

SUN! POWER! ICE! POP! (1 HOUR)



Addresses NGSS

Level of Difficulty: 3

Grade Range: K-2

OVERVIEW

In this activity, students will assess solar power by comparing its effect on rain (water), sleet (ice), and snow (popsicles). Students will observe the temperature changes on these elements and compare the temperature of the elements in direct sunlight with the same elements out of sunlight.

Topic: Solar Energy and Temperature

Real-World Science Topics

- An evaluation of the sun and its properties: its large mass and gas make up, the distance from the sun to the Earth, and the ability of its energy to travel and heat the Earth and our Solar System
- An exploration of the three stages of matter and how the sun (a gas) alters the state of one object (solid) to another (liquid) as well as the sun's effects on the temperature of each
- An exploration of how heat changes the form of a substances and specifically, measures of temperature at which matter freezes, melts, or remains constant

Objective

After completing this activity, students should be able to explain how the sun distributes heat to Earth and make measurable comparisons of how the sun directly affects the melting and warming of an object. Students in grades 2-3 should also be able to describe the three states of matter and temperatures at which ice freezes and melts.

NGSS Three-Dimensions

Science and Engineering Practices	Disciplinary Core Ideas	Crosscutting Concepts
<p>Planning and Carrying Out Investigations</p> <ul style="list-style-type: none">• Make observations (firsthand or from media) and/or measurements to collect data that can be used to make comparisons. <p>Asking Questions and Defining Analyzing and Interpreting Data</p> <ul style="list-style-type: none">• Use and share pictures, drawings, and/or writings of observations.• Use observations (firsthand or from media) to describe patterns and/or relationships in the natural and designed world(s) in order to answer scientific questions and solve problems.	<p>K-PS3-1,2: Conservation of Energy and Energy Transfer</p> <ul style="list-style-type: none">• Sunlight warms the Earth's surface.	<p>Patterns</p> <ul style="list-style-type: none">• Patterns in the natural and human designed world can be observed, used to describe phenomena, and used as evidence.

Constructing Explanations and Designing Solutions

- Use information from observations (firsthand and from media) to construct an evidence-based account for natural phenomena.

Background Information

What are the unique characteristics of the sun that directly impact the conditions and climate on Earth?

The Sun determines the Earth's seasons, weather, climate, and ocean currents. The energy produced at the sun's core gives off all of the light and heat that we receive on Earth.

What are three of the four states of matter and how does one change from one state to another?

Solids, liquids, and gases are known as the three states of matter. They are all made up of microscopic particles, but all behave differently. The gas and liquid each take the shape of the container holding it while a solid does not change its form. A solid, liquid, and gas can adapt and change from its current state to another state when its temperature changes. Plasma is considered the fourth state of matter, but this activity will not address it.

How does heat affect an object and what are the points at which temperature has an effect on an object?

When an object of a certain temperature is heated, the state of that object can change. When a liquid object such as water reaches 32 degrees Fahrenheit, it changes to a solid state or form known as ice. When this is exposed to heat, the solid then begins to melt and becomes a liquid again.

Key Vocabulary

Sun – a star made up of 92% hydrogen and 7.8% helium, which is at the center of the Universe, is held together by its own gravity, and enables life to exist on Earth

Solid – a state of matter whose particles are solid and tightly packed and usually form a pattern

Liquid – a state of matter whose moving particles are close together with no arrangement.

Gas – a state of matter whose particles are well separated with no pattern and are moving at high speeds

Heat – transfer of energy from a system and its surroundings to another system or body

Materials Needed for Activity

You will divide your class into groups of 4 children.

- Chart paper and a marker
- A model of the sun, which can be a sun drawn on yellow construction paper
- A large model of a thermometer
- 6 clear cups for every group
- A bag of ice
- Water (room temperature for hot climate or cold for milder climates)
- 3 Thermometers for each group
- 2 popsicles per group
- Appropriate student handout (Grade K-1 and 2-3 student handouts included)
- Stopwatch or measuring tool for tracking time (Grade 2 may supply these for each group if available)

