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Celebrating Chemistry

International Year of Chemistry 2011— Environment
AMERICAN CHEMICAL SOCIETY

Water in Our World
WOW

Water in Our World

By Clinton Harris

Did you know that to a large extent all the water that began on Earth is still present on Earth? Water is everywhere! There is not a day that you do not interact with water. Your body is composed of mostly water. When you take a shower, you use water. When you drink your favorite beverage, it mostly contains water. Water sometimes falls from the sky in the form of rain, snow, or even ice! Water helps fruits and vegetables to grow so that you can eat.

In addition, sometimes we use water to have fun. Think of all the different fun ways you use water. Water is plentiful on the Earth but most of it is unusable salt water–not like the water that we use to drink, cook, and wash with. Water is a substance that we all can take better care of. In this edition of *Celebrating Chemistry*, we will describe topics that concern us about the water in our world:

- Are you wondering about water? Read about the exciting properties that water has. (Water, Water, Everywhere, page 3.)
- How is water cleaned, and how is it kept clean? Learn about how water is washed and the importance of clean water. (Getting Water Clean, page 5.)
- Do you know why water matters? Take a look at what you can do to conserve this precious resource. (Things You Can Do To Conserve Water, page 9.)
- How does pollution affect the water we use? Explore a common problem that is harmful to humans and the world's water supply. (What Is Acid Rain? page 10.)

Water Drop Word Search

In this word search, each ≈ symbol represents the word "water," which is in all 45 words or phrases on the list below. After you find the words in the grid, the leftover letters will give the 18-letter answer to this question: What is the technical name of water?

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≈
HTP
G≈OHO
ENYAL≈L
GIIOFNYCO
NAS≈BWFV≈HO
FIRISH≈SPANIELE
≈IR≈DRTRENETFOS≈Y
SK≈REDNULLNHO≈≈HTAB
USAABYSNOETEIPKTCDNIS
≈AE≈RUDHMLZCARRALYIUH
YLRUHIGH≈DETANOBRACDT
CGBRENALP≈RMOGPLENSLM
O≈GNIKNIRD≈O≈DAEHNOXE
ID≈FOTUOHSIFEVBACK≈
≈PUMPBODYOF≈≈HSID
OLAFFUB≈LLITS
```

BACKWATER
BATHWATER
BODY OF WATER
BREAKWATER
CARBONATED WATER
CHLORINE WATER
CLEARWATER
DISHWATER
DRINKING WATER
FISH OUT OF WATER
FRESHWATER
HEADWATER
HEAVY WATER
HIGH WATER
HOLY WATER
ICE WATER
IRISH WATER SPANIEL
MOUTH-WATERING
RAINWATER
SALT-WATER TAFFY
SELTZER WATER
STILLWATER
TAP WATER
UNDERWATER
WATER BED
WATER BOY
WATER BUFFALO
WATER BUG
WATERBURY
WATER CHESTNUT
WATER CYCLE
WATERFORD
WATER GLASS
WATERING HOLE
WATERLOO
WATERMARK
WATERMELON
WATER PLANE
WATER POLO
WATER-PROOF
WATER PUMP
WATERSKIING
WATER SOFTENER
WATER TABLE
WATER VAPOR

Water, Water, Everywhere

It's just about everywhere! It covers almost three-quarters of the Earth's surface! It makes up about two-thirds of your body's weight! Every living thing needs it to survive! It's amazing! It's incredible! It's the one and only, your friend and mine, that multi-talented substance we know and love! Let's hear it for that wild and wonderful wizard of wetness: WATER!

To help understand what makes water so special, we have to think small: very small. You may already know that everything in the world is made up of *atoms.* When two or more atoms join together, they make a *molecule.* A molecule of water is made up of three atoms: two *hydrogen* atoms and one *oxygen* atom. That's why scientists call water H_2O. When water molecules get near each other, they *attract.* This is what gives water some of its very interesting qualities.

A special characteristic of water is the way it sticks to itself and holds together. This is called *cohesion.* Water also clings to other things. This is called *adhesion.* Cohesion and adhesion are caused by the attraction of water molecules to each other and to other things.

The cohesion and adhesion of water molecules also help them move up the very thin tubes in the roots and stems of plants. This movement of a liquid up tiny tubes or spaces is called *capillary action.* Water molecules are attracted to the sides of the tubes and to each other as they move up the tubes. This water brings the plants the nutrients they need to live. The cohesion of water molecules also helps form raindrops. In a cloud, water molecules join together until the drops get big enough to fall as rain.

