Nasco education LESSON PLAN

K TO Career solutions

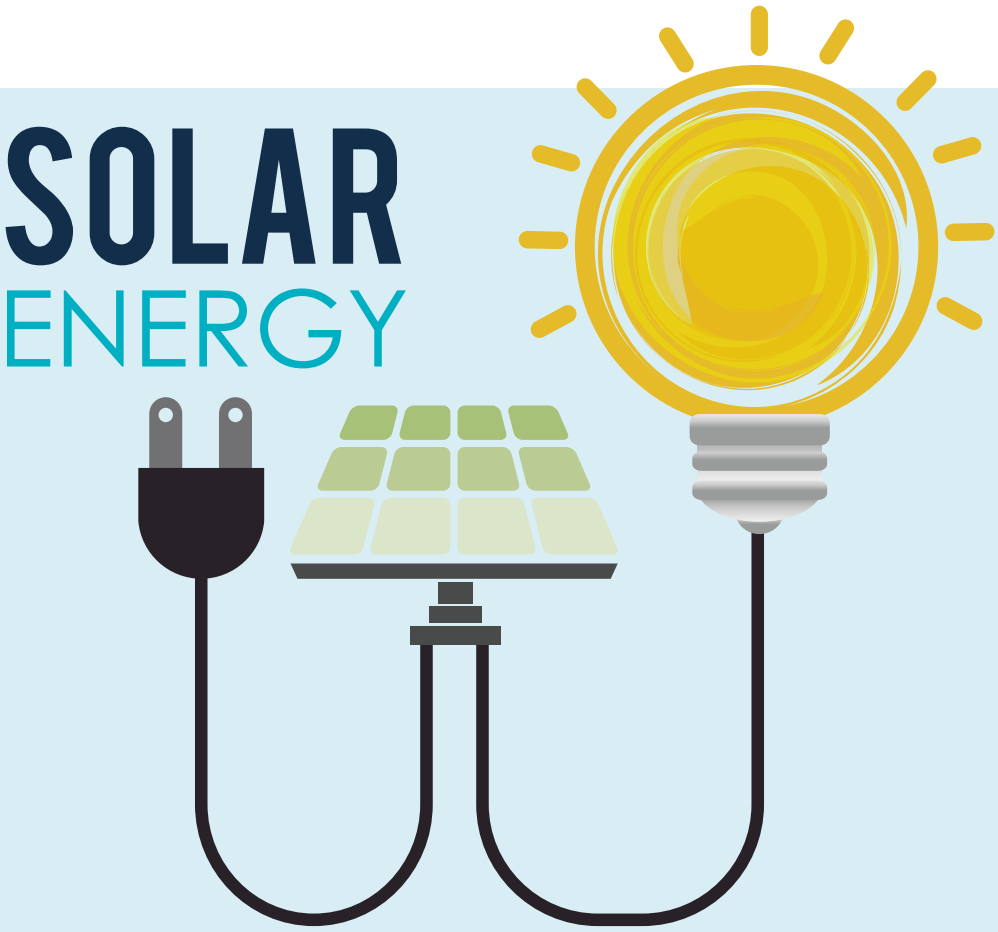
steamworks

VOL. 6

INTRODUCTION TO SOLAR ENERGY

Developed with Kristin Hotter
Grades K–2

Time: 2 hours



STEAM CONNECTIONS

S (Science) Students will gain a basic understanding of solar energy.

T (Technology) Through their understanding of solar energy, students will be able to provide a basic explanation as to how solar panels function.

E (Engineering) Students will design a solar-powered technology of the future.

A (Art) Students will illustrate the above mentioned solar-powered technology.

M (Math) Students will either keep time or count aloud as boats "race." They'll keep track of the data and use it to compare and contrast the performances of each type of boat.

OBJECTIVES

Students will...

- Be able to act out how solar energy moves through a solar panel
- Be able to compare and contrast the performance to various solar-powered boats
- Be able to apply their understanding of solar power to sketch an idea for a way solar power could be used in the future

LEARNING STANDARDS

K-PS3-1. — Make observations to determine the effect of sunlight on Earth's surface.

K-2- ETS1-3. — Analyze data from tests of two objects designed to solve the same problem to compare the strengths and weaknesses of how each performs.

MATERIALS

- Ice
- 2 clear plastic cups
- *Running on Sunshine: How Does Solar Energy Work?* by Carolyn Cinami DeCristofano
- 3 completed Solar Bottle Boat Kits **(SB40881)** – 1 air boat, 1 speed boat, and 1 surface submarine
- Large plastic tub, kiddie pool, or Raingutter Regatta® **(NA10268)** filled with water
- A sunny day (preferably close to noon with little to no wind)

CONTENT

In this lesson, introduce students to solar energy by discussing and demonstrating how the sun provides thermal energy. That discovery will lead into the idea that solar energy also provides electricity. Using the book *Running on Sunshine: How Does Solar Energy Work?*, introduce students to solar energy, how it works, and the function of solar panels. Then show them the three solar boat models you created prior to the lesson. Students will learn the function of the boat's rudder, motor, propeller, and solar panel. They will have the opportunity to watch the boats "race" and make observations about each craft's performance. Finish with reading the book to show students other ways solar panels are used and possibilities for their use in the future.

