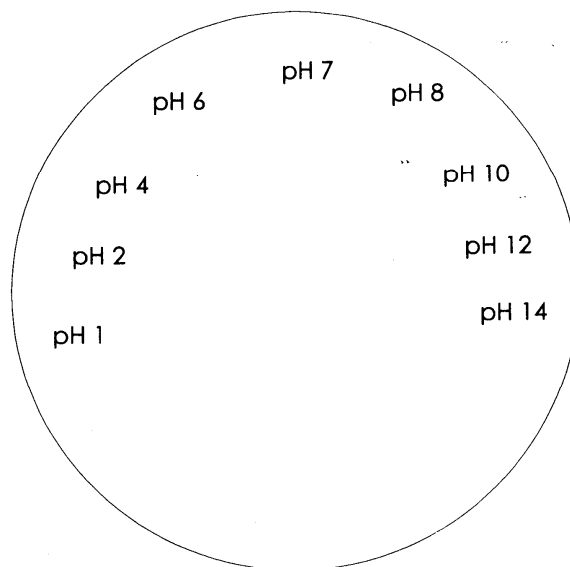
Place the dried red cabbage paper in a plastic bag. Store in a cool place, away from bright light. The paper keeps for at least 6 months.

### 2. Set up the acid and base solutions

Use the black permanent marker to label each plastic cup with the solution it will contain. For pH solutions, write "pH 1", "pH 2", etc. For household materials write the name of the product.

Place about 5 mL of each solution in the proper labeled cup. Add a stirring rod to each cup.

For the household materials, make solutions of solids or thick gels or pastes. Place some of the material in a labeled plastic cup, add about 10 mL of water and stir to mix.



**Figure 1.** A labeled piece of red cabbage paper.

### 3. Prepare a color chart of pH colors

Demonstrate this to the students:

Obtain a piece of red cabbage paper

Note the pH solutions and buffers that are available for the experiment. Using a pencil or pen, label the red cabbage paper with the pH values of the available buffer solutions as shown in Figure 1.

Using stirring rods, placed in the individual pH and buffer solutions, put a small drop of each solution on the red cabbage paper next to the pH value. (For example, put a drop of pH 1 buffer next to the pH 1 label on the paper.)

Have the students tell the results they observe after placing the spots of the solutions on the red cabbage paper

#### 4. Test household materials

Use the solutions of common household materials, available in the laboratory.

Use the stirring rods from each solution to place a drop on an open space in the center area of the red cabbage paper. Label each spot with the identity of the household material used.

The students are provided a chart to record the pH of each of the solutions.

Can the students determine any patterns of pH values with certain types of household products?

#### 5. Taste an acid / Taste a base

**Safety Precautions:** This activity must be performed in a clean, contamination free area, away from laboratory chemicals. All materials used must be food grade or better and should be newly purchased. If stored, they must be stored away from any possible source or contamination, preferably at home.

##### Materials needed

2 pitchers (plastic preferred). One pitcher should be labeled "ACID" and one pitcher labeled "BASE"  
sour salt (citric acid) Available in supermarkets  
baking soda (sodium bicarbonate)  
water  
3 ounce drinking cups  
stirring rods – large wood or plastic kitchen spoons

##### Procedure

Prepare an acid solution. Fill the ACID pitcher with drinking water. Add sour salt (citric acid), small amounts at a time, stirring and tasting until a suitable sour tasting solution is obtained. Cover the pitcher until ready to use.

Prepare a base solution. Fill the BASE pitcher with drinking water. Add baking soda (sodium bicarbonate), small amounts at a time, stirring and tasting until a suitable bitter tasting solution is obtained. Cover the pitcher until ready to use.

Pour about 5 to 10 mL of acid and base solutions into separate paper cups. Each student should receive one of each solution.

Instruct the students to SIP a SMALL AMOUNT of the ACID solution. Ask them to describe the taste. If necessary, students may take a second taste of the solution. They should NOT drink all the solution.

Instruct the students to SIP a SMALL AMOUNT of the BASE solution. Ask them to describe the taste. If necessary, students may take a second taste of the solution. They should NOT drink all the solution.

Discard any remaining solutions and the paper cups.

These are photos of typical student results:

