



Title: Make a Solar Oven Written by GEF Staff

Grades: Middle School

Subjects: Science, Social Studies, Language Arts

Time: 60-90 minutes (over two days)

Standards:

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 (e.g., oil, coal, natural gas).

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 # 4: Design a solution or product, (e.g., solar oven) taking into account needs and constraints (e.g., time, properties of materials, safety).
- Benchmark # 5: Implement a proposed design (e.g., organizes materials and resources, plans work, and 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., air and water quality, existing energy industries, manufacturing processes).

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).

Language Arts Standard 1: Use the general skills and strategies of the writing process.

- Benchmark # 14: Write technical text (e.g., identifies essential steps in a logical sequence; list materials equipment needed; describe all factors and variables that need to be considered; use appropriate formatting).

Objectives:

Describe thermal energy in relation to heat. - Evaluate the effectiveness of a working solar oven design.
Develop and implement a design for a solar oven. - Explain the principles behind their design concept in a written format.

Materials:

- Pizza boxes
- Wax paper
- Aluminum foil
- Construction paper



- Clear packing tape
- Glue - Scissors
- Dowel
- Thermometer (One for the class is sufficient.)
- "Pizza Oven Box Directions" worksheet provided below
- Science Journal

Overview: The sun releases heat and light that reaches 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.

In many parts of the world people burn wood and other natural materials for cooking purposes. Cooking in this manner can be time consuming, taking many hours to gather the fuel sources. It can also adversely affect the environment, contributing to air pollution and deforestation; and result in personal health issues, such as respiratory illnesses. Fortunately, solar energy can be used for cooking. Solar cookers, which use the energy of the sun to provide the heat to cook, are Earth-friendly devices that provide a safe, simple and convenient way to accomplish this daily chore.

A solar cooker requires space outdoors in an area that receives sunlight for several hours and that can be protected from the elements. Since dark surfaces get very hot in sunlight, food cooks best in dark, shallow containers with tight covers that retain the heat and moisture.

There are a variety of solar cooker designs. Many of these are quick and easy to build from inexpensive, and easily obtained materials. One of the most common is the solar oven. A solar oven can cook anything that can be cooked in a traditional oven, often requiring less water, salt and sugars. Solar cooking is an effective, efficient and economical way to prepare food.

Kid's Speak: 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. Solar energy can also be used for cooking. Solar cookers use the energy of the sun to provide the heat to cook. They are a safe, simple and convenient. Solar cookers require space outdoors in an area that receives sunlight for several hours and that can be protected from the weather. Solar cookers are quick and easy to build from inexpensive and easily obtained materials. One of the most common is the solar oven.

Eco-Fact: The hottest place on Earth is Dallol, Ethiopia (East Africa).

Procedures:

Before Making Solar Ovens:

- Give a brief review of solar energy and thermal energy.
- Start an open class discussion on thermal energy by asking students why it gets hot in a car and why blacktop gets hot. Explain to students that they are going to use their knowledge of solar and thermal energy to create a working device.
- Explain to students that they are going to create a working solar oven out of a pizza box, wax paper, aluminum foil, construction paper, and clear packing tape.
- Have students design a solar oven using the materials listed above. Then have them create a diagram of their solar ovens in their journals, label the parts and explain the purpose of each part. Using what they know about solar energy, have students explain in their journals their oven design, why they believe it will work, and what factors could affect their oven's productivity (outside air temperature, clouds, wind, sun angle, reflection, and absorption).

Making Solar Ovens:

1. Have students construct their solar ovens using their original design.
2. Once students have completed construction on their ovens ask for volunteers to explain their oven designs and why they think their ovens will work. Have students test their ovens by



checking the temperature they reach after a given period of time. Have them record this temperature in their journals.

3. After the sharing of ideas, introduce students to the step-by-step instructions for the construction of a working solar oven on "Pizza Oven Box Directions" worksheet provided below .

Redesigning Solar Ovens:

- Have students review the instructions and make any adjustments to their designs that they feel are necessary.
- Ask students to record any changes they make to their oven designs and explain why they made these changes.

After Making the Solar Oven:

- In a second session have students use a thermometer to measure the heat their ovens produce now. Which design reached the highest temperature?
- Have students try to bake something in their ovens, such as cookies or English muffins.
- Hold a final discussion on why some ovens worked better than others. Show students designs of large solar ovens and explain their uses and benefits.

Adaptations: The project can be done with 3rd, 4th, and 5th grade students; but, give students at this age the instructions at the start of the project.

Extensions:

- Research the use of low cost solar ovens in third world countries.
- Visit a solar project in your area.
- See other solar lessons on this GEF site.
- For tips on dietary guidelines and healthy eating habits visit the [USDA Food Pyramid](#).