Water molecules can also form a kind of "skin" on the surface of water. The water molecules at the surface are attracted to each other and are also pulled down because they are attracted to the water molecules beneath them. These attractions pull the water molecules at the surface very close together. This results in what scientists call *surface tension.* Surface tension helps a drop of water hold its shape. It also lets some insects walk around on the surface of the water.

Water molecules can also *dissolve* many different things. If a substance dissolves in water, its atoms or molecules are attracted to water molecules. The water molecules attach to these atoms or molecules. The water molecules pull and bump into them so much that the substance begins to fall apart. This action of water molecules lets you dissolve sugar, salt, or other substances in water. We can then use the liquid with the dissolved substance in it for different jobs. Substances like oil that are made up of atoms or molecules that are not attracted to water molecules do not dissolve in water.

Water molecules also act in a special way when water freezes. When most liquids freeze, their molecules get closer together and the substance shrinks or *contracts.* But when water freezes, water molecules get farther apart and the water *expands.* After water has expanded to form ice, it is able to float on liquid water. This is very helpful in nature. When lakes freeze, ice forms on the surface and the water underneath stays liquid. This helps living things in the water survive during the winter.

Milli's Safety Tips Safety First!

ALWAYS:

- Work with an adult.
- Read and follow all directions for the activity.
- Read all warning labels on all materials being used.
- Wear eye protection, specifically goggles.
- Follow safety warnings or precautions, such as wearing gloves, or tying back long hair.
- Use all materials carefully, following the directions given.
- Be sure to clean up and dispose of materials properly when you are finished with an activity.
- Wash your hands well after every activity.

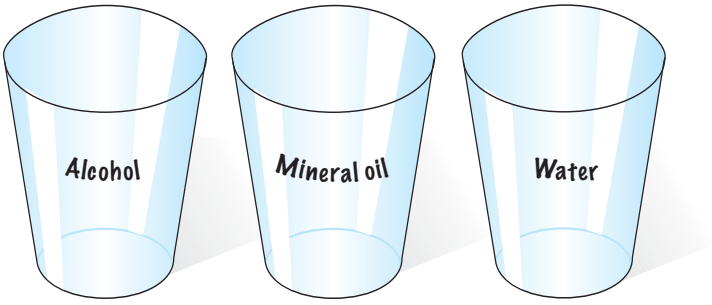
NEVER eat or drink while conducting an experiment, and be careful to keep all of the materials used away from your mouth, your nose, and your eyes!

NEVER experiment on your own!

For more detailed information on safety, go to www.acs.org/earthday and click on "Safety Guidelines."

Water: Clearly Unique!

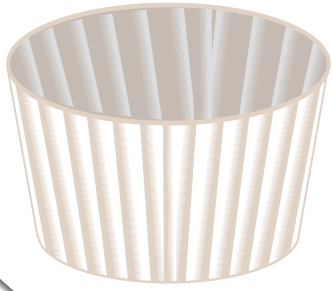
Water is clear and colorless and has many interesting and useful characteristics. There are other liquids that are also clear and colorless but have properties very different from water. In this activity, you can use some quick and easy tests to see the difference between water and other liquids that look very similar.



NOTE: *When using isopropyl alcohol, be sure to read and follow all safety warnings on the label. Be sure all participants are wearing properly fitting goggles.*

Materials

- 3 clear, plastic, 12-ounce cups
- 3 teaspoons
- Masking tape
- Pen
- Water
- Isopropyl alcohol (rubbing alcohol)
- Mineral oil
- 6 straws or droppers
- Wax paper
- Brown coffee filter



Procedures

1. Use the masking tape and pen to label the three cups *Water, Alcohol,* and *Mineral Oil.*
2. Place about ½ teaspoon of each liquid in its labeled cup. Be sure to use a clean teaspoon for each liquid.
3. Using a different straw or dropper for each liquid, place a drop of each liquid on a piece of wax paper. Do all the liquids look the same on the wax paper? Tilt the paper to let the drops move a little. What do you notice?
4. Tear open a brown coffee filter and lay it out flat. Using the remaining (but different) straws or droppers, place a drop of each liquid on the coffee filter paper. Is there anything similar or different about how the liquids absorb into the paper?
5. Gently wave the coffee filter back and forth to try to make the liquids evaporate.
6. Check to see if there are any differences in how fast the different liquids evaporate.

Think about This ...

