

# Activity 5.7

## Color changes with acids and bases

### How can you tell if a substance is an acid, a base, or neutral?

In *Activities 5.1* and *5.2*, students saw that the color changes of red cabbage indicator can be used to help distinguish similar-looking powders. Students used this evidence to conclude that the powders were chemically different. In this activity, students will use the color changes of red cabbage indicator to classify substances as either acid or base. This knowledge will then be built upon in *Activity 5.8* as students neutralize acid and base solutions and in *Activity 5.9* as students compare the amount of acid in different solutions.

### Materials needed for each group

Red cabbage leaves	Zip-closing plastic bag,	1 Dropper
Cream of tartar	storage-grade, quart-size	1 Tablespoon
Vinegar	5 Clear plastic cups	Permanent marker
Powdered laundry detergent	3 Small cups	White piece of paper
Water	2 Flat toothpicks	

### Notes about the materials

- Be sure you and the students wear properly fitting goggles.
- Use fresh red cabbage; pre-shredded red cabbage will not work. Students will also make red cabbage indicator solution in *Activities 5.8* and *5.9*. Refrigerate the cabbage so that it will stay fresh.
- If you choose to do *Activity 5.8—Neutralizing acids and bases* immediately following this activity, do not discard any of the liquids. These will be reused in *Activity 5.8*. If you plan to do *Activity 5.8* on another day, students should make fresh solutions.

### Preparing materials

- Label 3 small cups **vinegar**, **detergent**, and **cream of tartar** for each group.
- Place about 1 teaspoon of vinegar in its labeled cup.
- Place about  $\frac{1}{4}$  teaspoon of detergent and  $\frac{1}{4}$  teaspoon of cream of tartar in their labeled cups.

### Activity sheet



Copy *Activity sheet 5.7—Color changes with acids and bases*, p. 288, and distribute one per student when specified in the activity.

### Assessment

An assessment rubric for evaluating student progress during this activity is on pp. 305–307. For this formative assessment, check a box beside each aspect of the activity to indicate the level of student progress. Evaluate overall progress for the activity by circling either “Good”, “Satisfactory”, or “Needs Improvement”.

# Activity 5.7

## Color changes with acids and bases

### Question to investigate

## How can you tell if a substance is an acid, a base, or neutral?

### 1. Introduce this activity.

Remind students about the demonstration you conducted during *Activity 5.1*, p. 256, with red cabbage indicator solution and two similar-looking powders—cream of tartar and laundry detergent. Tell students that in this activity, they will make their own indicator solution and experiment with these powders. Tell students that red cabbage indicator changes color when certain chemicals are added to it. It turns pinkish when *acids* are mixed with it. It turns green when *bases* are mixed with it. And it remains blue when *neutral* substances are mixed with it. A neutral substance is neither an acid nor a base.



Distribute *Activity sheet 5.7—Color changes with acids and bases*.

### 2. Have students prepare for the activity.

#### *Procedure*

#### Make red cabbage indicator solution

1. Tear 2 red cabbage leaves into small pieces and place them in a storage grade zip-closing plastic bag.
2. Add about 1 cup of room temperature water. Get as much air out of the bag as possible and seal the bag securely.
3. While holding the bag, repeatedly squeeze the water and cabbage leaves until the water turns a medium to dark blue. This is your indicator solution.
4. Open a corner of the bag and carefully pour the red cabbage indicator into an empty clear plastic cup, leaving the cabbage pieces behind in the bag.



#### Prepare the cups

5. Label four empty clear plastic cups **indicator + detergent**, **indicator + cream of tartar**, **indicator + vinegar**, and **control**.
6. Carefully pour 2 tablespoons of indicator solution into each cup.
7. Place the four labeled cups on a white piece of paper.

### 3. Have students add acids and a base to the indicator.

#### Procedure

##### Cream of tartar

1. Use the flat end of a toothpick to scoop up a small amount of cream of tartar. Add the cream of tartar to the *indicator + cream of tartar* cup.
2. Gently swirl to mix. Observe any color change in the cup and record this in the chart on the activity sheet.



##### Laundry detergent

3. Use the flat end of a toothpick to scoop up a small amount of laundry detergent. Add the detergent to the *indicator + detergent* cup.
4. Gently swirl to mix. Observe any color change in the cup and record this in the chart.

##### Vinegar

5. Use a dropper to add 1 drop of vinegar to the *indicator + vinegar* cup.
6. Gently swirl to mix. Observe any color change in the cup and record this in the chart.

**Expected results:** Cream of tartar and vinegar turn the indicator a pinkish color. Laundry detergent turns the indicator a greenish-blue color.

### 4. Discuss student observations.

Remind students that red cabbage indicator turns pink when acids are added to it and greenish-blue when bases are added to it. Ask students which substances they tested are acids and which are bases. They should conclude that vinegar and cream of tartar are both acids and that laundry detergent is a base.

Remind students that in *Activity 5.3—Exploring baking powder*, the combination of baking soda and cream of tartar was the only pair that bubbled when water was added. That is because cream of tartar, like vinegar, is an acid and will react with baking soda to produce carbon dioxide gas.

**Note:** If you choose to do *Activity 5.8—Neutralizing acids and bases* immediately following this activity, do not discard any of the liquids. These will be reused in *Activity 5.8*. If you plan to do *Activity 5.8* on another day, students should make fresh solutions.