ECOLOGY

Water Water Everywhere

In this packet we'll learn more about
the **amount of fresh water available** on Earth -
how water is treated to make it drinkable, -
and what we can do to **conserve** our precious resource.

Here are the activities we'll do as we investigate:

1. Water World: The water available on the Earth's surface and the amount available as freshwater.
2. Surface tension, parts 1 and 2
3. Building an aquifer.
4. Nature's water cycle.
5. Cleaning up Your Act – Water Conservation

The experiment kit contains:

1. (3) 9oz.plastic cups
2. (1) paper cup for "rainmaker"
3. (2) 1 gallon self sealing plastic bags
4. medicine cup
5. coloring sheet for water world demo
6. 1 piece modeling clay (enough for 2" pancake)
7. 1/4 cup white play sand
8. 1/3 cup aquarium gravel
9. paper clip
10. plastic pipette

****You will also need these things, they are not in your kit****

1. Sunny window
2. blue, red and green coloring pencil
3. red and blue food coloring
4. empty washed 1 gallon milk jug and a 1-cup measuring cup
5. small amount of cooking oil
6. dish washing liquid
7. ceramic mug to fit inside large bowl inside plastic bag
8. permanent marker
9. yard or garden dirt (several teaspoonfuls)

Water World

The surface of our planet, Earth, is seventy-five percent water. All life on Earth from the largest whales to the tiniest insect depends on water to survive. Every living organism is composed of more than sixty-percent water. We use water to drink, cook, manufacture good, grow crops, produce energy, transport items, and for recreation. Ninety-seven percent of all the water on Earth is salt water. Salt water cannot be used to maintain terrestrial (land) plants, including food crops. It is also not a suitable source of water for most animals. Only 3% of the Earth's surface is fresh water. Two thirds of the fresh water is in frozen form as glaciers, ice caps and snow. This leaves only about 1% of all the water on Earth to meet our needs for fresh water.

The amount of water available on Earth is **finite** and essentially the same water has been moving through the water (also called the **hydrologic cycle**) cycle since the beginning of time. We are using the same water that was used by dinosaurs and our great-great grandparents!

What you need: the coloring sheet on the next page your handout

What to do:

1. The sheet is divided up into 10 x 10 rows of blocks.
2. **Color 97 of the blocks all blue.** This represents the amount of salt water on the Earth's surface.
3. **Color 2 of the remaining blocks red.** This represents the amount of freshwater in glaciers, polar ice caps, rivers, lakes, ponds, plants and clouds.
4. Now **color the last remaining block green.** This represents the amount of freshwater available to us as drinking water.

COLORING SHEET WILL GO HERE

Bathtub Demo

You can **conserve** water by doing this experiment at bath time and using warm water. (Don't forget to close the drain!)

What you need:

1. Clean 1 gallon container, like a milk jug (which is not in your kit).
2. Bath tub or container which can hold 10 gallons of water easily.
3. 1 cup measuring cup
4. 1 gallon plastic bag or large bowl
5. Small plastic cup
6. Plastic pipette

What to do:

1. Measure out **10 gallons of water**, one at a time and pour into the bathtub. This represents all the water on earth, about 77 trillion gallons per person. That's 77,000,000,000,000 gallons a person!
2. Open your plastic bag or bowl and while holding one side open take **4 and one half cups** of water from the tub and place in the bag. This represents the amount of **freshwater** available. All the rest of the water in the tub is the volume of **salt water** on the earth.
3. Take your measuring cup and fill it to the brim from your freshwater bag or bowl. All the rest of the water in your bag or bowl represents the amount of water that is frozen in glaciers and ice caps. Only the **cup of water** in your hand is what is available as fresh water from all the water on earth. But guess what? Not all of it is drinkable.
4. Using your pipette, remove **10 drops** from your one cup of freshwater and place it in the small plastic cup. This represents the only clean drinking water we have available. All the rest of the water in the cup is water that is trapped beneath the earth, is too contaminated too drink, or is in some other use like in lakes and ponds, rivers, soil, plants, and clouds. It may look like a small amount but it actually represents about 232 thousand gallons per person.