Here's another quick test to see any differences between the liquids. Gently and carefully place one drop of food coloring onto the surface of each liquid. Describe your observations for each cup and how they are similar to or different from each other.

Where's the Chemistry?

Every liquid has certain characteristics based on the molecules it is made of. The wax paper and the coffee filter also have certain characteristics based on the molecules they are made of. The way the liquids act when placed on the wax paper and the coffee filter depends on how the molecules of the liquid and the surface interact.

Getting Water Clean

Have you ever looked closely at the water in a lake or stream? What about water from a spring? Was it clean? Would you drink it? Do you think it would make you sick if you did? The water that we find in a lake or stream is usually too dirty to drink without cleaning it first. Sometimes we can tell that water is dirty because it looks muddy or smells bad. But other times, although it may look and smell clean, it would make us sick if we drank it. To be safe, you should never drink water unless it has been treated properly. Water for our towns and cities is cleaned in water treatment plants before it comes to our homes and schools. Water treatment plants use four basic steps to clean water: coagulation, sedimentation, filtration, and disinfection. These steps are described in detail below.

Coagulation

To coagulate something means to make it stick together in clumps. Our blood does this naturally when we get a cut. Blood will clump together to form a scab over a wound. In water treatment plants, chemicals are added to dirty water to make the very small particles (of dirt and waste) coagulate or clump together. These larger clumps are much easier to remove from the water. The most common chemical used for coagulation is alum. You have probably come across alum before without even knowing it. Alum is what makes your mouth pucker when you eat a dill pickle. It is used as a home remedy for healing canker sores in your mouth.

Sedimentation

Sedimentation means settling to the bottom. In a fast-moving stream, soil and other materials are stirred up into the water, making it look cloudy. When a stream runs into a lake, the water slows down, letting the soil and other solid materials fall to the bottom of the lake. In a water treatment plant, water is pumped into a large tank called a sedimentation tank. The sedimentation tank usually has several walls rising up from the bottom of the tank. These walls are short enough to let the water flow over their tops, but tall enough to slow the water down. The solid materials settle to the bottom of the tank just like in a big lake. The cleaner water at the top of the tank is then pumped out into a filter.

Filtration

A filter is a barrier that has fine holes or gaps that allow small molecules like water to pass through, but block large particles. The filters used to treat water in water treatment plants are usually made of sand, but they may also have gravel, coal, or activated charcoal. These filters remove the solid materials not taken out by the sedimentation process. The water is now crystal clear, and it would taste good to drink, but it could still make you sick.

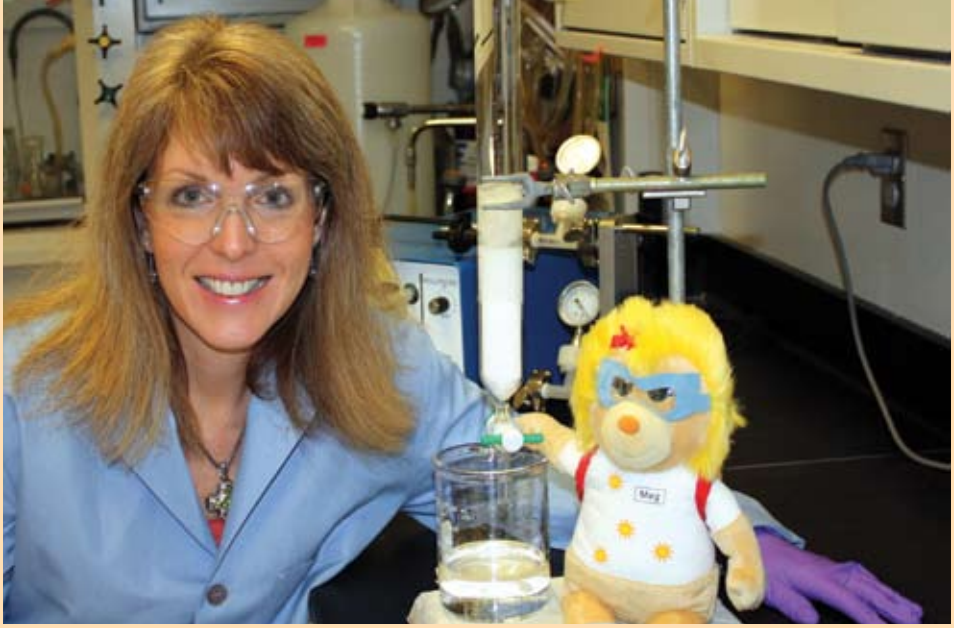
Disinfection

Many times, water from streams or lakes contains harmful germs and parasites that can make us sick, but are too small for us to see or filter out. These germs are removed in the final treatment step called disinfection. During disinfection, a chemical like bleach is added to the water to kill the germs and make it safe to drink. Water treatment makes all the difference with respect to our health. Before water treatment plants were common, many children died every year because of diarrhea and dehydration. Many others became ill. But because of water treatment plants, we no longer have to worry about getting sick from drinking dirty water.