INTRODUCTION (Time varies depending on temperature)

Brainstorm with students what they know about the sun and make a list. (It gives light. It is hot. It gives off heat.) If a student says that it gives off heat, refer back to that. If not, add that idea to the list. Explain that the sun is best known for the warmth it provides. Proceed with the following experiment.

For this part, you'll need two clear plastic cups and two ice cubes.

1. Place an ice cube in each cup.
2. Take the cups outside. Place one cup in direct sunlight and one in the shade.
3. Ask students which ice cube they think will melt faster.
4. When the ice cube in direct sunlight melts faster, explain to students that the sun gives off something called energy. This energy produces the heat that caused the ice cube to melt faster in the sun than in the shade.
5. Begin reading aloud *Running on Sunshine: How Does Solar Energy Work?*
6. As you read page 11 (about the solar panel) ask students to remember that term. Tell them you'll be coming back to it frequently throughout the lesson.
7. As you read, start a list of different ways that solar energy is used.
8. Stop after reading page 15.

ACTIVITY 1 (40 mins.)

In the introduction, students learned that the sun's heat is a form of energy. This energy can be used in another way. The book explains how solar energy can power different vehicles. What were some that were mentioned? (Plane and cars)

Ask students if any of them have remote-controlled cars or other vehicles at home. What powers those toys? (Batteries)

Show students the solar-powered boats. These boats are like remote-controlled toys because they can move from place to place. But these boats also very different because they don't move using a remote control. They move using the sun's energy called solar power.

Let students take a closer look and provide the name of each boat.

Start with the speed boat. Explain that it's similar to other toy boats because it has many of the same parts. Show students the motor, propeller, and rudder on each boat and define the purpose of each part.

Motor: A machine that uses energy to provide a vehicle with power

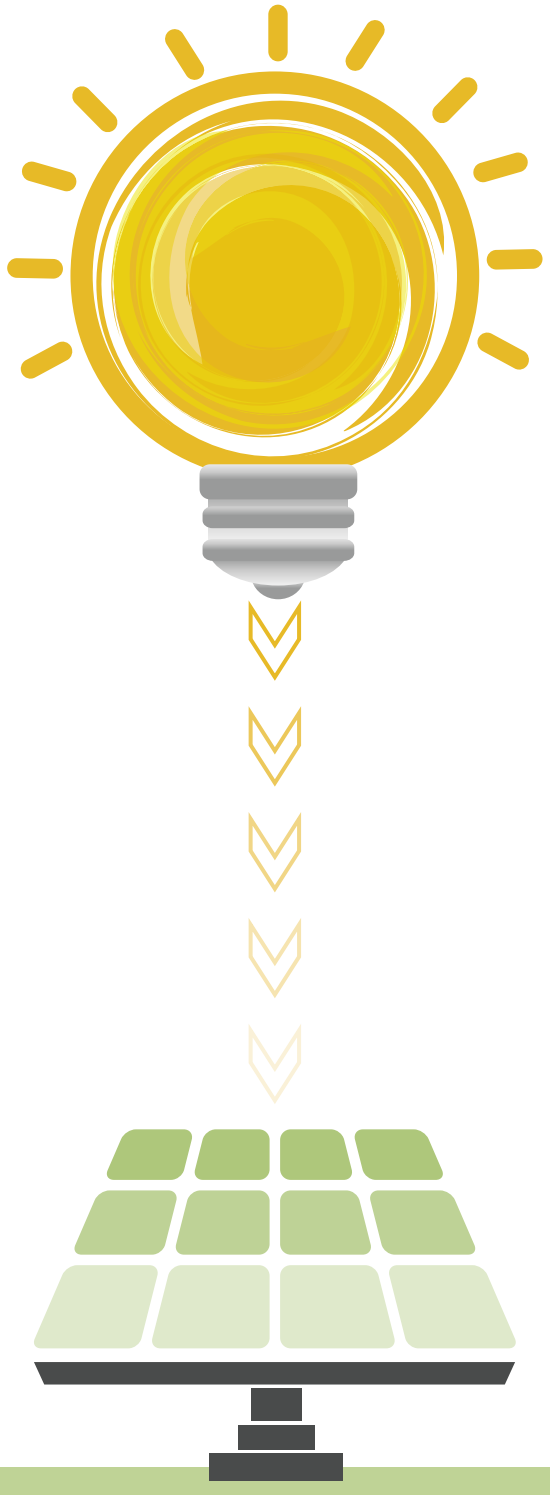
Propeller: A revolving device that uses blades to move a boat

Rudder: An underwater blade near the back of the boat that aids in steering

Do the same with the air boat and the surface submarine.

