Return to Primary Lesson Plans

Title: What is pH and Why is it Important?
Level: Primary - Middle (3 - 8)
Time: Varies according to age/level for which it is used
KERA Goals: 1.2, 1.3, 2.1, 2.3, 5.1, and 6.2

Objective:

1. Learn acids, bases, and pH, and related this knowledge to the problem of acid deposition.

Background Information:

Students will test various substances to determine whether they are acidic or basic, using litmus paper or pH paper. They will then relate this experience to acid deposition and to hazardous or toxic substances through reading.

It is important to know the acidic or basic nature of a liquid because the nature of the liquid often determines its use.

Our stomach liquids are acidic so that specific enzymes can aid in digestion. Bathroom toilet bowl cleaners are strongly acidic or basic so that they can effectively clean. Automobile battery fluids are acidic so that electrical energy can be produced.

The examples are all positive uses for acidity and/orbasicity. Sometimes, however, there is too much of one or the other and problems arise. For example, if our stomachs are too acidic, we get a stomach ache.

Whether a liquid is acidic, basic, or neutral is measured by a quantity called pH. pH is a measure of how much hydrogen, in an ionic form, is in a solution. pH measurements are put on a scale from 1-14, with 1 being the most acidic and 14 being the most basic. If a solution has a pH of 7 it is said to be neutral.

The pH scale is a "power of ten" scale. In other words, something with a pH of 9 is ten times as basic as something with a pH of 8.

There are several techniques used to measure pH. Litmus paper or pH paper are commonly used when the measurements do not need to be highly accurate. pH meters are used when accurate measurements are needed.

In this activity, litmus paper will be used since it is easily obtained and easily used. Blue litmus paper turns red in acidic solutions, and red litmus paper turns blue in basic solutions.

The issue of acid deposition is one that has energy, environmental and scientific ramifications. (One step in determining if a body of water has been affected by acid

deposition is to measure its pH accurately over time and under various conditions. Since the major contributor to the acid deposition today is the burning of fossil fuels in cars, factories, and power plants, acid deposition is an energy issue.

Once students understand pH, they can be introduced to the idea that many familiar and innocent-looking substances may in fact be hazardous or toxic substances. They can learn to beware of the possible effects of these substances on health and the environment.

All energy sources and many of the other conveniences of modern life have environmental consequences. Acid deposition is one which needs a great deal of study so that prompt and appropriate action can be taken.

Activity:

Prior to the lesson, collect substances from home to be tested. They should be liquids or substances that will dissolve in water. Such things as baking soda, vinegar, lemon juice, orange juice, very diluted ammonia cleaner, diluted bleach, diluted oven cleaner, tap water, or acids and bases from the junior or senior high school chemistry lab will all work well.

1. Have the students prepare a class data table on the board, such as the one below, on which to record their results.
2. Group the students into teams and assign several substances to each team for testing. Have a team recorder enter the group's results on the board.
3. For each substance to be tested, list its name, if known, and the reaction of a piece of red litmus and of blue litmus. Have each substance tested with both colors of paper. Remember not to drop the papers into the glass containers.
4. After the substances have been tested, the students should make their own record of how each substance reacted on the Acid Test Data Sheet. Have the students classify the substances as acid, base, or neutral.

Acid Test Data Sheet

Pure, distilled water is neutral. Most other liquids are either acidic or basic. How can you tell?

Litmus paper allows you to make a simple test.
Blue litmus paper turns red in acids.
Red litmus paper turns blue in bases.

Materials:

Several clean glass containers
Blue litmus paper
Red litmus paper
Several liquids to test

Student Directions:

1. Place a small amount of one liquid to be tested in a clean glass container.
2. Take a strip of red litmus paper and dip one end into the liquid. Record any color change.
3. Repeat the test using a strip of blue litmus paper. Once again, record your results.
4. Repeat steps 1,2,and 3 for all of the liquids that you teacher gives you to test. Remember, the glass container must be clean.
5. You have tested the substances. Now classify the substances according to the characteristics of acid, base, or neutral.
6. Copy the information from your Data Table on the chalkboard so that other students can record your data.
7. From the blackboard, copy information about other substances tested by other students.

Substance	Red litmus test results	Blue litmus test results	Classification acid, neutral, or base?

Why Worry About Acid Rain?

You have probably heard things in the news about acid rain. In fact, normal rain is somewhat acidic. And actually, water that is quite acidic may not be all dangerous for humans. After all, we can drink lemon juice, which has a pH of less than 3.

But for plants and for animals that live in water, a low pH can be dangerous. If a lake's pH gets below 5, many fish will die. What causes this so-called acid rain?

When coal or oil are burned, they release substances into the air. Some of those substances are acidic. They may settle out of the air, or mix with moisture in the air. Then the rain or snow becomes more acidic.

Sooner or later, the acidic substances get back to ground level. They fall on forests, fields, and lakes. Not all fall as rain, though. It is really more accurate to say "acid deposition" rather than acid rain.

The causes and effects of acid deposition are not completely understood. We do know that exhaust from cars, trucks, and buses is the main source of nitrogen oxides (NO_x). Factories, including smelters and electric generating plants, are the main source of sulfur dioxide (SO_2).

We certainly don't want to give up driving cars or using electricity. But we don't want to damage our environment either. That is why today a lot of research is going on to pinpoint the causes and effects of acid deposition.

You have just learned about pH.

When scientists study acid deposition, they are actually keeping an eye on the pH of our environment.

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