Read about the difficulties around the world concerning clean water, the many people on Earth who do not have drinkable water, and how unclean water causes lots of diseases by visiting www.acs.org/iyc2011 and clicking on the IYC Environment PowerPoint pack.

The Adventures of Meg A. Mole, Future Chemist

Meg celebrates the International Year of Chemistry 2011 and interviews Susan Richardson, Ph.D.



Meg with Dr. Richardson in her lab—helping to extract drinking water samples.

When you think about water, the first thing that always comes to mind is drinking it! Moles are thirsty little creatures! Luckily, I met a wonderful chemist who spends her days making sure our water is safe to drink.

Susan Richardson works for the U.S. Environmental Protection Agency (EPA)'s National Exposure Research Laboratory in Athens, Georgia. Dr. Richardson tests drinking water in the United States and other countries for any chemical contaminants. She explained that one of the EPA's goals is "to protect the safety of America's waters, and drinking water is a part of that."

I asked Dr. Richardson how she tested the water. She explained that she uses "a special instrument called a mass spectrometer to help identify chemical contaminants in drinking water." I wondered how contaminants could get into drinking water. I learned there were many ways! She also explained that "when drinking water is disinfected, there are chemical by-products that are formed that we are trying to better understand." She wants to make drinking water as safe as possible.

So how does the water from other countries get to her lab? Dr. Richardson told me about a study she was currently working on in Europe! "We are receiving drinking water samples from several countries, where we are analyzing the chemical by-products." "We ship coolers with bottles inside to have the drinking water collected, and they send it back," and the tests are done in her lab!

Being a chemist is great! I asked Dr. Richardson what she liked best about being a chemist. She told me she liked to "do experiments and have new discoveries that are important for human health." Also, "getting to work with other scientists in the U.S. and in other countries and sometimes traveling to those other countries." She has "developed great friendships with scientists" and enjoys working with them "to solve environmental problems."

Every time you take a drink of clean water, remember the chemists like Dr. Richardson all around the world working hard every day to make sure our drinking water is safe!

To read more about my visit with Dr. Richardson, please visit my web pages at **www.acs.org/kids.**

Personal Profile

FAVORITE FOOD: I love any kind of Mexican food!

FAVORITE HOBBY:
My favorite hobby is fossil hunting. My children often go with me on fossil hunts. Recently, we found trilobites on a river bank in North Georgia, and we often go to Fernandina Beach, Florida, to pick up shark-teeth fossils and lots of other kinds of fossils, even extinct mammoth teeth! It is so exciting to find fossils of ancient creatures. It is like a treasure hunt, and you get to hold a piece of history in your hands.

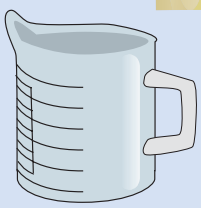
ACCOMPLISHMENT YOU ARE PROUD OF:
I received a major award two years ago: the American Chemical Society's Award for Creative Advances in Environmental Science and Technology. This award was for my research in drinking water.

Cleaning Water with Dirt

When we get a drink of water from the water faucets in our homes, we do not have to worry about getting sick. That is because our water has been cleaned and treated at a water treatment facility. Most water treatment facilities use sand and charcoal filters to clean the water. In this activity, you will make your own water treatment system and see how it works.