What is happening?

We see water everywhere around us.

Name some of the places you see water everyday.

Did you include puddles and clouds, plants and lakes?
We can get water from our faucet at home and water fountain at school. Some water we use to drink and some we use for other purposes like bathing, washing clothes and dishes…

Have you been to the beach or ocean?

What was the water like? Could you drink the water if it was salty?

Try this one…

Can plants use salty water? Set up an experiment using two flowers. Place one flower in fresh water and the other is water that contains a teaspoon of salt. Record the daily changes. Is salty water good for growing plants?

Surface Tension - part 1

A drop of water is small, but it is made of even smaller parts called molecules. Water molecules have bonds that hold them together. At the surface of the water, the molecules hold on to each other even more tightly because there are no molecules pulling on them from the air above. As the molecules on the surface stick together, they form an invisible "skin" called surface tension.

Water striders and other insects can walk on water without sinking. The surface tension is strong enough to hold them. The insects' feet make dents in the surface tension, but it doesn't break. Here are some experiments to show that surface tension is there, even if you can't see it.

What you need:

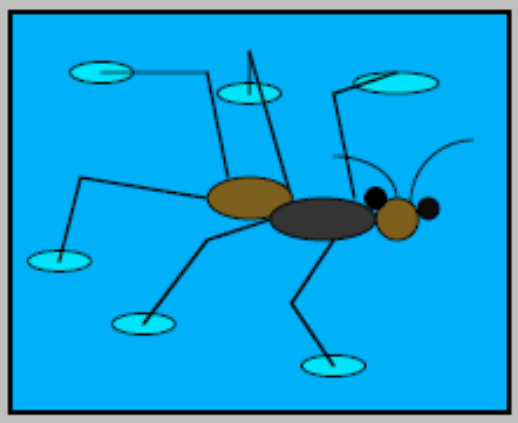
- cooking oil
- water

What to do:

1. Rub a few drops of cooking oil on your hand.
2. Let water from a faucet (tap) run over your hand then turn off the faucet. What happens?

3. Wash your hands with soap. Does this make the oil go away?

WATER STRIDERS



Water strider on the water.

Water striders are insects that glide on the water's surface. Their legs stay on top of the water through surface tension. Air is trapped on hairs at the ends of the legs of the water striders, keeping their legs from falling into the water. If you look at one floating on the water, it looks like the ends of its legs are resting on little floating pads. These are actually small dents in the surface of the water made by the weight of the insect pushing down. Water bugs help the ecosystem. Some eat algae, which helps keep the amount of algae from becoming too high. They also provide food for other creatures .

by Andrew McCreight

How it Works:

The water molecules stick together tightly and will not mix with the oil on your hand. Since water molecules are attracted to each other so strongly, they formed small balls or drops which rolled over your oil coated hand. There is an invisible "skin" of surface tension around each drop.

Soap molecules are attracted to both water and oil. One end of the soap molecule sticks to oil, the other end sticks to water. The soap breaks up the surface tension and keeps the oil drops mixed in with the water so that the oil can wash off your hand.

Surface Tension - part 2

Sometimes detergents (soaps) get into creeks or lakes. This could happen if people use too much soap to wash their cars. The water washes down the street, into street drains, and into a creek or lake. Once in the creek or lake, detergent could destroy the surface habitat.

What you need:

- a plastic cup (free of detergent)
- paper clip
- fork or tweezers
- liquid dish detergent

What to do:

1. Fill the bowl with water.
2. Put a paper clip on the times of the fork, or hold it with the tweezers. Gently place the paper clip on the surface of the water. Be patient and careful. You will be able to get the clip to sit on top of the water! Can you see the surface tension bend under the paper clip?

