Lesson Plan 100104

Acid Rain in the Water (Target: Grades 3-6)

Objectives:

1. Create awareness of acid rain and its effects on the natural world.
2. Introduce the concept of chemical balance (pH) as a way to clarify what "acid" is and means in the context of "acid rain."
3. Develop action steps that can be taken by students to help change behavior and raise awareness levels for the effects of acid rain.

Materials:

1. 3 clear 1-cup containers
2. 1 eyedropper
3. 1 bottle of RealLemon lemon juice concentrate
4. pH test (Litmus) paper or pH pool test kit.

Methods:

1. Discussion/demonstration of pH: place one cup of tap water in each of three clear containers. Test the pH of any one of the containers with a piece of Litmus* paper. Next, place two drops of concentrated lemon juice into first container, four drops into second container, and eight drops into third container. Stir each container thoroughly. Use Litmus paper to measure the pH in each container. Be sure students can see the differences in each test color. *If you plan to use a pool test kit instead of paper, follow the kit's instructions for amount of water in a container and adjust the number of drops of lemon juice accordingly. With a pool test kit, you may only have to demonstrate in a single container and empty and refill with fresh water for each stage of acidity.
2. **Review:** Causes of acid rain
3. **Discussion:** Ask students for ideas on how to reduce acid rain. Write ideas on the chalkboard. Have students write all the ideas on their worksheet, and then assign them the job of taking the worksheet home and asking parent/guardian/adult for any other ideas.
4. **Follow-Up:** Discuss any additional ideas that came from adults on the next day.

Lesson Information:

1. Acid Rain: "Acid Rain" is the term used to describe a certain type of pollution. Every day, cars, trucks, airplanes and factories create harmful waste gases and waste particles. These poisons are released into the air around us. Next, the gases and particles rise into the upper atmosphere where they are suspended among other atmospheric components. When clouds release moisture in the form of rain or snow, the harmful chemicals travel back to the earth with them. Now, instead of being suspended in the air, these chemicals are absorbed into the ground and fall into lakes and streams. The pollution changes a chemical balance that we find throughout the natural world. Scientists measure the chemical balance of water and soil with a "pH scale" (It's sort of like a chemical ruler—but it is a whole different subject!). In the average, healthy lake in North America, the pH is between 6.5 and 7. With that chemical balance, all sorts of plants and animals can live and grow naturally. As polluted rain falls, it lowers the pH of the water, and makes it more acidic (a-SID-ik).

2. How Acid Rain Affects Nature: When the level of acid rises, the plants and animals living in or near the water begin to die or to have trouble growing properly. For example, crayfish ("crawdads") are like tiny fresh water lobsters and rely on a hard outer shell for protection from predators. In a lake with too much acid, crayfish can't grow a hard shell, so they are more vulnerable and are eaten in larger numbers. If too many crayfish die, the population is eliminated and all fish and birds that eat crayfish will run out of food. Eventually, when a lake's chemical balance becomes too acidic, everything dies. When everything dies in a lake, there is very little that can be done to reverse the damage.

3. The Growing Impact of Acid Rain: Because there are so many cars and factories, the effects of acid rain are almost too big to imagine. In the Northeastern United States, many millions of people live in a relatively small geographic region. All those millions of people drive cars and use products created in tens of thousands of factories that are shipped by fuel-burning trucks and trains. The chemical pollution from all those cars and factories and trucks and trains has affected thousands of lakes in the Northeastern US. Also, because the pollution is high up in the atmosphere, it has been blown into Canada and has polluted over 20, 000 lakes in Southeastern Canada!

What Can be Done: Although the causes of acid rain are woven into the very fabric of the lives of people in modern civilizations, many steps can be taken to reduce the effects of acid rain. Walking and riding bikes for short errands can help. Carpooling can help. Reducing the number of trips in the car or SUV can help. Buying fuel-efficient vehicles helps. Asking lawmakers to pass stricter laws relating to fuel-efficiency, pollution and public education can help. Over time, these and other measures can have a large impact on reducing acid rain.

Ask Rustle the Leaf™ About...

Dear Rustle:

Can you tell me what "Acid Rain" is?

-- Michael, Springport, IN

Dear Michael:

You have asked a short question that needs a pretty long answer! "Acid Rain" is the term used to describe a certain type of pollution. Here's what happens: Every day, cars, trucks, airplanes and factories create harmful waste gases and waste particles. These poisons are released into the air around us. Next, the gases and particles rise into the upper atmosphere (the really, really high air where the clouds are). When clouds release their moisture droplets in the form of rain or snow, the harmful chemicals travel back to the earth with them. Now, instead of being suspended in the air, these chemicals are absorbed into the ground and fall into lakes and streams.

