

Measuring the pH of Rainwater

from **Celebrating Chemistry**



In this experiment, you will find out what it is like to work for the United States' National Atmospheric Deposition Program (NADP). Each year, chemists at NADP test over 10,000 samples of precipitation (water that falls from the sky, such as rain or snow) to check for air and water pollution. In this experiment, you will collect rainwater and use a test strip to measure its pH. The test strip has a color pad with a chemical indicator. The indicator changes color when it touches an acid or a base. The color of the pad can be compared to a color chart to find out the pH value of your sample. The scale starts at 0, which is very acidic, and it goes to 14, which is very basic. A value of 7 is at the middle of the scale and it is not acidic or basic. It is neutral. After completing the experiment, you will be asked to enter your results in NADP's web-based system to compare your values with the results of other NADP scientists.

Materials

1 pound coffee or juice can (minimum 40 oz), or a 1 liter soda bottle
Tap water
Soap
Liquid dish detergent
Paper towel
Small rocks or gravel
1-quart zip-closing freezer bag*
Permanent marker or pen
Masking tape
Large rubber band
Aluminum foil or plastic wrap
Sheet of graph paper
Rainwater
pH test strips (pH range 0 to 14)[†]
pH test strip color chart
Watch or timer



Be sure to follow Milli's Safety Tips and do this activity only with adult supervision! Do not drink any of the liquid samples used in this activity.

Procedure

Select a Day to Conduct the Experiment

1. Watch or listen to the local weather to find out when rain is forecasted for your area.
2. When rain (or other precipitation) is in the forecast for your area, follow the steps below to collect and then measure the pH of your rainwater.

Prepare Your Rain Collector

1. Ask your adult partner to cut the top off of a large can or soda bottle to serve as the rain collector.
2. Wash your hands first; then wash the rain collector with liquid dish detergent and tap water. Rinse the rain collector and dry it with a paper towel.
3. Place some small rocks or gravel in the bottom of the rain collector so the rain collector cannot be easily pushed or blown over when it is placed outside.
4. Use masking tape and a pen to label a new clean 1-quart zip-closing freezer bag with your initials, city, state, zip code, and the date. Also record this information in the "What Did You Observe?" section.

5. Touching only the outside and very top of the zip-closing bag, open the bag and fold it back to form a "collar". The collar should be about 2½ cm (1 inch) wide and will hold the bag to the edge of the rain collector and keep it from sliding down inside.
6. Carefully place the bag into the container and slide the collar you just made over the outside of the container.



* Ziploc® brand bags have been tested by NADP scientists and were found to be acceptable. Other bags can be substituted but may contain substances that will change the pH.

[†] This activity was conducted using pH strips made by Industrial Test Systems, Inc. 800-861-9712, <http://www.sensafe.com/index1.php> Catalog #480104, but others should also work.

These statements do not imply endorsement by the American Chemical Society of Industrial Test Systems, Inc. or Ziploc® brand.



- Use a large rubber band to hold the bag in place. Have your adult partner help you put the rubber band on from the bottom of the container to avoid touching inside the bag.
- The collector is now ready to be placed outside. Cover it with some aluminum foil or plastic wrap to keep it clean while you are moving it.

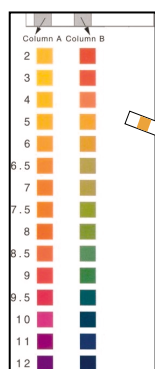
Collect Your Sample

- Place the collector outside, 3 or 4 meters (about 10 feet) away from anything around it. If it is too close to buildings, trees, or other structures they could affect the amount of rain/precipitation collected. If too close to other structures, something extra could fall into the sample and cause a problem with your results.
- Draw a map on a sheet of graph paper showing where you placed the container. Include nearby buildings and trees on your map.
- After you have collected a rain sample, carefully slide the zip-closing bag out of the container and zip it closed. Bring the sample inside, and if it is cold outside, wait about an hour for it to warm up to room temperature before going on to the next section.

Measure the pH

- When your sample is at room temperature, re-open the zip-closing bag.
- Open the pH test strip at the end labeled "OPEN".

- Without spilling the sample, place the test strip in the water collected so that the end with the colored test pads is completely in the sample.
- Slowly move the test strip with a back and forth motion for 10 seconds.
- Remove the test strip from the sample, shake off excess water and lay it flat on the table with the colored pads facing up for 20 seconds to allow the color to develop.
- Compare the color of your pH test strip with the color chart. Match up the pad on the left with the color most like it in the column on the left, and the pad on the right with the color it is most like in the column on the right. Record the pH value (the number on the chart) for the colors closest to your test strip in the "What Did You Observe?" section.
- Thoroughly clean your work area. Pour the rest of your rainwater sample down the drain. Throw away any other trash. Be sure to wash your hands.

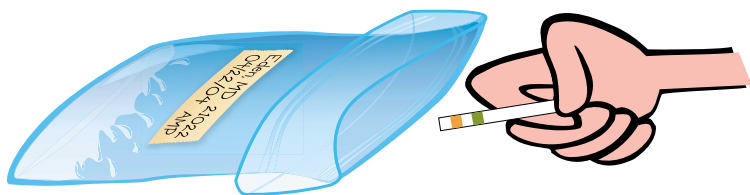


Report Your pH value

- With your adult partner, log onto <http://nadp.sws.uiuc.edu/earthday> and follow the "Enter Test Results" link on the Acid Rain Experiment home page.
- Follow the screen prompts to enter your results and to compare with the NADP data for your area.

Where's the Chemistry?

When it rains, the rainwater can "wash" chemicals out of the air as it falls. If the air has chemicals from factories and car and truck exhaust mixed in, the rainwater becomes acidic. We measure how acidic or basic something is using the pH scale. Rainwater is usually slightly acidic, with a pH value of 5.5. When pH values are less than 5, it is called "acid rain". You used the pH scale to measure the pH of the precipitation in your area. The pH that you measured may or may not have matched the data collected by the NADP scientists. If it was different, it could be that something fell into the bag that changed the pH. Dust and soil will result in higher pH values than expected. If the rain in your area is acid rain, it means there was a great deal of pollution in the air. One way you can help to reduce acid rain is by walking, biking, or taking public transportation.



What did you observe?

Rainwater Collection Information:

Your initials: _____

City _____

State _____

Zip Code _____

Date _____

pH Value of Sample Collected:

Is your sample acidic, basic or neutral? _____

