

# THE AMERICAN CHEMICAL SOCIETY CLEVELAND SECTION

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As part of the 2020 National Chemistry Week celebration, ask students in grades 2 through 6 to investigate:



## Cabbage Chemistry in Your Home

Some household items can be described as either acids or bases. Scientists can tell if a substance is acidic, basic or neutral (not acidic and not basic) by using an indicator. Make **red cabbage indicator paper** and use it to test whether various substances in your home are acidic, basic or neutral.

Follow the instructions below and answer the questions.

### Materials:

- Small clear plastic disposable cups
- 2 large plates or shallow containers
- Small saucepan with cover
- Strainer
- Mixing bowl
- Red cabbage (1/2 head)\*
- Tap water
- 3 white index cards (not lined)
- Measuring spoons and cups
- Plastic stirrers
- 3 small saucers
- Paper towels

### Small quantities of the following test samples:

- Liquid dishwashing detergent
- Liquid laundry detergent
- Powder cleaner with bleach (e.g., Comet)
- 2 different fruit juices (orange, cranberry, apple, etc.)
- Soda (e.g., Pepsi or Sprite)
- Vinegar
- Baking soda
- Milk
- Shampoo
- Conditioner
- Body lotion
- Toothpaste

## Instructions

1. With an **adult helper**, make **red cabbage juice** by doing the following:
  - a. Peel off six big cabbage leaves and tear into small pieces.
  - b. Add the cabbage pieces to the saucepan and add tap water to cover the pieces.
  - c. Cover the saucepan and heat on a stove (on high) until the water boils.
  - d. Lower the heat on the stove (to medium low) and continue to boil the water for 30 minutes.
  - e. Turn off the heat and allow the saucepan to cool.
  - f. Pour the contents of the saucepan into the strainer placed over the mixing bowl and collect the cabbage juice.
  - g. Discard the cabbage pieces in the strainer.
2. Make **red cabbage indicator paper** by doing the following:
  - a. Pour cabbage juice into the large plate or shallow container to cover just the entire surface.
  - b. Place three index cards on the cabbage juice and push them under the liquid so the cards are completely soaked in the juice. Do not allow the cards to overlap. Turn the cards over a few times to wet both sides completely.
  - c. Leave the cards in the juice for 15 minutes.
  - d. Turn the cards over and leave for another 15 minutes.
  - e. Remove the cards from the juice (after 30 minutes of soaking), allow excess juice to drip back to the plate and place the cards on the second, clean plate.
  - f. Leave the index cards on the plate until they are completely dry; this will usually take at least one hour.
  - g. Cut the three index cards (when they are completely dry) across the width into eight strips. The strips are the **red cabbage indicator paper**, and you will have 24 strips.
3. Make a table (on a sheet of paper) similar to the one below and list your test samples in the **Sample** column.

Sample	Indicator Paper Color	Result
Liquid dishwashing detergent		
Liquid laundry detergent		

4. Place a small amount of one test sample in the small saucer. Add a few drops of water if the material is a powder; e.g., baking soda.
5. Dip the end of one strip of your indicator paper into the material and turn it around to make sure that both sides are well covered.

- After about 10 seconds, take the strip out of the material, gently blot excess material using a clean paper towel, place the strip on another saucer, leave for a few minutes and then observe the color of the wet part of the strip.
- The red cabbage indicator paper will change color depending on whether the material is acidic, basic or neutral. The indicator changes color in the following order as the material changes from very acidic through neutral to very basic.

<b>Pink / Red</b>	<b>Purple</b>	<b>Violet</b>	<b>Blue</b>	<b>Blue-Green</b>	<b>Greenish-Yellow</b>
<b>Acidic</b>	<b>Slightly acidic</b>	<b>Neutral</b>	<b>Slightly basic</b>	<b>Basic</b>	<b>Highly basic</b>

(Purple is more reddish in color than violet)

- Observe the end of the indicator strip (the part that was dipped in the material) and record the color in the **Indicator Paper Color** column of your table.
- Use the indicator color order to describe whether your material is acidic, neutral or basic in the **Result** column of your table. (For example, acidic for pink and slightly acidic for purple)
- Repeat steps 4 – 9 for the rest of your test samples (one by one). Do not allow the test strips to touch one another while they are drying.

#### **Questions:**

- Which sample was most acidic?
- Which sample was most basic?
- Which samples were close to neutral?
- Based on your results, would you expect most food to be acidic or basic?
- Based on your results, would you expect most cleaning products to be acidic or basic?
- Based on your results, would you expect most personal care products (e.g., toothpaste) to be acidic or basic?
- What would happen if you were to add a few drops of vinegar to a tablespoon of milk? Try it out and test the mixture with a clean indicator strip and describe your result.
- What would happen if you were to add a pinch of baking soda to a tablespoon of milk? Try it out and test the mixture with a clean indicator strip and describe your result.

**\*Teacher hint:** If this activity is being done in a classroom setting, one head of red cabbage should provide sufficient indicator for one class.