

# BLUEBERRY AND CABBAGE MAGIC STEM TO-GO

## DRIVING QUESTION: HOW DO ACIDS AND BASES AFFECT ME?

### Penny Cleaners



Acids and bases can be useful. Two common cleaners are vinegar and dish soap mixed with water. For this experiment, you need

- Three pennies that are very dirty and tarnished
- Three small dishes
- Vinegar
- Soapy water
- Plain water

<http://themoneyifound.blogspot.com/2006/01/dirty-penny.html>

Which do you think will clean the pennies better? Water, vinegar or soapy water?

- Water is a neutral solution. Most things dissolve or break down in water.
- Vinegar is an acid. It is used to clean and preserve food.
- Soapy water is a base. It is used to clean many things including dishes, laundry and people.

Based on what you know and what you think, write a **hypothesis**. Remember, a hypothesis doesn't have to be correct. We just have to be able to prove that a hypothesis either correct or incorrect.

**Hypothesis:** We think \_\_\_\_\_ will clean the pennies the best because \_\_\_\_\_.

- In an experiment, the **control** is what you keep the same to compare other things against. In this experiment, the plain water is the control.
- We are going to change or test **independent variables**. In this experiment are evaluating vinegar and soapy water. They are both independent variables.
- The **dependent** variable is the outcome, or the result of what you test. The cleanliness of the pennies is our dependent variable.

### Procedure:

1. Place one penny in each of the containers. In one container, cover the penny with water. In the second container, cover the penny with vinegar. In the third container, cover the penny with soapy water.
2. Wait ten minutes.

**Data Analysis:** Which penny is cleanest now? \_\_\_\_\_

**Think about it:** Sometimes what we think is "dirt" is actually something else. Pennies contain copper and zinc which oxidize like rust on the penny. Which type of cleaning supply would take off the rust better, an acid or a base?

## Acid Rain Capture

Normally, the gases in the atmosphere combine with water in rain to be slightly acidic. But air pollution is making our rain an even stronger acid, nearly as strong of an acid as vinegar. This “acid rain” causes damage to plants, to wildlife, to water, and even to statues and buildings. The following experiment was adapted from:

<https://www.youtube.com/watch?v=s9kAiph27aI>



Let's model how acidity can impact plant life. For this experiment, you need

- three little jars with lids
- three little green leaves off the same tree, and
- rain water
- water from your sink, and
- vinegar
- masking tape and a pen to label the jars.

Image from Tina Manley

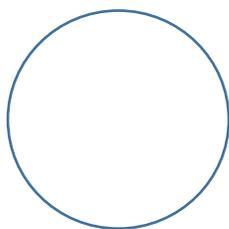
[https://pubs.acs.org/cen/\\_img/88/i23/8823sci4deadtrees250.jpg](https://pubs.acs.org/cen/_img/88/i23/8823sci4deadtrees250.jpg)

### Procedure:

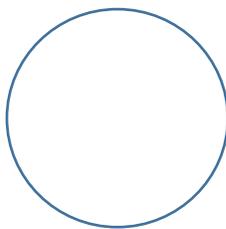
1. During the next rainy day, place a leaf in a jar with the lid off. Let the rain cover the leaf. Close the lid. Label it “rain water.”
2. Place approximately the same amount of tap water from the sink in another jar. Place a leaf in the jar and close the lid. Label it “tap water.”
3. Place the same amount of vinegar in the final jar. Place a leaf in the jar and close the lid. Label it “vinegar.”
4. Move all three jars into the same location. Wait at least 24 hours and check the jars.
5. Compare what you see.

### Data analysis:

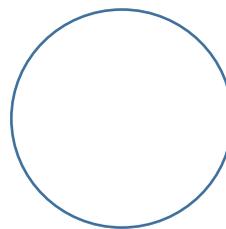
Do all of the leaves look the same? Draw a picture to compare and contrast the samples.



Tap Water



Rain Water



Vinegar

**Think about it:** Some areas, Mount Mitchell in North Carolina, have trees damaged by acid rain. Yet, there are very few people, few factories, and very little traffic near that mountain and its forest.

1. How can air pollution become a problem for wild places far away from cities and factories?
2. What can people do to reduce air pollution?