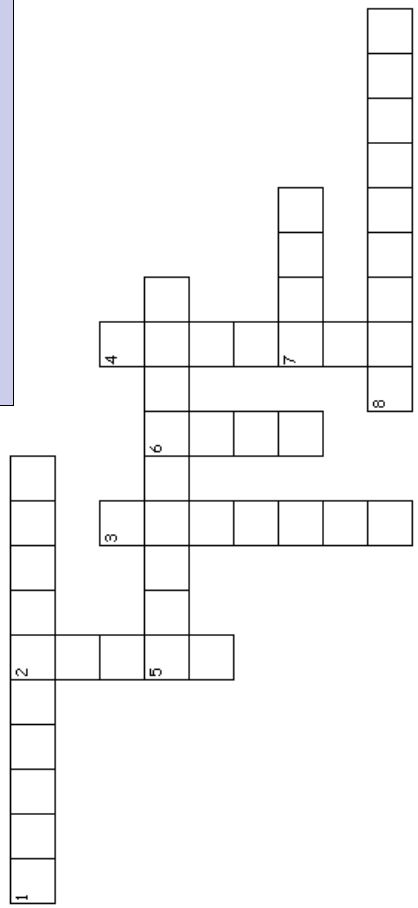
Concepts

Chemicals and chemical reactions are part of the environment. Some chemicals can cause environmental problems. Other chemicals can help some environmental problems.

Words to know

matter - anything that fills space and has mass
atom - a very, very small particle that makes up all matter
molecule - a small particle made of two or more connected atoms
ion - an atom or molecule with an electrical charge
element - a substance made of all the same type of atoms
mixture - two or more materials that are mixed together but not chemically bonded
solution - a completely uniform mixture of atoms, ions and/or molecules
soluble - able to dissolve in another substance
pollutant - a chemical that is unwanted in a particular environment
toxin - a chemical that is harmful to living things
acid - a compound that increases the number of hydrogen ions (H+) in solution with water. All acids have a pH below 7.
base - a compound that decreases the number of hydrogen ions (H+) in solution with water. All bases have a pH above 7.
pH - a scale that measures relative acidity and basicity
indicator - a chemical that changes color with changes in pH
recycling - using a substance or parts of a substance more than once

Use the clues and the Words to Know to complete the crossword puzzle.



Across

1. Activated charcoal is a chemical compound used to filter _____ from water.
5. Bromothymol blue, an _____, turns yellow in acids and blue in bases.
7. Soap is a common _____; its pH is greater than 7.
8. People help the environment by _____.

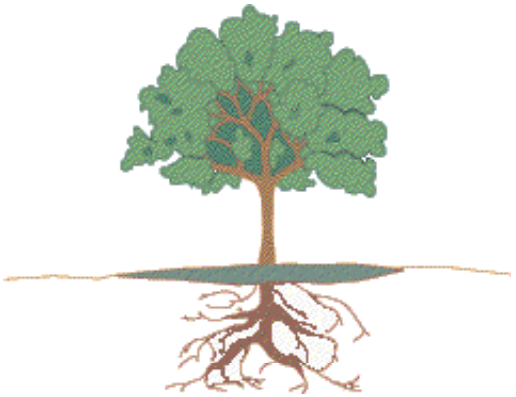
Down

2. Carbon monoxide gas (CO) is a _____, a chemical harmful to living things.
3. Trash is an example of a _____; it is made of many items mixed together that are not chemically bonded.
4. Many minerals in nature, such as calcium (Ca), are _____ (can be dissolved) in water
6. _____ rain contains sulfuric acid (H_2SO_4) and nitric acid (HNO_3)

OMSI
OREGON MUSEUM OF SCIENCE AND INDUSTRY

CheM LaB

Take-Home Activities



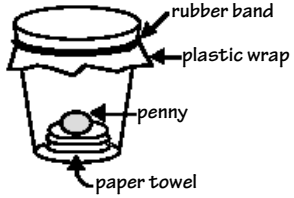
Environmental Chemistry

This project funded by
National Science Foundation
WHERE DISCOVERIES BEGIN

Iron in the Environment

Why is the Statue of Liberty corroding?