MATERIALS

- Water
- Measuring cup
- 2 medium, disposable, paper cups (8-ounce)
- Food coloring (red, green, or blue)
- Measuring spoons
- Dirt and grass
- Wooden craft stick
- Fragrant oil (optional; orange or lemon works best)
- 5 small, disposable, paper cups (3-ounce)
- Ballpoint pen
- 2 cotton balls
- Sand (available at a hardware store)
- Quarter (25-cent coin)
- Metric ruler (15-centimeter)
- Activated charcoal (available at a pet store with the aquarium supplies)
- Scissors



SAFETY! *Be sure to follow Milli's Safety Tips and do this activity with an adult! Do not drink any of the water samples in this activity.*

PROCEDURE

Dirty Water

1. Add ¾ of a cup of water to one of the 8-ounce paper cups.
2. Add one drop of food coloring (red, green, or blue works best) to the water.
3. Add a tablespoon of dirt and grass to the water, and carefully mix everything together using the wooden craft stick. You will use this "dirty water" to test how well your filter works.

ADAPTATION *As an option, you can ask an adult to add a drop of fragrant oil to your dirty water to imitate smelly things that are sometimes found in pond or lake water. Be careful—fragrant oils are usually very concentrated and can burn your eyes!*

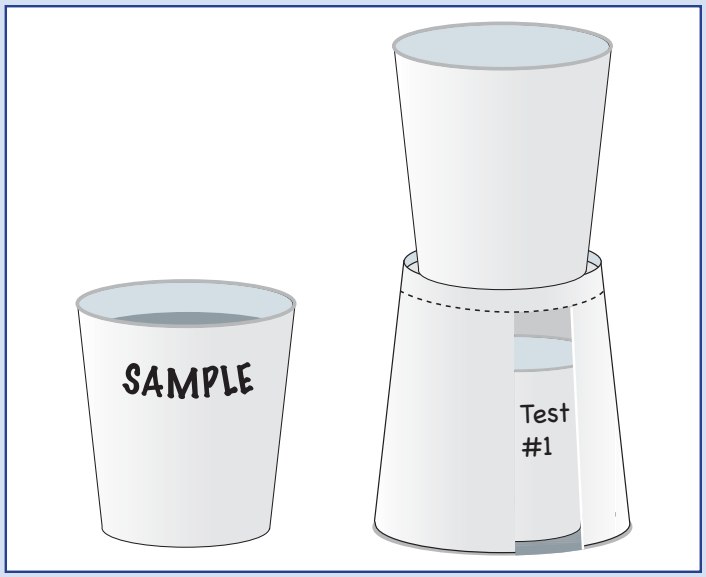
SAND FILTER

1. To make a sand filter, ask your adult partner to make a hole in the bottom of one of the small cups by pushing the tip of a ballpoint pen through the bottom. They must be careful to push the pen away from them, so that they don't poke themselves in the hand!
2. Stuff a cotton ball into the hole that was just made for you, using the ballpoint pen to help. The cotton ball should plug the hole completely, so that the sand that you put in next will not fall out.
3. Put 5 tablespoons of clean sand into the cup.

FILTER STAND

1. Make a stand for your filter from a medium paper cup.
2. Start by turning the cup upside down. Place a quarter in the middle of the bottom of the upside-down cup, and trace its outline using the ballpoint pen.
3. Ask your adult partner to cut along the line with scissors to make a hole in the bottom of the cup that is about 1 inch wide. You must not try to do this yourself! Don't worry if the hole is not perfectly round.
4. Holding the cup right side up, measure up from the bottom of the cup 1 centimeter and mark a line all the way around the outside of the cup using the ballpoint pen.
5. Flip the cup upside down and have your adult partner cut straight down the side of the cup. Your adult partner should cut from the rim of the cup to the line that you just drew. Your adult partner should be careful not to cut completely through to the bottom of the cup, but to stop where you drew the line.

6. For the next cut, measure 3 centimeters over from the cut that was just made and have your adult partner make a second cut straight down the cup from the rim to the line.
7. Fold the entire flap out, and cut it off.
8. Turn the cup upside down and place it on the table. You now have a filter stand.



TEST #1: THE SAND FILTER

1. Place a small, empty, paper cup on the table. Write *Test #1* on the side of the cup using the ballpoint pen.
2. Put your filter stand over the top of the smaller cup. The small cup should fit inside of the filter stand. The small cup should be right side up, and the filter stand cup should be upside down.
3. Place your sand filter on top of the filter stand. The hole with the cotton in it should be centered over the hole in the top of your filter stand. Write *Sample* on the side of a new, clean, small, paper cup.
4. Stir your dirty water with the wooden craft stick.
5. Fill the small paper cup labeled *Sample* half-full with the dirty water.
6. Pour the dirty water from the small cup labeled *Sample* slowly onto the sand filter.
7. Watch through the side of the filter stand to see what happens to the water after it passes through the filter into the new (bottom) cup. If you added a fragrant oil, wave your hand over the top of the bottom cup to bring any odors to your nose. Do not place your nose or face directly over the top of the bottom cup. Can you smell the fragrant oil, or was it removed from the filtered water?
