Environmental Science Institute
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Solar Still

Adapted by Duc Tran, Environmental Science Institute: December, 2010
Source: "Build a Solar Still" by Peace Corps Coverdell World Wise Schools
http://teachers.egfi-k12.org/lesson-build-a-solar-still/
Grade Level: 3 – 6; may be adjusted for other grades
Time required: Two to three class periods
Sample TEKS:
§112.14. Science, Grade 3: 2A, 2B, 2D, 2F, 3A, 3C, 4A, 8B
§112.15. Science, Grade 4: 2A, 2B, 2D, 2F, 3A, 3C, 5A, 5B, 5C, 7A, 8A, 8B
§112.16. Science, Grade 5: 2A, 2B, 2C, 2D, 2F, 3A, 4A, 5A, 8B
§112.18. Science, Grade 6: 2A, 2B, 3A, 3B, 3C, 3D, 4A

Overview

Human survival is dependent on access to freshwater. Freshwater is not equally accessible in all parts of the globe so the knowledge of scientific principles, such as the water cycle, can be beneficial.

Objectives

Students will be able to generate fresh water from seawater, using the sun as the power source and the natural processes of evaporation and condensation. Students will build and evaluate their model of a solar still. Students will:

1. Describe how water changes from one phase to another through the processes of evaporation and condensation.
2. Investigate and explain how a solar still functions to purify water.
3. Discuss how water distillation can benefit human communities.

Materials (per group of 2 - 3 students)

- Large bowl
- Short glass or cup
- Tape
- Plastic wrap
- Small rock
- Pitcher of water
- Salt
- Spoon
- Liquid measuring cup

Procedure

Day 1 — Introduction

1. Looking at a globe, discuss: *What covers most of the earth? Can we drink all of the water that covers earth? Why not?* Explain that most bodies of water on earth contain saltwater, and only a few bodies of water (lakes, rivers) contain fresh water. Less than 1% of water on earth is usable by humans.

2. Ask students to brainstorm all the places they can think of on earth where there is water. Prompt students to think about less obvious sources (e.g. not in liquid form). Is the water in

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these places freshwater or saltwater? [Possible lists: *Saltwater—Oceans, seas; Freshwater—Lakes, rivers, glaciers, atmosphere/clouds, inside plants/animals; Groundwater (can be saline or fresh).*]

3. Explain that many people get their drinking water from underground. Groundwater is usually pure and good to drink. Near the ocean, however, it can contain too much salt. This can be a problem for people in areas with little access to freshwater.

4. Tell students they are going to see how people in Cape Verde are dealing with this problem. Find Cape Verde on a map; provide some information about the culture and geography. Introduce Nicholas Hanson and Brian Newhouse as Peace Corps Volunteers serving in Cape Verde. If students are unfamiliar with Peace Corps, share some background information (http://www.peacecorps.gov/).

5. View video *Bringing Water from Sol to Soul.* Then discuss: (http://www.peacecorps.gov/wws/multimedia/videos/solarstill/)

- What problem were Nicholas and Brian trying to solve? [remove salt from the groundwater so it would be drinkable]
- What did they do to solve the problem? [built a solar still to distill the saltwater into freshwater]
- How did the solar still work? [The sun heated up the saltwater, causing the water to evaporate, but leaving the salt behind. The evaporated water condensed on a plastic sheet, and turned back into a liquid form containing no salt]

6. Now students are ready to practice distilling saltwater into freshwater. To prepare, teachers should read the activity instructions from PBS Zoom (http://pbskids.org/zoom/activities/sci/solarstill.html). View the demonstration video (www.teachersdomain.org/resource/ess05.sci.ess.watcyc.solarstill1/). Teachers should also determine ahead of time the best placement for the stills in a protected, sunny location. Before students begin, ask them to make predictions such as:

- What do you think will happen?
- Will this solar still be able to turn saltwater into freshwater? If so, how?
- How much freshwater do you think will be produced?
- Where do you think the salt will go?
- How long do you think it will take to distill the water?
- What would make it go faster?

7. Divide students into small groups of 3-4, supplying each group with the materials. Demonstrate how to set up the model solar still.

Activity: Solar Still Construction
A solar still distills, or purifies, water by turning saltwater into fresh water using the sun and gravity. Rays from the sun heat up the salty water in the bowl. When the water gets warm, it evaporates and becomes a gas. When the gas rises and hits the plastic wrap, it turns back into water droplets. Eventually, gravity makes the water droplets roll down the plastic wrap towards the rock. Then the water droplets slide off the plastic wrap into the glass. The salt doesn't

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evaporate, so it gets left behind in the bowl. Water evaporates in the same way from lakes, rivers, and oceans. The water heats up, turns into a gas, and then condenses to fall back down as rain.

Directions:

1. Add salt to fresh water, stirring until the salt dissolves.

2. Pour about two inches of saltwater in a large bowl.

3. Take an empty glass and place it into the bowl. The top of the glass should be shorter than the top of the bowl but higher than the saltwater.

4. Place plastic wrap over the top of the bowl, taping the edges to make sure the seal is tight.

5. Place a weight, such as a rock, in the center of the plastic wrap, suspended over the empty glass. The rock will weigh the plastic down and help the water collect.

6. Carefully transport each solar still to a designated area, preferably outside, in a protected location that receives several hours of strong sunlight.

Day 2: Evaluation

1. Have students retrieve their stills, removing the plastic wrap and observing the water that has collected inside the cup. What happened? How accurate were their predictions?

2. Help students measure the amounts of distilled water collected in the cups and taste the water to see if it still contains any salt.

3. Ask students to posit explanations about what happened. How did the water in the cup become purified? Discuss the processes of evaporation and condensation, and their roles in the distillation process.

4. Refer back to Nicholas and Brian's project in Cape Verde. How did the ability to distill water impact the people in their community? Why is distillation useful to people with limited access to freshwater?

Extensions:

- Students explore further about solar stills; where, and for what purposes are they used? Some students may have built a version of a solar still through a scouting or outdoors program; how did construction differ? What refinements could they introduce to their stills?
- Students examine other techniques for water gathering through the fog collector lesson plan (http://teachers.egfi-k12.org/lesson-water-from-fog/).
- Students research water issues in one of the other countries featured in World Wise Schools' *Water in Africa* (http://www.peacecorps.gov/wws/educators/enrichment/africa/index.html .
- Students can play online animated water cycle games:
    - From the EPA: Thirstin's Water Cycle (http://www.epa.gov/safewater/kids/flash/flash_watercycle.html)

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- From NASA: Droplet and the Water Cycle (http://kids.earth.nasa.gov/droplet.html)