

Chapter 5. The Idea of pH

Lesson 3. Acid rain and deposition are a result of industrial smoke, coal combustion and car exhaust.

Overview: Contaminants that influence the quality and usefulness of water can be chemical, physical, or biological. Many household and industrial items washed down the sink contaminate our water supply and reduce water quality. Pollutants like car exhaust, industrial smoke, anti-icing agents for highways and roads, highway oil and spilled gasoline end up in our water as chemical contaminants. Indirectly, exhaust and smoke end up in our water as part of acid rain precipitation and deposition. An important property of water that determines its reaction with many substances is acidity, which we measure as a property called pH. To understand chemical contamination of water, a person must consider pH. Many chemical contaminants have the ability to raise and lower the pH of water from its natural systems, and the health of their associated fisheries, aquatic insects and plants.

Purpose: The purpose of this activity is to introduce the students to the idea of pH and its affect on the quality of surface water.

Ideas Taught: Acid rain and deposition are serious problems in the more industrial countries. Many lakes and rivers have become acidified as a result, and many more acidified lakes and rivers are without fish.

Materials Needed:

- Box of chalk
- Vinegar
- Spray bottles, one for each group of 4
- Paper or plastic bowls
- Newspaper

Procedure:

1. _____ When the class begins, ask the students if they have ever heard of acid rain. Write "acid rain" on the chalkboard. Ask them what this word means. Ask them how rain could become acidic. From the discussions in parts 1 and 2, they should have a good idea of why rain becomes acidic. When water passes through the soil, rocks, rubbish, or peat, it may become acidic. Similarly, rain passes through smoke from coal burning, industrial smoke, and car exhaust in the atmosphere to become more acidic. Ask them what happens to the rain when it hits the ground. If the rain were acidic, what affect would it have on things with

which it comes in contact? Eventually the acid rain may end up in a lake or a river through the process called runoff.

2. ____ At this point have the students organize into groups of four, at separate tables if possible. Pass out a bowl of water to each group and tell them to imagine it is a lake. Ask them what types of plants, fisheries and animals would likely come in contact with their lake. It may be useful to list on the chalkboard the plants, fisheries and animals that depend on lakes to survive. Discuss what would happen if acid rain fell on their lake. A slight decrease of pH in the lake may cause the plants and animals to become sick, or unable to reproduce. Over time, the pH may decrease enough to cause die-offs of the plants and animals in and around the lake. Remind them that their bowl could very well be a river system.

3. _____ Write the words "acid deposition" on the board. Remind the students that it is not always raining. Ask them what eventually happens to smoke from coal burning, car exhaust and industrial smoke if it does not rain. The process of these particulates falling back to earth is called deposition. During a time of drought these particulates may build up to substantial levels on earth. Ask the students what would happen if it finally rained after a long period of drought. Rain can pass through these particulates in the air. Once it hits the ground, rain can react with these same substances, which have built up over time. In both instances, the pH of rain will decrease. Acid deposition also occurs after winter when the snow melts and creates runoff. In which of the following instances would water be more acidic: runoff, frequent rain, rain following drought, or snowmelt? Have the students discuss why one mechanism may result in more acidic runoff than another. Suppose a drought has lasted for many years. When it finally rains, there would be a very large drop in pH once it hits the ground. Ask the students how this large drop in pH would affect the plants, fisheries and animal life. Any sudden change in aquatic environment is likely to be fatal to some more vulnerable organisms, such as the aquatic plants and fish. Acid rain and deposition is a very serious problem in the more industrial countries. There are many lakes in New York State and in northern Europe that are now without fish because of acid rain and deposition.

4. _____ Pass out chalk and some newspaper to each group. Have them imagine it to be a priceless statue standing in one of their favorite cities. Have some squirt bottles filled with vinegar ready, and pass them out too. The bottles contain instant acid rain showers. Explain to the students that acid rain is harmful to the buildings and structures in our cities. Have them place their chalk on some newspaper, then tell them to squirt their statue and report what they see. Discuss how the people of a city would feel if such a phenomenon were to happen in their city.

Lesson Learned: Acid rain and deposition are serious problems in the more industrial countries. Many lakes and rivers have become acidified as a result, and many more acidified lakes and rivers are without fish.

The lesson above was adapted from "What is Water Quality? A Resource Guide for 4-H Leaders and Teachers," 80 pages of activities and experiments related to water quality. (\$5.00) Order from the Montana 4-H Program at Montana State University-Bozeman. Phone 406-994-3501.