8. Write down your observations in the "What Did You Observe?" table.

CHARCOAL AND SAND FILTER

1. To make a charcoal and sand filter, ask your adult partner to push the tip of a ballpoint pen through the bottom of one of the small paper cups. They must be careful to push the pen away from them, so that they don't poke themselves in the hand!
2. Stuff a cotton ball into the hole using the ballpoint pen to help. The cotton ball should plug the hole completely.
3. Add 2 tablespoons of clean sand to the cup.
4. Add 2 tablespoons of activated charcoal to the cup. It should form a layer on top of the sand.
5. Carefully add another tablespoon of clean sand on top of the charcoal.

TEST #2: THE CHARCOAL AND SAND FILTER

1. Place a small, empty, paper cup on the table. Write *Test #2* on the side of the cup using the ballpoint pen.
2. Put your filter stand over the top of the smaller cup. The small cup should fit inside. The small cup should be right side up, and the filter stand cup should be upside down.
3. Place your charcoal and sand filter on top of the filter stand, so that the hole with the cotton in it is centered over the hole in the top of your filter stand.
4. Stir your dirty water with the wooden craft stick.
5. Fill the small paper cup labeled *Sample* half-full with the dirty water.
6. Pour the dirty water from the small cup labeled *Sample* slowly onto the charcoal and sand filter.
7. Observe (through the side of the filter stand) the water after the filtration process is complete to see what happens to the water. If you added a fragrant oil, wave your hand over the top of the cup to bring any odors to your nose. Do not place your nose or face directly over the top of the cup. Can you smell the fragrant oil, or was it removed from the filtered water?
8. Record your observations in the "What Did You Observe?" table.
9. Thoroughly clean your work area and wash your hands. Dispose of all liquids down the drain. All solids and cups must be placed in the trash.

Try This...

Try using dirt in place of the sand in the filter. What is the difference between dirt and sand? Which one works better? Try using a coffee filter. Does it work more like the sand filter, or more like the charcoal filter?

What Did You Observe?

	Test #1 Using the Sand Filter	Test #2 Using the Sand and Charcoal Filter
Water Color before Filter		
Water Color after Filter		

1. Was there any difference in the results of the two tests?
2. What did the sand do to the dirty water?
3. What did the charcoal do to the dirty water?

Where's the Chemistry?

Sand is a very good filter for solids like dirt, grass, and trash. It works because the pieces of sand pack very tightly together with only small channels or holes in-between. There just isn't enough room for the pieces of dirt and grass to get through the layer of sand. So in this experiment, the sand was able to keep the dirt and grass from getting through, but the food coloring passed straight through.

Activated charcoal is actually burnt wood that has been dried in an oven. Many different types of chemicals will stick to the surface of activated charcoal. Some people use charcoal filters to clean the water in aquariums. Other people use it to clean the water in their kitchen sinks. If you have a filter on your water faucet at home, it probably has activated charcoal in it.

In the second experiment, the activated charcoal removed the food coloring and the fragrant oil from the water. However, if the same filter were used for more water samples, the food coloring would eventually start to come through. That is because the charcoal can only hold so much food coloring. Once all of the binding sites on the surface of the charcoal are full, the charcoal filter no longer works—there are no places left that can hold any more food coloring or oil. That is why you should replace the filter in your aquarium once a month.

Things You Can Do To Conserve Water

1. Do not let the water run while brushing your teeth.
2. Limit your shower to less than 10 minutes or your bath water to less than 6 inches (15 centimeters) deep.
3. Never litter or dump anything toxic, such as paint, pesticides, or motor oil, into storm drains or sewers. This pollution can flow into streams, rivers, or bays and eventually the ocean and pollute water or kill aquatic animals and plants.
4. Encourage your school to adopt a water conservation program.
5. Keep a container of drinking water in the refrigerator instead of letting the faucet run until the water cools down. Running the faucet wastes 3 to 7 gallons (11 to 26 liters) of water per minute.