Teacher Preparation

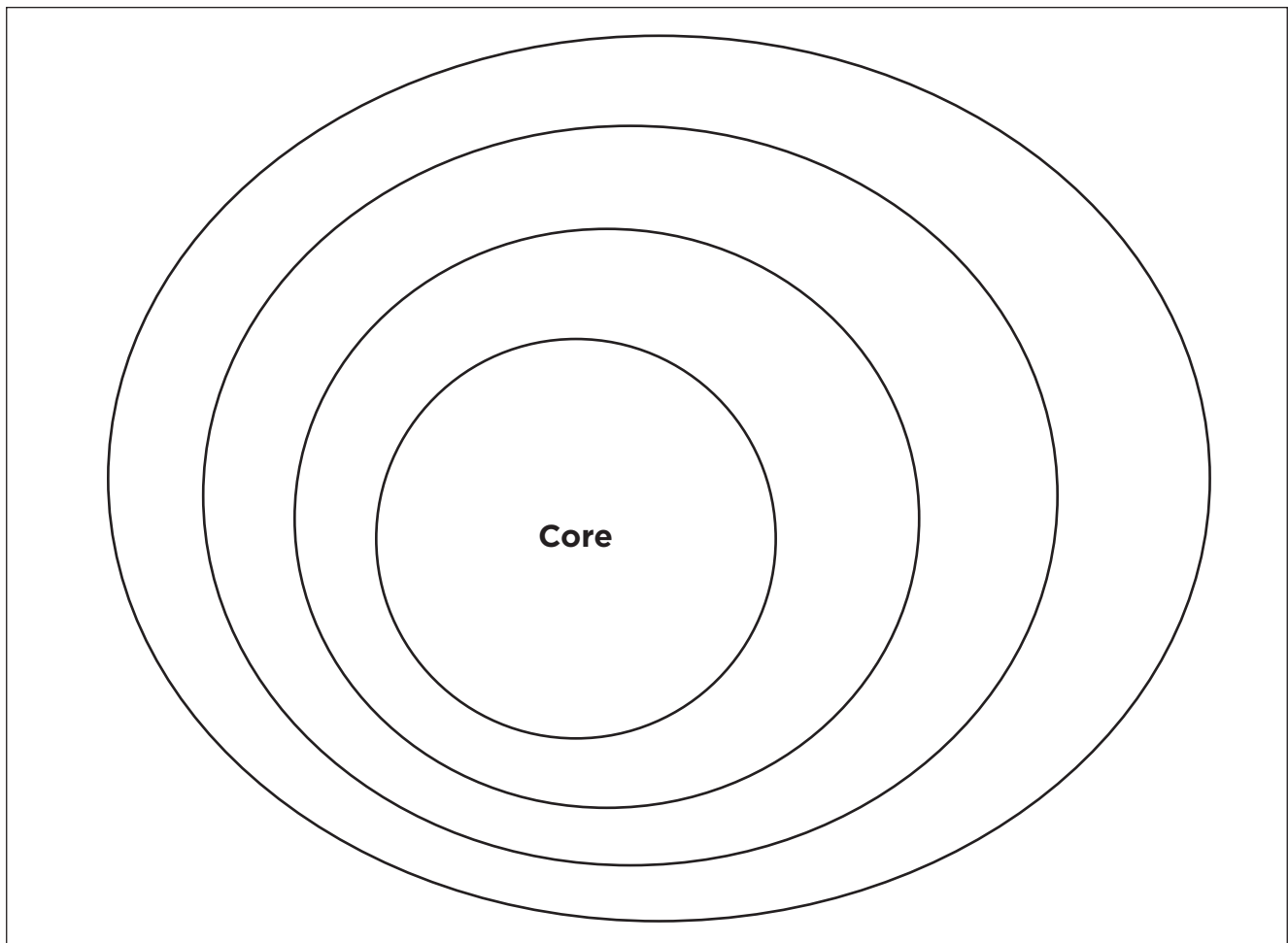
Before students arrive, use a permanent black marker to label six cups for each group of four students. Three cups should be labeled sun-rain, sun-snow, and sun-ice. Label the other three rain, snow, and ice.

On the chart paper, make charts similar to the handouts included.

Have available a cup of water, a popsicle, and a cup of ice for yourself, and one for each group of 4 students.

Draw a model of the sun on construction paper.