3. Add one or two drops of detergent to the water near (not on top of) the paper clip. What happens?

What is happening?

The paper clip was resting on top of the surface tension. This "skin" supported the clip and kept it from sinking. When you added detergent, the soap weakened the attraction the water molecules had for each other. This caused the surface film to disappear. Then the paper clip sank.

Building an Aquifer

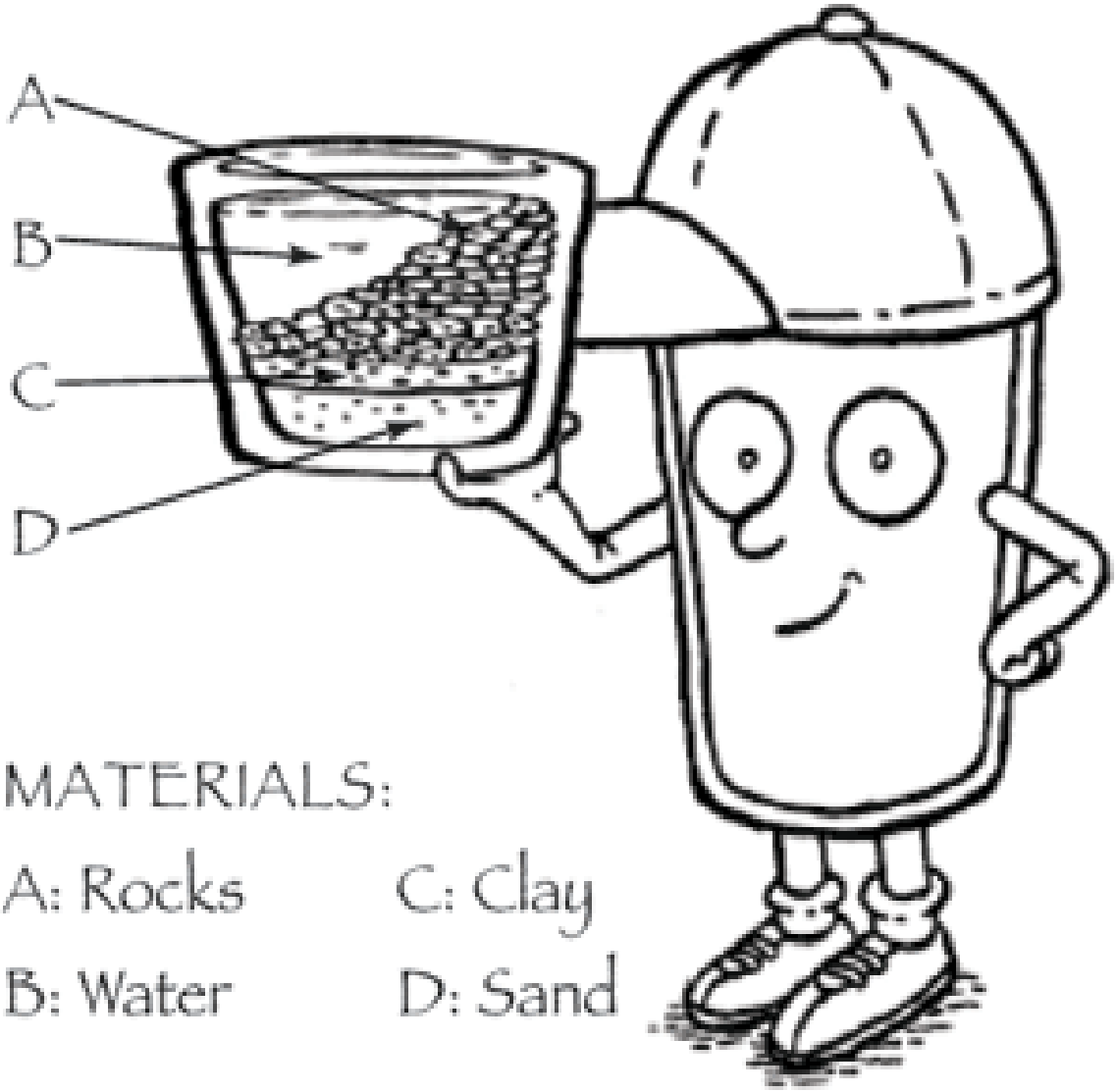
When rain falls, it is collected below the earth's surface and forms the lakes and water tables we need for drinking water. Many people get their drinking water from underground sources called aquifers.