6. Recycle your wading pool water by using it to water your garden.
7. Collect rainwater to water indoor plants or your garden.
8. Organize a cleanup day at a river or beach in your area.

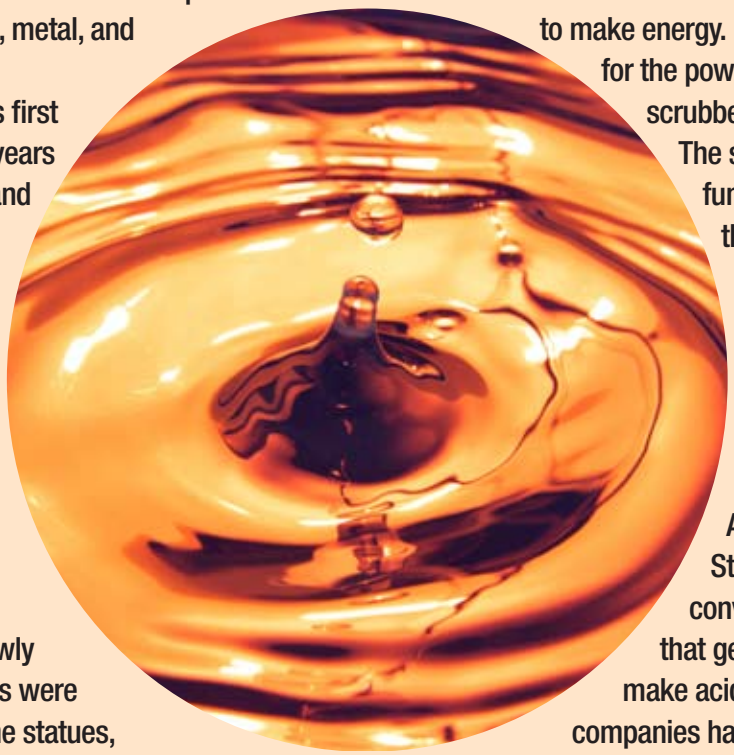
9. Don't use the sprinklers just to cool off or for play. Running through water from a hose or sprinkler is fun, but wastes gallons of water.
10. Be conscious of the clothes you put in the laundry. Wash clothes only when they are too dirty to wear.

Tell your friends and neighbors and ask your parents to help out. Set a good example and see how many ways you can think of to help planet Earth.

What Is Acid Rain?

We all know what rain is. It is water that falls from the sky. But what is acid rain?

Acid rain comes from air pollution. It looks just like regular rain. Although it has very little effect on us, it makes a harmful difference for plants and also eats away slowly at stone, metal, and buildings.



Acid rain is not new. It was first noticed in England about 200 years ago. Most of the cities in England are quite old and have many buildings made of marble. Marble is a beautiful stone that stands up well over time. Many of the statues carved by the ancient Greeks and Romans still stand. But marble dissolves in acid rain. During the late 1800s, people began to notice that marble statues and carvings were slowly starting to dissolve. Fine details were gone, and larger features on the statues, such as noses and ears, were disappearing.

Scientists turned to chemistry for the answer. By testing rainwater, they were able to figure out that it contained an acid and that the acid was reacting with the statues. At that time, most people used coal to cook their food and stay warm through the winter. The coal that they used had a lot of sulfur in it that burned to form sulfur dioxide. The sulfur dioxide floated up into the air with the smoke from the fire and mixed with water vapor in the clouds. When sulfur dioxide and water mix in air, they react to make sulfuric acid. The sulfuric acid stays mixed in the water vapor and falls to the ground as acid rain. Acid rain can also come from other sources, such as exhaust fumes from cars and other gas-powered engines.

Acid rain also affects plants and animals. Along the east coast of the United States, where acid rain is a problem, some trees have begun to lose their leaves or needles. New trees have also been slow to grow, and in some places few seeds are able to sprout. Ponds and streams have also been contaminated, which causes problems for fish.

In the United States, most of the pollution that causes acid rain comes from electric power plants that burn coal to make energy. Recently, chemists working for the power plants have begun to install scrubbers on the coal furnaces. The scrubbers wash the exhaust fumes with water to remove the sulfur dioxide. Some other pollutants remain, but the amount of pollution produced has been greatly reduced.

Acid rain-producing pollution from cars has also been reduced in recent years. All new cars sold in the United States must have a catalytic converter installed. It is a device that gets rid of the pollutants that make acid rain. Chemists at gasoline companies have also been working hard to invent and develop detergents and other additives that keep car motors clean on the inside. Cleaner engines work better, use less fuel, and produce less pollution. We can help prevent acid rain in many different ways. For example, we can encourage adults to switch from gas-powered lawn mowers and leaf blowers to tools powered with renewable energy such as solar panels. Last year, gas-powered lawn mowers produced about one-tenth of the air pollution in the United States. We can also encourage people to walk, carpool, or take public transportation. Finally, we can look for cleaner-burning fuels. Chemists and engineers are developing new technologies, such as hydrogen-fueled cars, gas/electric hybrids, and more efficient electric motors.