Materials:



1 cup of water
tablespoon measure
salt
vinegar
3 paper towels
2 copper pennies (or pieces of copper wire)
2 iron nails (or paper-covered iron twist ties)
steel wool (or fine sandpaper)
3 small plastic cups
plastic wrap
3 rubber bands

To do and notice:

1. Add one tablespoon of vinegar and a tablespoon of salt to one cup of water. Mix the contents. Fold each sheet of paper towel several times and soak it in the water mixture.

2. Clean all the metal pieces with the steel wool.
   - **What do the metals look like?**

3. Put one paper towel in the bottom of each of the paper cups. Into cup 1, put an iron nail. Into cup 2, put a copper penny. Into cup 3, put a penny and piece of iron together, touching each other.

4. Cover each cup with a piece of plastic wrap secured by a rubber band.

5. Let the cups sit for 2-3 days. Observe the cups each day.
   - **What is happening to the metals in each cup?**
   - **Which piece of metal shows the most change?**

A closer look:

The combination of salt and acid (vinegar) in the water helps cause the corrosion (oxidation) of iron. Iron combines with oxygen to form rust (iron oxide). If the iron is in contact with copper, the copper accelerates this reaction.

The Statue of Liberty is corroding quickly because the iron inner structure is in contact with the copper outer structure and is also in contact with moist, salty sea air and acid rain.

Recycling Paper

Make your own paper!

Materials:

paper to recycle
water
bowl
flour (or cornstarch)
shallow pan or dish (about 6 inches by 8 inches)
screen (about 8 inches by 10 inches)
blender
tape
rolling pin

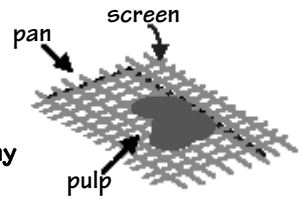
To do and notice:

1. Tear half a sheet of paper into small, stamp sized pieces. Put the paper pieces in the bowl and cover them with water. Let the papers soak until they are completely wet.

2. Add ¾ cup of water to the blender. Add the wet papers on top of the water. Blend the paper and water to form a thick pulp.

3. Add two teaspoons of flour to the mixture. Blend again until smooth.

4. Place the screen over the shallow pan. To keep the screen flat, tape the edges of the screen to the pan. **CAUTION: A wire screen may have sharp edges.**



5. Slowly pour the pulp mixture over the screen. Use a rolling pin to smooth the paper over the screen in an even thin layer.

6. Let the paper sit and drain into the pan for at least one day until it is completely dry.

7. When the paper is dry, carefully peel it from the screen.
   - **What is your paper like?**
   - **Can you write on it?**

A closer look:

Paper is made from very large long molecules of cellulose. Water dissolves the cellulose and the blender breaks it down. Then the flour binds the cellulose molecules to each other again.

The more you roll the wet fibers, the thinner and flatter your paper will be. You can try adding glitter, seeds, or bits of colored paper to make designs in your paper.

Water Ways

What is surface tension? How can it change?

Materials:

2 small, identical plastic cups or glass jars
1 larger cup
several pennies (or paper clips)
water
liquid soap

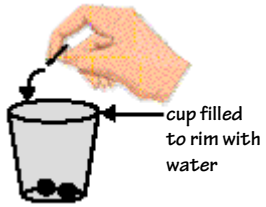
To do and notice:

1. Rinse the small cups with water.

2. Fill one small cup to the rim with water.

3. In the larger cup, mix 2 tablespoons of dish soap with tap water. Skim the foam off the top. Slowly pour the water-soap mixture into the second small cup. Fill it to the rim.

4. Carefully drop a penny into the cup with plain water.
   - **What happens?**
   - **How many pennies can you drop in before the water overflows?**



5. Carefully drop a penny into the cup with soapy water.
   - **What happens?**
   - **How many pennies can you drop in before the water overflows?**

A closer look:

You are looking at a property of water called "surface tension." Water molecules attract each other, allowing water to form a dome above the surface of each cup. When you add soap to the water, the soap molecules interfere with the water molecules' ability to bond to each other. This reduces the surface tension of the soapy water, so it cannot support a dome above the rim of the cup.

Surface tension is an important part of the environment. Waterstrider bugs walk on water because the surface tension of the water is strong enough to support their weight. **What would happen if water striders tried to walk on soapy water?**