Each of the parts has a special job that helps the boat move from place to place. Each boat has one more special part that helps it move. Take a look at the solar array. Notice how each boat has this part. Does this part look like anything from the *Running on Sunshine?* (Students should recognize the array looks like the solar panel on page 11 of the book).

1. The solar panel on the top of each boat catches the sun's energy and uses that energy to move.
2. We already know that remote-controlled toys use batteries to run. What about objects, like a television or microwave? How do those items work (electricity)? Electricity is how we get power most often.
3. Read pages 16-18 aloud to explain how electricity works.
4. Ask students to recap the problems named that relate to how we get electricity. (Changes in climate, pollution, etc.)
5. Tell students there may just be another way to get the energy we need to run things like microwaves and televisions in our homes. That way of getting energy relates to these boats–sunshine.
6. Read aloud pages 19-23.
7. Remind students that the author compares the flow of solar energy through a solar panel to "kids fidgeting in a line." Have students stand up in a line. Tell them that you're going to show them how the sun's energy moves through a solar panel. You'll be the sun and each student will be an electron within the solar panel. Start by tapping the first student in line. That student will tap the student behind and the tapping will continue down the line until it reaches the end. Once a student has been tapped, they need to "flutter." That can be waving arms, running in place, or whatever motion you choose. Once you complete the line, you can also set students up in an array like a traditional solar panel.
8. Bring students back to the boats and remind them that the solar panel on each boat is going to collect energy from the sun to help it move.
9. Ask students to create an illustration that shows how the sun's energy moves through a solar panel.



ACTIVITY 2 (60 mins.)

In the previous activity, students were introduced to the boats, learned some of the basic terminology, and gained a basic understanding of how the sun's energy travels through a solar panel. In this activity, you will compare and contrast the features and abilities of each boat.

1. Take a look at the boats two at a time.

   Pair 1: Speed boat and air boat

   Pair 2: Speed boat and surface submarine

   Pair 3: Air boat and surface submarine

2. Ask students to point out the features (motor, propeller, rudder, and solar panel) of each boat in Pair 1.
3. Begin comparing the features and looks of the two boats. Model this for students by saying, "I notice the speed boat and the air boat both are made from one bottle." Ask students to come up with some of their own comparison statements.
4. Contrast the features and looks of the two boats. Model for students by saying, "I notice the air boat has a larger rudder than the speed boat."
5. Repeat steps 2-4 for pairs 2 and 3.
6. Now it's time to put these boats in the water to see how they run. Ask students to consider everything you've talked about. Remind them the boats all run the same way–through the solar panel on the top. Take a poll to determine which boat students think will be able to cross a kiddie pool or Raingutter Regatta®the fastest.
7. Take students outside to conduct trials in a prefilled kiddie pool or Raingutter Regatta®.
8. Start with Pair 1. Ask one student to keep time for the speed boat and another student keep time for the air boat. Explain they will run from one end of the pool to the other. Remind them again that the boats will be using the energy they get from the sun to complete the trip. Conduct the "race" and record the times.
9. Repeat step 8 with pairs 2 and 3.
10. Reconvene to debrief about the results. Here are some topics you could discuss.
    - Which boat was the fastest? Slowest?
    - How much faster was ____ than ____?
    - Were you surprised by the results?
    - Why do you think _____ was the fastest/slowest boat?
11. Once you complete the line, you can also set students up in an array like a traditional solar panel.
12. Bring students back to the boats and remind them that the solar panel on each boat is going to collect energy from the sun to help the boat move.
13. Ask students to create an illustration that shows how the sun's energy moves through a solar panel.

***Modification: If using a kiddie pool, rather than having boats "race" against one another, run one boat at a time. Have students count aloud to see how long it takes for the boat to cross the kiddie pool.**

ACTIVITY 3 (40 mins.)

Now that students have a better understanding of solar energy, read the rest of *Running on Sunshine*. The book provides interesting examples of how solar energy can be used to power different things.

1. As you read the rest of the book, ask students to keep a mental list of other ways solar panels can be used. If students have trouble remembering, re-engage their memories by showing a picture and asking how the picture relates to solar energy.
2. Take a closer look at the examples on page 37. As you look at the examples, ask students to point out where the solar panel is located on each item.
3. Brainstorm a list of additional ways solar power could someday be used. Students can use the example on this page and throughout the book as a jumping off point (solar powered motorcycle, solar powered purse, solar powered grill, etc.).
4. Students should choose one solar powered idea and illustrate it. Remind them a solar panel must be included in the illustration. Ask where the solar panel should be located (on the top of the item pointing toward the sun).

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