

Rain Machine (Solar Still)

Student Objective

The student:

- will be able to explain a simple way to desalinate water using solar energy
- will understand the evaporation and condensation process, and relate it to the water cycle on Earth

Key Words:

condensation
desalinization
evaporation
purify
solar still

Materials:

- bowl (one per group)
- plastic cup, 1" shorter than sides of bowl or cut to size (one per group)
- clear plastic food wrap
- tape or rubber band large enough to go around bowl (one per group)
- small rock or weight (one per group)
- salty water

Time:

1 hour to build still and discuss

Background Information

Stills are commonly used to purify liquids. Through the process of distillation, non-volatile impurities can be separated from the liquid. Distillation can be a simple process—heat is first added to a liquid to evaporate it and produce a gas or vapor, then heat is removed from the vapor to condense it back to a liquid.

A solar still uses the greenhouse affect to trap energy from the Sun. The solar still is a model of the water cycle on earth: evaporation, condensation, precipitation.

Procedure (prior to class)

1. Make a solar still as an example to the class.

Procedure (during class)

1. Lead the class in a discussion of desalination. Questions that might be asked:
 - Have you ever tasted salt water? Can we drink it?
 - How could we make seawater drinkable? (*Take the salt out of it*)
2. Tell the class that they are going to experiment with a ‘solar sill’, a simple way to use evaporation to make salty water drinkable.
3. Divide the class into working groups of 2 - 3 students per group.

4. Explain the procedure to the class:
 - salty water will be put in the bowl
 - the cup will be placed in the middle of the bowl
 - plastic wrap will be pulled tightly over the top of the bowl and secured with either a rubber band or tape
 - a weight is put in the center of the plastic wrap above the cup so that the evaporated water will drip into the cup.



5. Pass out the materials.
6. Help students during the construction process.
7. Place the solar stills in full sun.
8. Write “evaporation” on the board. Lead a discussion on what evaporation is and when they have seen it occur.
9. Check the still’s progress as often as you desire, in ½ hour increments. Point out the small water droplets on the inside of the plastic wrap. Solar stills can be left out for several days if desired.
10. Taste the water in the cup. Ask the students if it tastes different than their tap water (*yes*). Why does the water taste different than tap water? Lead a discussion of evaporation and desalination.

Further Research

1. Is rain colorless? Try your solar still with colored water or tea. Does the color evaporate and condense into the center container?
2. Can you use a still to remove the water from a solution? Is there water in your milk (or juice)? Put milk or another liquid in your solar still and see what happens.
3. Put together a classroom terrarium (with a lid) to make further observations about the water cycle.

Related Reading

- ***Down Comes the Rain (Let’s-Read-and-Find-Out Science 2)*** by Franklyn Branley and James Hale
This book is a concise and informative look at the water cycle. Branley provides a fundamental understanding of how water is recycled, how clouds are formed, and why rain and hail occur. A few easy science activities are included.

- **Hydro's Adventure Through the Water Cycle** by Randi Goodrich and Michael Goodrich
This book tells the story of Hydro, a wise and whimsical water molecule who travels through a never-ending water cycle crisscrossing the skies, sliding down mountains, and evaporating into a cloudy mist. Deftly embedded within the text of a charmingly told tale is basic information on how the earth's water cycle works; who is affected by the earth's water cycle; and the challenges that confront the water cycle.

Internet Sites

http://www.atmos.washington.edu/k12/pilot/water_cycle/index.html

Water: A Never-Ending Story. Student friendly information on the water cycle that starts out by asking if we are drinking the same water that the dinosaurs drank.

<http://kids.earth.nasa.gov/droplet.html>

NASA kids site. Droplet and the Water Cycle game—get Droplet safely from the forest out to the sea where the Sun can warm him and help him get back to the clouds.

<http://www.swfwmd.state.fl.us/education/splash/>

Splash: Water Resources Education by the Southwest Florida Water Management District includes lesson plans, fact pages and a game.

EnergyWhiz

Create a piece of art or write a poem or skit about the water cycle. Submit your art to the EnergyWhiz website (**<http://energywhiz.com/>**) and we will send you an EnergyWhiz t-shirt!

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			.1	.2	.3	.4	.5	.6
Energy	Standard 1	SC.B.1.2-	X	X	X	X		X
	Standard 2	SC.B.2.2-						
Processes that Shape the Earth	Standard 1	SC.D.1.2-			X			
	Standard 2	SC.D.2.2-						
Earth and Space	Standard 1	SC.E.1.2-			X			
	Standard 2	SC.E.2.2-						

Benchmark SC.B.1.2.1 - The student knows how to trace the flow of energy in a system.

Grade Level Expectations

The student:

Fourth

- knows how to trace the flow of energy in a system

Fifth

- knows how to trace the flow of energy in a system.

Benchmark SC.B.1.2.2 -The student recognizes various forms of energy.

Grade Level Expectations

The student:

Third

- knows objects that emit heat and light
- knows different forms of energy.

Benchmark SC.B.1.2.3 - The student knows that most things that emit light also emit heat.

Grade Level Expectations

The student:

Third

- knows that the Sun provides energy for the Earth in the form of heat and light.

Benchmark SC.B.1.2.4 - The student knows the many ways in which energy can be transformed from one type to another.

Grade Level Expectations

The student:

Fourth

- knows ways that energy can be transformed.

Benchmark SC.B.1.2.6 - The student knows ways that heat can move from one object to another.

Grade Level Expectations

The student:

Fifth

- understands that convection, radiation, and conduction are methods of heat transfer.

Benchmark SC.D.1.2.3 - The student knows that the water cycle is influenced by temperature, pressure, and the topography of the land.

Grade Level Expectations

The student:

Third

- understands the stages of the water cycle

Fourth

- understands how the water cycle is influenced by temperature and land features.

Benchmark SC.E.1.2.3 - The student knows that the Sun is a star and that its energy can be captured or concentrated to generate heat and light for work on Earth.

Grade Level Expectations

The student:

Fourth

- knows how the energy of the Sun can be captured as a source of heat and light on Earth.

Rain Machine (Solar Still)

condensation - a reduction to a denser form as from steam to water

desalinization - process of removing salt and other chemicals and minerals from water

evaporation - process of changing into vapor

purify - to remove undesirable elements or impurities

solar still - a device that uses solar energy to evaporate a liquid

Rain Machine (Solar Still)

1. Where did the water droplets on the plastic wrap come from? _____

2. What happens to the rain on the sidewalk after the sun comes back out?

3. What would have happened to the water in the bowl if the bowl wasn't covered with the plastic wrap? _____

4. What energy source was used in this device? _____

5. Where might we apply this idea on a large scale? _____