Water suppliers or utility companies often drill wells through soil and rock into aquifers for the ground water contained therein to supply the public with drinking water. Sometimes people have their own private wells drilled on their property.

Unfortunately, ground water can become contaminated by harmful chemicals, such as lawn care products and household cleaners that were used or disposed of improperly, and any number of other pollutants, that can enter the soil and rock, polluting the aquifer and eventually the well. Such contamination can pose a significant threat to human health. The measures that must be taken by well owners and water plant operators to either protect or clean up contaminated aquifers are quite often costly.

What you need:

1. clear plastic cup
2. 1 piece of modeling clay or floral clay that will allow a 2" flat pancake to be made for their cup
3. White play sand
4. Aquarium gravel
5. Red food coloring
6. small paper cup w/ holes – a "rainmaker"



What to do:

1. Pour the white sand in the bottom of each cup completely covering the bottom of the container. Using your rainmaker, pour a small amount of water into the sand, wetting it completely (there should be no standing water on top of sand). Watch how the water is absorbed in the sand, but remains around the sand particles as it is stored in the ground and ultimately forming part of the aquifer.

2. Flatten the modeling clay (like a pancake) and cover 1/2 of the sand with the clay (press the clay to one side of the container to seal off that side). The clay represents a "confining layer" that keeps water from passing through it. Pour a small amount of water onto the clay. Watch how the water remains on top of the clay, only flowing into the sand below in areas not covered by the clay.

3. Use the aquarium rocks to form the next layer of earth. Place the rocks over the sand and clay, covering the entire container. To one side of the cup, slope the rocks, forming a high hill and a valley (**see illustration**). These layers represent some of the many layers contained in the earth's surface. Now pour water into your aquifer until the water in the valley is even with your hill. See the water stored around the rocks? The rocks are porous, allowing storage of water within the pours and openings between them. You might also notice a "surface" supply of water (a small lake) has formed. This shows a view of both the ground and surface water supplies which can be used for drinking water purposes.

4. Use the food coloring and put a few drops on top of the rock hill as close to the inside wall of the cup as possible. Sometimes people use old wells to dispose of farm chemicals, trash, and used motor oil. These chemicals can show up in the ground water and the drinking water. The color spreads not only through the rocks, but also to the surface water and into the white sand at the bottom of the cup. This is one way pollution can spread throughout the aquifer over time.

What is happening?

The food coloring represented a potential source of pollution to drinking water supplies. Now that you see how water is stored in an aquifer, and how ground water can become contaminated, you can see how this contamination ends up in a drinking water well. Careless use and disposal of harmful contaminants above the ground can potentially end up in the drinking water below the ground.

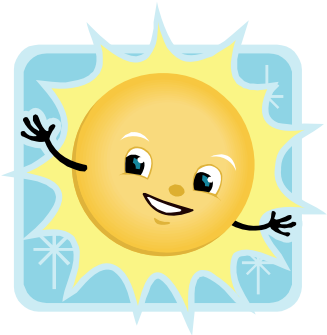
Nature Recycles

The three basic parts of the hydrologic cycle are evaporation, condensation and precipitation. **Evaporation** is the process in which the heat energy of the sun causes the water to change from a liquid to a vapor (gas). **Condensation** is the process of changing from a vapor (gas) back into liquid form. Condensation is what forms clouds. **Precipitation** occurs when water droplets or ice particles from vapor increase in size and fall to the Earth's surface.

