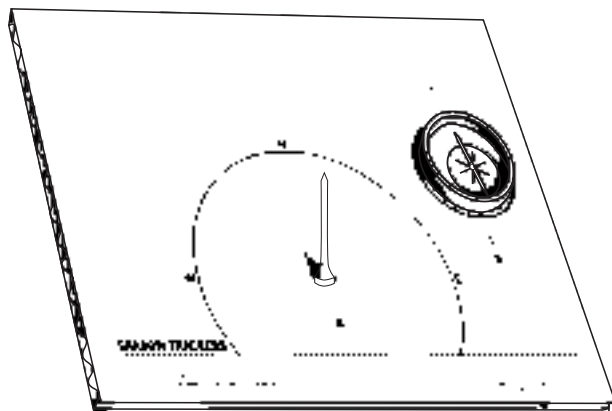


OVERVIEW

SOLAR ENERGY



GOALS

The Solar Energy Module consists of four investigations that allow students to experience solar energy firsthand and to investigate the variables that affect solar-energy transfer.

FOSS EXPECTS STUDENTS TO

- Become aware of the potential of solar energy, an inexhaustible source, as an alternative energy source to fossil fuels, a nonrenewable source.
- Observe differences in size and position of shadows as a result of the relative positions of Earth and the Sun.
- Gain experience using a compass to orient objects on Earth.
- Become proficient in using a thermometer to monitor temperature change in a variety of materials.
- Observe solar-energy transfer in a variety of situations.
- Relate the rate and amount of temperature change to variables involved in energy transfer.
- Design solar water heaters and passive solar space heaters.
- Apply mathematics in the context of science.
- Acquire vocabulary associated with solar energy and energy transfer.
- Use scientific thinking processes to conduct investigations and build explanations: observing, communicating, comparing, organizing, and relating.

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SOLAR ENERGY MODULE MATRIX

SYNOPSIS

SCIENCE CONTENT

THINKING PROCESSES

1. SUN TRACKING

Students observe the changes in shadows over a day and relate the position of the Sun to the shadows. They make and use a shadow tracker to systematically monitor the position of the Sun.

- Shadows are the dark areas that result when light is blocked.
- The length of a shadow depends on the position and orientation of Earth relative to the Sun.
- The lengths of shadows on Earth change as the Sun's position in the sky changes during the day.

- Observe and compare shadows over time.
- Organize information and communicate results.
- Relate the position of the Sun to a shadow's shape and direction.

2. HEATING THE EARTH

Students set up an investigation to find out what happens when the Sun shines on four earth materials: water, sand, dry soil, and wet soil. They relate the differences in temperature change to the properties of the materials.

- Change of energy from one form to another or the movement of energy is called energy transfer.
- Energy from the Sun is absorbed and released by different materials at different rates.
- A heat sink is a material that can absorb a large amount of heat for its volume and release the energy slowly.

- Observe and compare temperature change of different materials over time.
- Organize and communicate results of investigations.
- Relate the rate and amount of temperature change to properties of materials.

3. SOLAR WATER HEATERS

Students investigate ways to capture solar energy to heat water in containers and zip bags. They investigate color, surface area of the collector, and a cover on the heater. They establish relationships between the variables in the solar water heater and the rate of temperature increase.

- The color of the collector in a solar water heater affects the change in water temperature.
- Placing a clear cover on a solar water heater affects the change in water temperature.
- The surface area of the collector in a solar water heater affects the change in water temperature.

- Observe and compare the effect of different colors and covers on solar water heaters.
- Organize data and communicate results on graphs.
- Relate the surface area of a collector to energy transfer.

4. SOLAR HOUSES

Students are challenged to discover the most effective way to heat a house with solar energy. They assemble a cardboard house and investigate variables of window orientation, interior color, heat sink, and insulation. They establish a relationship between the variables in a solar house and the efficiency of the heating.

- The change of energy from one form to another or the movement of energy is called energy transfer.
- A heat sink is a material that can absorb a large amount of heat for its volume and release the energy slowly.
- Insulation can be used in a solar house to maintain its inside temperature.
- Solar energy is energy from the Sun that comes to Earth in the form of light.
- Space heating is the transfer of heat energy to air in an enclosed space.