1. **Warm-up Activity:** Provide each student with the cut out pictures of the three scenes: snow, ice, and rain. Tell the students to study the pictures, look at what is different about each picture, think about how each event happened, and what caused each event. Then, have each student discuss with a partner his ideas about what is seen in the picture.
2. Once students have discussed the different types of weather depicted in the pictures, share some of their ideas aloud. Possible teacher statements might include, "I heard many students naming the types of weather. I heard someone say, 'This one shows a snowy day.'" Provide praise to the students for their ideas. Tell the students that they all had great thoughts about the three different types of weather in the picture.
3. Say, "Now that we have discussed different types of weather, I'd like to ask you to think about what causes weather changes." Call on a few students to share out loud. If none of the students mention the sun as one of the contributors of weather change, introduce this fact to them now. On a sheet of chart paper, draw the diagram below. As you draw, explain that the sun has several distinct layers. Explain that the gravity of the sun is so strong that it pulls its mass inward. As you explain, draw circles around the sun to depict the motion of the gravity. Tell the students that the gravity creates pressure, which gives off energy and different types of light. This light moves in the form of waves and wind, which travel to heat the Earth.



4. Tell the students that they are going to examine the power of the sun energy called solar energy and how its heat affects the temperatures of rain, ice, and snow. Show the students the cup of water, the popsicle, and the ice and explain what each represents.

Grades K-1: Tell the students to think about what they know about the temperature of the water, ice, and popsicle and share with a friend. Call on a few students to share their ideas.

Grades 2-3: Ask the students to share what they know about temperature and how things freeze or melt. Call on students to share their ideas.
5. Hold up the teacher’s thermometer and explain how the thermometer works. The thermometer has numbers on each side that represent the temperature. It has a red line here, which is actually liquid. When the temperature increases, the liquid expands and moves up to a higher number. The temperature decreases when it cools. Does anyone know the temperature at which something freezes? How about the temperature at which something boils?
6. Explain to the students that they are going to work in groups to measure the temperature of the ice, snow, and rain inside the classroom away from the sun. Then, they are going to compare that with the temperature of the ice, snow, and rain in direct sunlight. Divide the students into groups of four. Then, count off your students 1-4 and assign each student in each group a job. Three of the jobs are to watch each of the three weather groups.

Grades K-1: The final job is to watch the temperature and report to the teacher. The teacher will record the group temperatures on chart paper.

Grades 2-3: The final job is to watch the temperature and record it.
7. Pass out the cups to each group. The teacher will have them record their initial temperatures. Then, the teacher will call out at one minute intervals so the groups can continue to report and record their temperatures.

Grades 2-3: Grades 2 and 3 The group recorder should write it on the Temperature Change Sheet.
8. Next, take the students outside and have them gather into the same groups. Pass out to each group the ice, the rain, and the snow in the cups. Tell them to report and record their initial temperatures. Repeat the steps to continue recording temperature at one minute intervals just as you did in the classroom.

Extension Activity

Collect soda bottles and fill them with ice, leaving enough space to hold a thermometer in each. Make sure the numbers on the thermometer are visible to the outside so the students can read the temperature. Close the bottle with a cap. Divide the soda bottles in half. Place half outside in direct sunlight and put the other half in the classroom away from the window. Measure the beginning temperature of each of the bottles. Have the students record the temperatures. Monitor the bottles over the course of a day. Check the temperature at specific intervals of 20 or 30 minutes. Keep a class chart and record the temperatures throughout the day. For second grade, have each student keep a chart and record the temperatures as they are changing throughout the day. Discuss the results. Ask the students to think about how the temperatures changed in the bottles as compared with the ice in the open cups. Why do they think the speed of the ice melting was different? What does this say about how humans use inventions to protect us from the sun?

Sources

<http://solarsystem.nasa.gov/planets/profile.cfm?Object=Sun&Display=OverviewLong> (teacher resource)

<http://www.chem.purdue.edu/gchelp/atoms/states.html> (teacher resource)

<http://kids.discovery.com/tell-me/space/how-does-the-sun-provide-heat-and-light>

<http://scienceline.ucsb.edu/getkey.php?key=804>

http://www.spaceweathercenter.org/resources/04/famguide_sun.pdf (teacher resource)



Name:

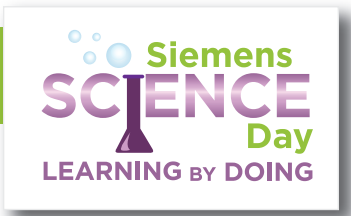
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Sun! Power! Ice! Pop! Temperature Change Worksheet

Record the temperature of the objects in the boxes below.

No Solar Power

	Rain Water	Ice	Snow
Minute Interval	Temperature	Temperature	Temperature
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			



Name:

Date:

Sun! Power! Ice! Pop! Temperature Change Worksheet

Record the temperature of the objects in the boxes below.

With Solar Power

	Rain Water	Ice	Snow
Minute Interval	Temperature	Temperature	Temperature
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			