Water Quality Monitoring

by Charlotte L. Naples

Introduction:

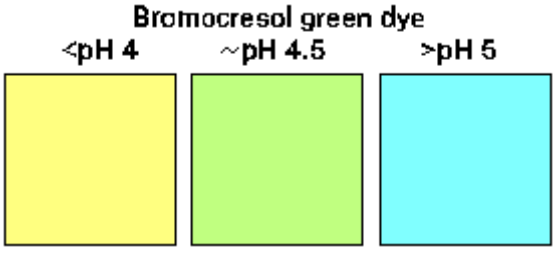
This lab is designed to study the water quality of a stream in your area, by measuring the temperature, pH, alkalinity and conductivity. It lends itself to integrating biology with earth science when using the microscope to study the living organisms in the water.

Objectives:

1. To determine the water quality of a local fresh water stream, as surface waters may be adversely impacted by human activity.
2. Measure the pH and temperature of the water.
3. To measure the alkalinity of the stream water to determine the amount of bicarbonate neutralizing power.
4. To measure the total dissolved solids in the water.
5. To monitor any living species using the microscope.

Materials:

1. pH meter, test kit, or pH paper. Small hand-held pH meters cost ~$50 each. A pH meter will also require 2 calibration solutions so it can be calibrated once in awhile.
2. Thermometer.
3. Dilute sulfuric acid solution (about 1%) in a dropper bottle or with a medicine dropper.
4. pH indicator dye that changes color at pH 4 or 4.5. One common one is Bromocresol green, 0.04% solution, available from chemical supply houses or a chemistry buddy. This dye turns from blue at high pH to green at the end point to yellow at low pH. The color change may not be easy to see for some "color blind" people. This is a titration. If you are unsure of what is going on in this test, have your chemistry buddy explain.



1. 100 ml graduated cyclinder,250 ml beaker, plastic spoon, white surface/paper.
2. Total dissolved solids (conductivity) tester, measures conductivity. Small hand-held TDS/conductivity meters cost ~$50 each. A pH meter will also require 2 calibration solutions so it can be calibrated once in awhile.
3. Container with a cap to collect a water sample. You might want to collect one sample of just water and another that contains some bottom sediment and algae.
4. Microscopes. These may be stereo (dissecting) and/or a biological microscopes.

Procedures:

1. If you are monitoring a small stream, monitor water at least three days after the last heavy rainfall. Heavy runoff from rain can result in anomalous measurements that cannot be compared with measurements taken later.
2. Calibrate all instruments according to the manufacturer directions.
3. Rinse all instruments and containers in the water to be tested.
4. Test and record the pH.
5. Measure and record temperature.
6. Measure and record conductivity.
7. Measure the alkalinity. First fill the graduated cylinder with 100 ml of stream water. Pour the water into the beaker and put the beaker on a white surface (such as white paper). Add 5 drops of the indicator dye, then have one person slowly add drops of dilute sulfuric acid while another person stirs with the spoon.. Count the number of drops. When the indicator dye changes to the end point color, stop adding drops and record number of drops you added. It is usually a good idea to bring three extra beakers so you can show the students the dye color before and after the end point is reached, and at the end point. Alkalinity, as parts per million bicarbonate, is calculated as follows:

   (1 / (% sulfuric acid)) x (number of drops) x 3.8 = ppm alkalinity, as bicarbonate (HCO_3^-)

8. Label the container(s). Collect the sample(s) in a clean area, away from your hand.
9. Use the microscope to view any living organisms in the water. This is good for integrating biology with Earth Science.

Web links:

- U.S. Geological Survey water data page
- Union College Geology Department data page (see the water chemistry table)
- Water and other testing kits.

Science labs web page
Pedagogy web page

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