- Observe and compare the effects of variables on solar-house heating efficiency.
- Use information to build an efficiently solar-heated model house.
- Investigate insulation as a means of holding heat in a space.

Language Extensions

- Collect sun and shadow stories.
- Go on a treasure hunt.
- Describe shadows.

Math Extensions

- Problem of the week.
- Use circles and degrees.

Science Extensions

- Work on day and night.
- Continue tracking.
- Research sundials.

Social Studies Extension

- Research shadow theater.

See the Science Stories folio.

- *The Sun*
- *Shadows*
- *Building Time Devices*
- *Effects of the Sun*

www.fossweb.com

Check the FOSS website for interactive simulations, to write questions to a scientist, for teaching tips, and to talk with other classes using FOSS.

Home/School Connection: Students use a pattern to construct a sundial. They figure out the angle of the gnomon that is appropriate for their latitude.

Language Extensions

- List the effects of heat.
- Write to a TV meteorologist.

Math Extension

- Problem of the week.

Social Studies Extensions

- Research temperatures around the world.
- Find out about Eratosthenes.

Science Extensions

- Investigate other materials.
- Increase the volume.
- Investigate similar masses.
- Investigate direct sunlight.
- Get rid of the air.

See the Science Stories folio.

- *Differential Heating*
- *The Pressure Is On*
- *The Sun, the Ocean, and the Weather*
- *Predicting the Weather*

Home/School Connection: Students take a look at seed packets or seed catalogs to compare how many “sun days” it takes to have the seeds produce.

Language Extensions

- Use *Hot Discussion Topics*.
- Write instructions for a solar water heater.
- List luminous and nonluminous light sources.

Math Extensions

- Problem of the week.
- Graph surface-temperature changes.
- Work with surface area.

Science and Social Studies Extensions

- Research the Sun in history.
- Research solar-energy use in different cultures.
- Visit a greenhouse.
- Test other collectors or use a reflector.
- Investigate photovoltaic cells.

See the Science Stories folio.

- *Solar Technology*
- *Maria Telkes*
- *Solar Cookers in Developing Countries*

Home/School Connection: Students investigate the source of energy used at home to heat water and how their family’s use compares to some average figures. They consider ways to cut down on the use of hot water as a way to save energy.

Language Extensions

- Interview solar users.
- Make a poster ad.
- Research commercial space heating.

Math Extension

- Problem of the week.

Social Studies Extension

- Investigate other cultures and solar energy.

Science Extensions

- Cook with solar energy.
- Research house design.

See the Science Stories folio.

- *Solar Power in Homes*
- *Solar Power from the Wind*
- *Living with a Star*

Home/School Connection: Students will need extra time at home to work on presenting their projects to the class.



FOSS AND NATIONAL STANDARDS

The Solar Energy Module encourages students to develop the skills of investigation in order to build explanations based on knowledge and evidence. This module supports the following National Science Education Standards.

SCIENCE AS INQUIRY

Develop students' abilities to do and understand scientific inquiry.

- Identify questions; design and conduct a scientific investigation to answer those questions.
- Employ tools to gather, analyze, and interpret data.
- Use data to construct reasonable explanations.
- Use mathematics in scientific inquiry.
- Understand that scientists use different kinds of investigations and tools to develop explanations using evidence and knowledge.

CONTENT: EARTH SCIENCE AND PHYSICAL SCIENCE

Develop students' understanding of transfer of energy.

- The Sun is a major source of energy for changes on Earth's surface, including winds that cause weather. The Sun loses energy by emitting light (visible, infrared, and ultraviolet radiation). A tiny fraction of that light reaches Earth, transferring energy from the Sun to Earth.
- Global patterns of atmospheric movement influence local weather. Oceans have a major effect on climate, because water in the oceans holds a large amount of heat.

SCIENCE IN PERSONAL AND SOCIAL PERSPECTIVES

Develop an understanding of types of resources.

- Resources are things that we get from the environment to meet our needs. Some energy resources are nonrenewable, such as fossil fuels; some are renewable, such as wood; some are inexhaustible, such as solar energy.

Develop an understanding of science and technology in society.

- Technology influences society through its products and processes. Technology influences the quality of life. Social needs, attitudes, and values influence the direction of technological development.
- Science and technology have advanced through the contributions of many different people, in different cultures, at different times in history.