What you need:

1. clear plastic cup
2. ruler
3. self sealing bags
4. small container (medicine cup) to fit inside self sealing bag

Evaporation

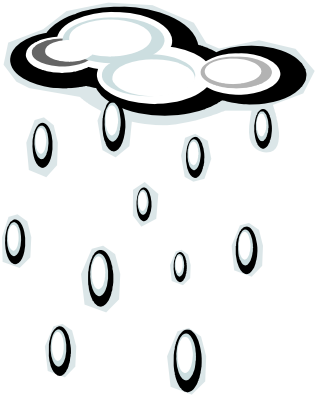


What to do:

1. Fill your cup one-half full of water.
2. Mark the level with a permanent marker.
3. Place the cup on a sunny windowsill.
4. Look at your cup every day. Measure how much water is in the cup, staring from the bottom, and record your data on the data sheet.

What is happening?

The water level in the cup should be less than where it was marked from day one. Why? Where did the water go? The water ***evaporated*** by changing from a liquid to a gas. Have you ever noticed how after a rain shower puddles disappear or get smaller on a sunny day? That is evaporation taking place.



Condensation

What to do:

1. Fill the medicine cup to about one half full with water.
2. Carefully place the cup in the corner of a self sealing bag. Do not spill the water in the cup. Tape the bag at an angle (which allows the cup to be level) to a sunny window.

3. Look at your cup every day. Measure how much water is in the cup, staring from the bottom, and record your data on the data sheet.

What is happening?
The plastic bag should have water droplets formed on the inside of the bag. Where did they come from? The process of ***condensation*** is how clouds are formed.

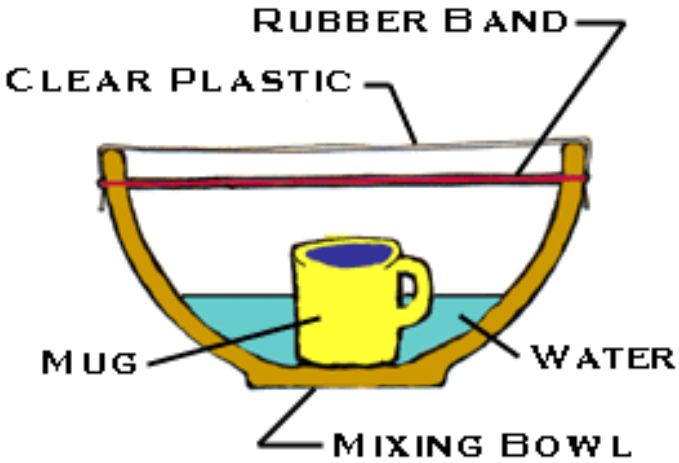
Evaporation and Condensation Data Sheet		
	Evaporation	Condensation
Day 1 water level		
Day 2 water level		
Day 3 water level		
Day 4 water level		
Day 5 water level		
Day 6 water level		
Day 7 water level		

Making your own Water Cycle

Many children in the world today do not have clean water to drink. Some school children in Africa are learning how to clean water with the help of the sun. The sun can also help you to make water cleaner in this demonstration.

What you will need:

1. A small amount of dirt (just a couple of teaspoons) mixed into 3 cups water.
2. Bowl large enough to hold mug and water.
3. Ceramic mug that will fit inside a bowl.
4. Self sealing plastic bag.
5. Small pebbles
6. Sunny location

