

PRELIMINARY ACTIVITY FOR Soil and Acid Precipitation

Acid precipitation can be very harmful to the environment. It can kill fish by lowering the pH of lakes and rivers. It can harm trees and plants by burning their leaves and depriving them of nutrients. In addition, it can weather away stone buildings and monuments.

Carbon dioxide, CO_2 , is a gas found naturally in the air. When CO_2 dissolves into water, it produces a weak acid called carbonic acid, H_2CO_3 . This makes precipitation slightly acidic naturally. Precipitation of pH 5 to 6 is common and does not generally cause any problems. Oxides of sulfur and nitrogen released into the air by fossil fuel burning power plants, various industries, and automobiles dissolve into atmospheric water to form acids such as H_2SO_3 (sulfurous acid), H_2SO_4 (sulfuric acid), HNO_2 (nitrous acid), and HNO_3 (nitric acid). The resulting precipitation can be as acidic as pH 4, precipitation with a pH below 5.6 is generally considered to be “acid precipitation.” Figure 1 shows precipitation pH in the United States in a typical year. Notice that the most acidic precipitation occurs over and downwind of heavily populated and industrialized areas.

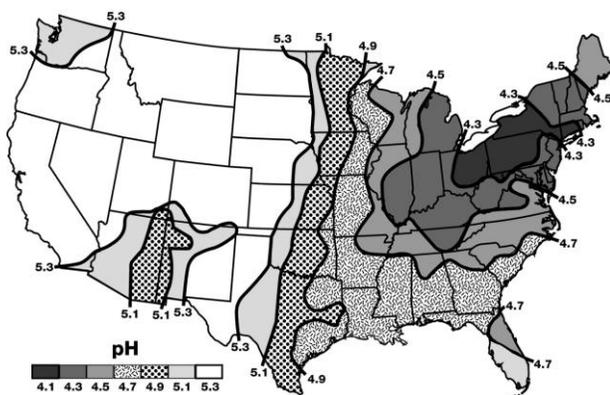


Figure 1

Acid precipitation is not problematic in all locations. Some soils contain substances that will help neutralize acid precipitation. These substances, called *buffers*, are commonly composed of limestone, calcium carbonate, or calcium bicarbonate. The buffers help stabilize soil pH and, because they dissolve into water runoff, they help stabilize the pH values of surrounding lake, stream, and pond waters as well.

In the Preliminary Activity, you will use a pH Sensor to measure the pH of acid rainwater. You will then filter the acid rainwater through soil, collect the resulting filtrate, and measure the filtrate pH as you determine the soil's influence on acid rainwater pH.

Experiment 12

After completing the Preliminary Activity, you will first use reference sources to find out more about acid precipitation, soil pH, and soil buffering capacity before you choose and investigate a researchable question. Some topics to consider in your reference search are:

- acid precipitation (acid deposition)
- soil pH
- buffers
- soil buffering capacity

PROCEDURE

1. Connect the pH Sensor and the data-collection interface.
2. Thoroughly rinse the pH Sensor with distilled water.
3. Obtain 100 mL of acid rainwater in a beaker.
4. Measure the pH of the acid rainwater.
 - a. Place the tip of the pH Sensor into the acid rainwater. Make sure the glass bulb at the tip of the sensor is covered by the water. Stir gently.
 - b. Note and record the pH value when the reading stabilizes.
5. Prepare the soil.
 - a. Set the funnel (top half of milk jug) on top of the beaker as shown in Figure 2.
 - b. Place a coffee filter in the funnel.
 - c. Add 50 g of soil to the filter. Make sure the soil is covering the bottom of the filter but do not pack it down.
6. Slowly pour the 100 mL of acid rainwater you just tested over the soil in the filter.
7. When the rainwater has filtered into the beaker, measure and record the pH of the filtrate.

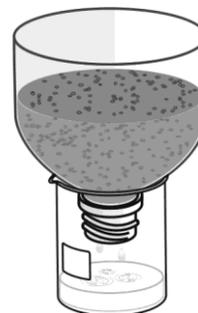


Figure 2

QUESTIONS

1. What was the pH of the acid rainwater before it was filtered through soil in the Preliminary Activity? What was its pH after filtering?
2. Calculate the pH change.
3. List three or more factors that affect the ability of soil to buffer acid precipitation.
4. List at least one researchable question for this experiment.