This is NOT good. The pollution changes a chemical balance that we find throughout the natural world. Scientists measure the chemical balance of water and soil with a "pH scale" (It's sort of like a chemical ruler—but it is a whole different subject!). In the average, healthy lake in North America, the pH is between 6.5 and 7. With that chemical balance, all sorts of plants and animals can live and grow naturally. As polluted rain falls, it lowers the pH of the water, and makes it more acidic (a-SID-ik). When the level of acid rises, the plants and animals living in or near the water begin to die or to have trouble growing properly. For example, crayfish (some people call them "crawdads") are like tiny fresh water lobsters and rely on a hard outer shell for protection from predators. In a lake with too much acid, crayfish can't grow a hard shell, so they are more vulnerable and are eaten in larger numbers. If too many crayfish die, the population is eliminated and all fish and birds that eat crayfish will run out of food. Eventually, when a lake's chemical balance becomes too acidic, everything dies. When everything dies in a lake, there is very little scientists can do to reverse the damage.

Because there are so many cars and factories, the effects of acid rain are almost too big to imagine. In the Northeastern United States, many millions of people live in a small geographic area. All those millions of people drive cars and there are tens of thousands of factories that make products bought and used by those millions of people. The chemical pollution from all those cars and factories has affected thousands of lakes in the Northeastern US. Also, because the pollution is high up in the atmosphere, it has been blown into Canada and has polluted over 20,000 lakes in Southeastern Canada!

That's the "bad news", Michael, but there is some good news, too. Over the last 30 years, more and more of us have become aware of the damage cause by acid rain. More and more of us are trying to use our cars less. Governments are beginning to make laws that restrict certain kinds of factory pollution and are also making laws that require cars and trucks to use less fuel. You can do your part, too. When your parents or other grown-ups are going on a short errand, ask that they use bikes or walk! That's good for everyone, because it reduces pollution from your car, and it provides a great way to see what's going on in the world around you. Thanks for your question, Michael! I look forward to hearing from you again soon.

Your Friend,

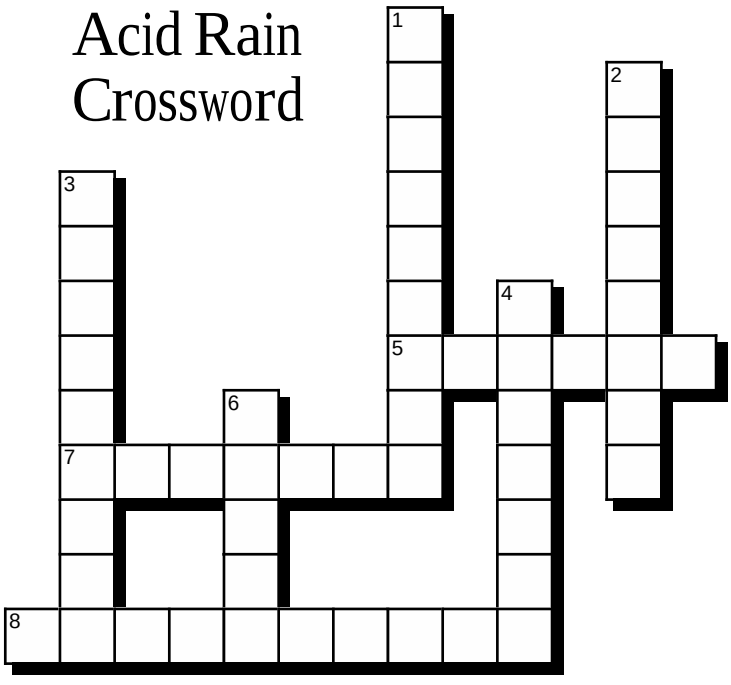
RUSTLE THE LEAF

Acid Rain Activity Page

Read the "Ask Rustle the Leaf About Acid Rain" page and fill in the blanks below:

Acid Rain happens when _____ droplets from clouds fall through the upper _____ and pass through waste _____ and particles that are created by the exhaust from _____, trucks, airplanes and factories. Carrying the chemicals from the waste gasses, the droplets fall to the earth and into water supplies, altering the _____ balance or "Ph level" of the soil and water. Most soil and water that supports life has a Ph level between ____ and _____. As soil becomes acidic, different types of life begin to weaken and to disappear. One example is the _____, similar to a fresh water lobster. As water becomes more acidic, these creatures have problems with their _____ hardening properly, making them more vulnerable to predators in the water.

Acid Rain Crossword



DOWN

1. Area of Canada where Acid Rain most commonly falls.
2. Creature that becomes vulnerable to predators when the acidity level of fresh water begins to rise too high.
3. Area of the United States where Acid Rain most commonly falls.
4. Method of transportation (for short trips) that does not cause pollution.
6. It is estimated that 20,000 of these have been polluted by Acid Rain in Canada.

ACROSS

5. What water and soil become when they are exposed to Acid Rain.
7. Waste gasses from cars, trucks and airplanes that rise high into the sky.
8. Name of area to which gasses from cars, trucks and factories rise.

RUSTLE THE LEAF™

CLASSROOM COMIC