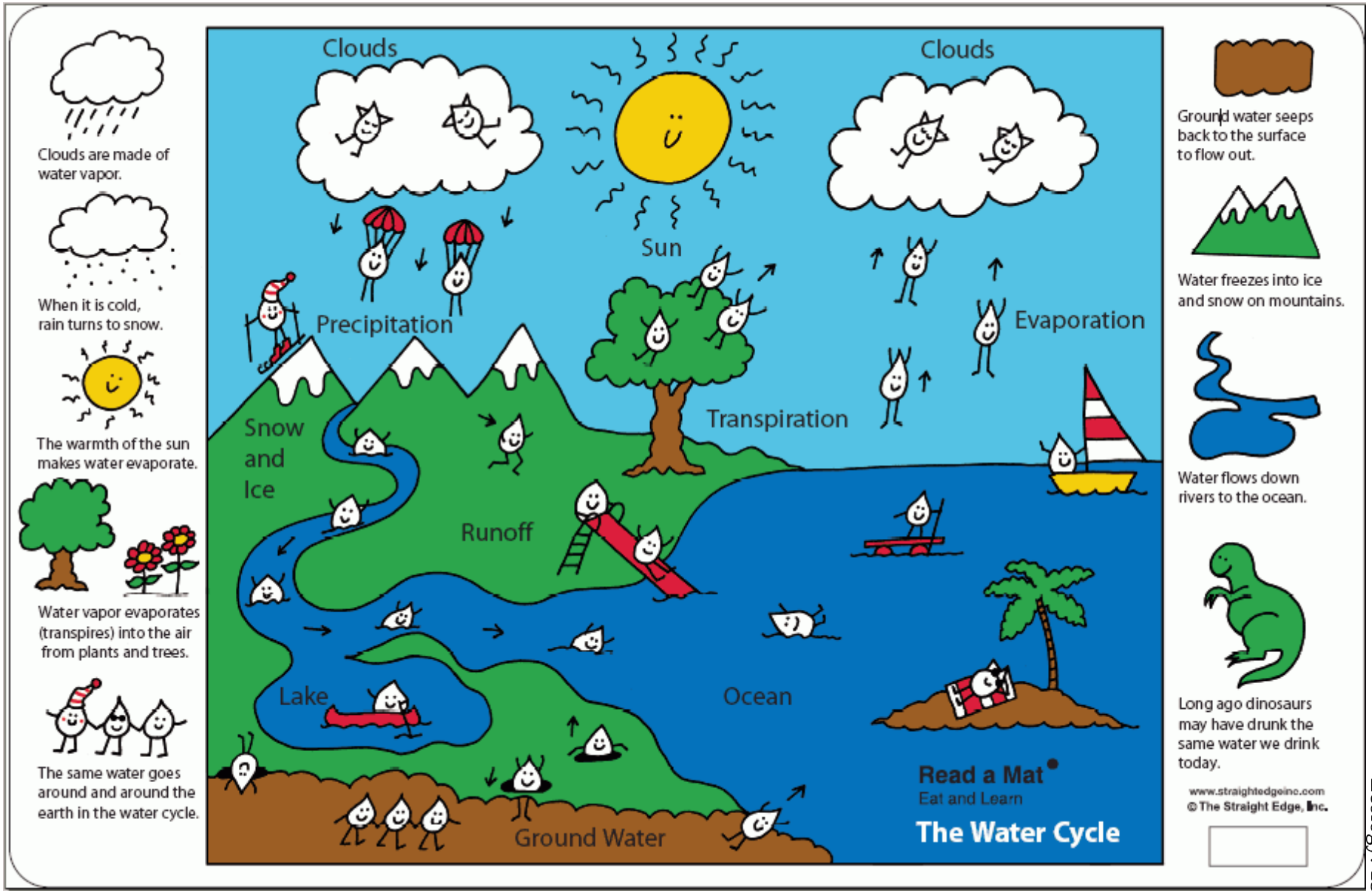


What you need to do:

1. Carefully pour the dirty water into the bowl.
2. Set the collection cup (mug) into the muddy water without getting any water inside.
3. Place the bowl into the plastic bag or cover with plastic wrap and seal shut.
4. Set in sunny location.
5. Place a few small pebbles on top of the bag directly over the mug.
6. Watch for clean water to collect at the top surface of the plastic bag and drip into the collection mug below.

What is happening?

