Concepts

Chemicals and chemical reactions are part of the environment. Some chemicals can cause environmental problems; other chemicals can help solve environmental problems.

Words to Know

Chemical—anything that uses space and has mass.

Atom—a very, very small particle that makes up all matter.

Molecule—a small particle made of two or more atoms that are chemically bonded together.

Element—a substance made of all the same type of atoms.

Compound—a substance made of two or more elements chemically bonded together.

Mixture—two or more elements and/or compounds that are mixed together but are not chemically bonded.

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.

Base—a compound that increases the number of hydroxide ions (OH^-) in solution with water.

pH—a scale measuring 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.

Solution—a completely uniform mixture of atoms, ions, and/or molecules.

Soluble/solubility—the ability of a substance to dissolve in another substance.

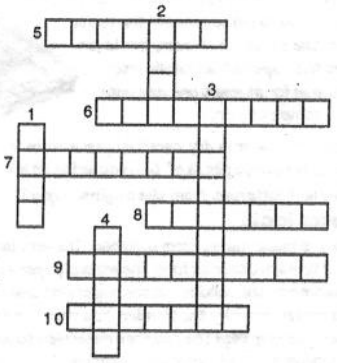
Fill in the crossword puzzle below with the "Words to Know."

ACROSS

5. Many minerals in nature, such as calcium (Ca), are ____ (can be dissolved) in water.
6. The environment is made of many different ____.
7. $CaCO_3$ is a chemical ____ found in marble and concrete.
8. People help the environment each time they ____.
9. Activated charcoal is a chemical compound used to filter ____ from water.
10. Trash is an example of a ____; it is made of many items mixed together that are not chemically bonded and can be easily separated.

DOWN

1. ____ rain contains sulfuric (H_2SO_4) and nitric (HNO_3) acids.
2. Soap is a common ____; its pH is greater than 7.
3. Bromthymol blue, an ____, turns yellow in acids and blue in bases.
4. Carbon monoxide gas (CO) is a ____, a chemical harmful to living things.



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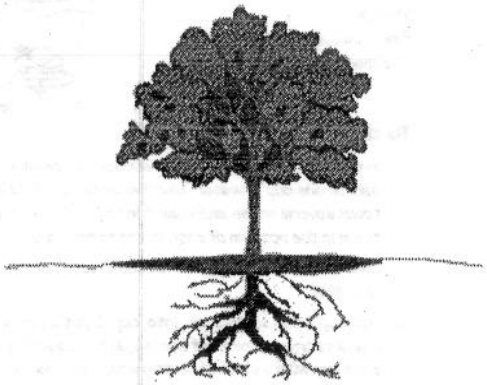
Chem lab

Take-Home Activities



Environmental Chemistry

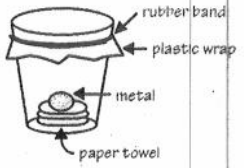
This project funded by the National Science Foundation

Iron in the Environment

Why is the Statue of Liberty corroding so quickly?

Materials:

Two copper pennies or pieces of copper wire
Two iron nails or paper-covered iron twist ties
Three small plastic cups
Three paper towels
Three rubber bands
Plastic wrap
Salt
Vinegar
Fine sandpaper or steel wool
One mixing cup



To do and notice:

1. In the mixing cup, 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. Put one paper towel in the bottom of each of the paper cups.
2. Clean all the metal pieces with the steel wool. **What do the metals look like?**
3. 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. Cover each cup with a piece of plastic wrap secured by a rubber band.
4. 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 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 by channeling electrons from the iron to the oxygen in the water. 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

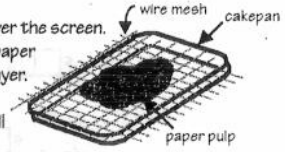
How do you recycle paper?

Materials:

Sheet of white paper
Flour or cornstarch
Blender or eggbeater
Tape/stapler
Wire or nylon screen (about 8 inches by 10 inches)
Cakepan or shallow container (dishpan, picture frame)
Water
Large mixing bowl
Rolling pin

To do and notice:

1. Tear half a sheet of paper into 1-inch pieces.
2. Add the paper pieces and water to the bowl. Let the papers soak until they are thoroughly wet.
3. Put the papers and up to 3/4 cup of water into the blender. Mix them to form a thick mush.
4. Add 2 teaspoons of flour and blend the mixture again until the mixture is smooth.
5. Place the screen over the cakepan or shallow container. To keep the screen flat, tape the edges of the screen to the pan or staple the screen to an old picture frame. CAUTION: **A wire screen may have sharp edges.**
6. Slowly pour the paper mixture over the screen. Use a rolling pin to smooth the paper over the screen in an even, thin layer. 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? How is it different from the original paper?**

A closer look:

Paper is made mainly from cellulose. The very large, long molecules bond to each other to form the strong paper structure. In this experiment, the cellulose in the paper was dissolved with the water and broken down by the blender. You then used the flour or cornstarch to help bind the cellulose molecules to each other again. It is difficult to make recycled paper that is similar in quality and cost to paper made directly from raw materials (wood), but recycling conserves natural resources and limits pollution.

Water Ways

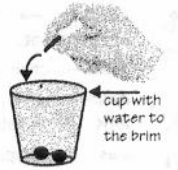
What is surface tension? How can it change?

Materials:

Two small, identical plastic cups or glass jars
One larger cup
Several pennies (or other small, identical metal objects)
Water
Liquid dishwashing soap

To do and notice:

1. Rinse the cups with tap water.
2. Fill one small cup to the rim with tap 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?** Drop in another penny. **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 a 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. Water-strider 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?**