If we all do our part, we can make the planet a better place to live, and we can ensure that future generations will have clean air, water, and soil.

Words to Know

1. **Aquifers** are underground areas that hold water in the gaps between rock, sand, or gravel, sort of like an underground lake or stream.
2. **Potable water** is water that is safe for use by humans and other animals.
3. **Water** is called the "universal solvent" because it dissolves more substances than any other liquid. This means that wherever water goes, either through the ground or through our bodies, it carries along various substances such as minerals and nutrients. Like everything else in the world, water is a chemical. Its formula is H_2O, which means it is made up of two hydrogen atoms and one oxygen atom.
4. **Water cycle** describes the existence and movement of water on, in, and above the Earth.
5. **Groundwater** seeps into the ground and becomes a source of drinking water.
6. **Water vapor** is water in the form of a gas; water in this form condenses to form clouds.
7. **Surface water** is found on the surface of the Earth, including rivers, streams, lakes, ponds, and oceans.
8. **Watershed** is the land area that drains water to a particular stream, river, or lake. For example, the part of a mountain range whose streams drain into a river below would be that river's watershed.
9. **Hydrologists** are scientists who study the movement, distribution, and quality of water throughout the Earth, working in the fields of earth or environmental science, physical geography, or civil and environmental engineering.
10. **Water recycling** is the reuse of treated wastewater for purposes other than drinking, such as irrigation and manufacturing.
11. **Fresh water** is the water from rain, hail, and snow that flows in streams and rivers and is not salty.
12. **Water table** is the highest point at which groundwater is found in any terrain.

Wondering about Water

What if water did not have all of its special properties? In what ways would the world be different? Think about how strange the world would be if water were different.

Think about These Things:

What if water was sticky and adhered to many substances?

- How well would windshield wipers work?
- How easily could you dry off after a swim?
- What would happen when it rained?

What if water was not very cohesive, and did not stick to itself easily?

- Could you pour a glass of water?
- How big would puddles be?
- Could plants survive?

What if water did not dissolve things?

- Could you make a glass of sweetened tea?
- Could you wash with soap?
- Would ocean water be salty?

What if ice sank in water?

- Could aquatic plants and animals live through a cold winter?
- How long would you have to wait to go ice-skating in the winter?
- Would there be liquid water to drink in a cold winter?

What if water did not have cohesion and adhesion?

- Would water bugs sink?
- Could we drip drops from an eyedropper?
- Would we need to use detergent to make bubbles in water?

Celebrating Chemistry

is a publication of the ACS Department of Volunteer Support in conjunction with the Committee on Community Activities. The Department Volunteer Support is part of the ACS Division of Membership and Scientific Advancement. Four editions of *Celebrating Chemistry* will be available for the 2011 celebration of the International Year of Chemistry (www.acs.org/iyc2011). Limited copies are available free of charge through your local section's Chemists Celebrate Earth Day and National Chemistry Week Coordinators.

International Year of CHEMISTRY 2011

What is the American Chemical Society?

The American Chemical Society (ACS) is the largest scientific organization in the world. ACS members are mostly chemists, chemical engineers, and other professionals who work in chemistry or chemistry-related jobs. The ACS has more than 161,000 members. Most ACS members live in the United States, but others live in different countries around the world. Members of the ACS share ideas with each other and learn about important discoveries in chemistry during meetings that the ACS holds around the United States several times a year, through the use of the ACS website, and through the journals the ACS publishes.

The members of the ACS carry out many programs that help the public learn about chemistry. One of these programs is Chemists Celebrate Earth Day, held annually on April 22. Another of these programs is National Chemistry Week, held annually the fourth week of October. ACS members celebrate by holding events in schools, shopping malls, science museums, libraries, and even train stations! Activities at these events include carrying out chemistry investigations and participating in contests and games. If you'd like more information about these programs, please contact us!

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The activities described in this publication are intended for elementary school children under the direct supervision of adults. The American Chemical Society cannot be responsible for any accidents or injuries that may result from conducting the activities without proper supervision, from not specifically following directions, or from ignoring the cautions contained in the text.