



Title: Make a Solar Still

Grades: Middle School

Subjects: Science, Social Studies

Time: 60 minutes

Standards: Students will...

Science Standard 1: Understand atmospheric processes and the water cycle.

- Benchmark # 7: Know that most of Earth's surface is covered by water, that most of that water is salt water in oceans, and that fresh water is found in rivers, lakes, underground sources and glaciers.

Science Standard 9: Understand the sources and properties of energy.

- Benchmark # 4: Know how the Sun acts as a major source of energy for changes on the Earth's surface (i.e., the Sun loses energy by emitting light; some of this light is transferred to the Earth in a range of wavelengths including visible light, infrared radiation, and ultraviolet radiation).
- Benchmark # 11: Understand the origins and environmental impacts of renewable (e.g., solar energy and non-renewable resources, including energy sources like fossil fuels).

Science Standard 12: Understand the nature of scientific inquiry.

- Benchmark # 3: Design and conduct a scientific investigation (e.g., formulate hypotheses, design and execute investigations, interpret data, synthesize evidence into explanations). Benchmark # 6: Use tools and techniques to gather, analyze and interpret scientific data.

Technology Standard 4: Understand the nature of technological design.

- Benchmark # 5: Implement a proposed design (e.g., organizes materials and resources, makes use of group collaborations, chooses suitable tools and techniques).
- Benchmark # 6: Evaluate the ability of a technological design to meet criteria established in the original purpose (e.g., consider the factors that might affect acceptability and suitability for intended users) suggest improvements, and try proposed modifications.

Geography Standard 16: Understand the changes that occur in the meaning, use, distribution and importance of resources.

- Benchmark # 7: Understand how the development and widespread use of alternative energy sources (e.g., solar, wind thermal) might have an impact on societies (in terms of, e.g., water quality).

Geography Standard 18: Understand global development and environmental issues.

- Benchmark # 1: Understand how the interaction between physical systems and human systems affects the current conditions on Earth (e.g., relationships involved in economic, political, social, and environmental changes; geographic impact of using solar power as a major energy source).

Objectives: Students will be able to...

- Explain the need for creating potable water systems and describe how the process of distillation can be effective in this area.
- Explain the process of distillation and how it works in a solar still.
- Identify solar energy as a major energy source and describe ways in which it helps man and the environment.
- Form and test a hypothesis, observe and record the results, analyze the data collected, and draw logical conclusions.

Materials:

- Bowl (one for each group)
- Plastic cups (at least two inches shorter than bowl)
- Clear plastic food wrap



- Tape or rubber band
- Small rock or weight
- Salty water
- Ruler
- Sunshine
- Journal or "Make a Solar Still" worksheet provided below

Overview: The sun releases heat and light that reach us here on Earth and provides us with an abundance of energy. This solar energy is what makes life on Earth possible. It is a renewable resource, available in inexhaustible amounts, and has many applications. One way is to reclaim water.

A solar still can be used to purify tainted water, removing salts, minerals and other contaminants from it through the process of distillation. Solar stills use energy from the sun to heat water until it reaches evaporation point. During evaporation water vapor rises, condenses and collects on the transparent covering. The condensed liquid drops into a trough, which is separated from the original water source. The end product is purified water.

A solar still can be useful to purify contaminated water sources in remote regions where the water borne disease is a threat, or in processing rainwater or seawater. Solar stills can effectively provide water for a family's drinking and cooking needs anywhere there is sunshine.

Kid's Speak: Stills use a process called distillation to make undrinkable water drinkable. In distillation, heat creates a succession of evaporation and condensation, which separates impurities from water. Solar stills use the same process, but use the sun as a heat source.

Eco-Fact: Each year the sun evaporates about 95,000 cubic miles of water.

Procedures:

Before Making Solar Still:

- Explain to students that 97 percent of the Earth's water is undrinkable. Of the remaining three percent, an additional two percent is frozen in the polar ice caps and in glaciers. This leaves only one percent of Earth's water available to meet people's needs. Inform students they are going to make a device that will use the energy of the Sun to distill salt water and make it suitable for drinking.
- Use the "Make a Solar Still" worksheet provided below for discussion questions, materials, and a still diagram.
- Begin by asking students questions that will get them thinking about desalination. Have student responses lead into a discussion on desalination and solar stills.
- Have you ever tasted salt water? - Can you drink it?
- If you were stranded on an island and the only water available to drink was salt water, how could you drink it?
- After the discussion, divide the class into groups of 2 or 3. Explain that each group is going to make a solar still.
- Show the class a sample of a solar still. Explain to the class the different parts of the still and the purpose of each part.

Making the Solar Still:

- Go over the procedure of building the still:
 - First, put salty water in a bowl.
 - Second, place the cup in the middle of the bowl.
 - Third, cover the bowl with plastic wrap. Wrap an elastic band or tape around the rim of the bowl. It must be airtight.
 - Finally, place a rock or a weight in the center of the plastic wrap.
- Distribute the materials to the class and allow students to begin construction of their stills.



- When stills are finished, have students put their still in a location that receives direct sunlight.
- Have students make a diagram of their still and label each of its parts. Students will also make predictions in their journals about what they think is going to happen in their stills after 30 minutes.

After Making Solar Still:

- After 30 minutes, have students check their stills to look for water drops hanging from the plastic wrap. Observe and measure any water in the cup. Taste the water in the cup. Ask students: How does it taste? Does it taste different from tap water? How effective was the solar still in distill the salt water? Are there any suggestions for improvements?
- Have students record their thoughts and observations in their journals.
- Lead a discussion on evaporation and desalination. Explain to students that the water may have tasted different than tap water because different minerals and chemicals are in tap water.
- Have students evaluate the effectiveness of the still and record any conclusions on the "Make a Solar Still" worksheet provided below.

Adaptations: Younger students can observe the experiment and create a diagram of the process.

Extensions:

- Stills can be observed every 30 minutes to extend the experiment.
- Have students research the different chemicals and minerals in tap water.
- Take a field trip to a waste water treatment facility.