The sun warms the dirty water. As the water evaporates and forms a gas it rises to the upper surface of the plastic bag. The water forms droplets when it condenses as it touches the bag. The droplets fall as precipitation from the lowest point on the bag surface and collect in the small cup below.


Clouds are made of water vapor.
When it is cold, rain turns to snow.
The warmth of the sun makes water evaporate.
Water vapor evaporates (transpires) into the air from plants and trees.
The same water goes around and around the earth in the water cycle.
Clouds
Sun
Clouds
Precipitation
Evaporation
Transpiration
Snow and Ice
Runoff
Lake
Ocean
Ground Water
Ground water seeps back to the surface to flow out.
Water freezes into ice and snow on mountains.
Water flows down rivers to the ocean.
Long ago dinosaurs may have drunk the same water we drink today.
www.straightedgeinc.com
© The Straight Edge, Inc.
Read a Mat
Eat and Learn
The Water Cycle

Conservation-Cleaning up your act!

We use about 50 gallons of water in our homes each day, but only 1% (approximately two quarts) is used for drinking. Because people usually think water is plentiful and renewable, many of our uses of water are wasteful. Seventy five percent of home water use occurs in the bathroom. There are many ways to change our water use behaviors to use less water.

Conservation

What you need:

1. one plastic cup
2. sink with plug to hold water
3. toothbrush and tooth paste.
4. running water for tooth brushing exercise.
5. large plastic bag to measure tooth brushing water from demo

What to do:

1. Fill the cup with water. This is the water you will use for brushing your teeth. Do not turn the faucet back on while you are doing your experiment.
2. Close the sink drain.
3. Wet your toothbrush by dipping into the cup of water.
4. Apply toothpaste and brush your teeth.
5. Use the water in the cup for rinsing your mouth and toothbrush.
6. Look at the amount of water collected in the sink.
7. Empty the sink by opening the drain.
8. **Close** the sink drain again.
9. This time brush your teeth the way you normally would with the faucet running.
10. **Careful not to overfill the sink!!!**
11. Place your collection bowl on the counter. Use your cup from the earlier demonstration to scoop out water from the sink into the bowl.
12. Empty the sink basin by scooping out the water one cup at a time and counting as you fill up the collection bowl.
13. You may not be able to get every drop out of the sink. It is not important to count every drop.
14. How many cups did it take to empty the sink?

What is happening?

Which method used less water? Keeping something from being wasted is called ***conservation***. There are lots of ways we can use less water around our homes.

List some of the ways you can think of.

How much water do YOU use?

HOW MUCH WATER DOES IT TAKE TO...

- Brush your teeth? - 2 to 5 gallons
- Wash the car? - 50 gallons
- Use the dishwasher? - 8 to 15 gallons
- Flush the toilet? - 1.5 to 4 gallons (each flush)
- Take a shower or bath? - 17 to 24 gallons
- Run the washing machine? - 35 to 50 gallons (each load)

Interested in learning more about Water Ecology and Conservation???

Credit where credit is due….
The experiments, discussions, and pictures in this handout were taken or adapted from the following websites and books:

1. Environmental Conditions Online for the DFW Metro PLEX (ECOPLEX) (**http://www.ecoplex.com**)

2. EPA's Water Foundation for Kids: **http://www.water-ed.org/kids.asp**
   Thirstin's Water Activity Book for Kids. K-3
   Drinking Water & Ground Water Kids' Stuff 2/7/2007
   http://www.epa.gov/safewater/kids/grades

3. Monroe County Water Authority – Kids Water Fun
(http://www.mcwa.com/kids.htm)

Questionnaire

Were the materials provided appropriate? Yes _____ No _____
Please

explain._____

1. Did you have enough materials for each experiment? Yes_____ No_____

Please

explain._____

2. Did the experiments work? Yes_____ No_____

If not, please

explain_____

3. Please provide any suggestions for improvements or additional

experiments/explanations._____

_____

_____