

# **Solar Boats**

# Lesson 7: Building Solar Boats

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**DESCRIPTION:** Students will follow step-by-step instructions to build their solar boats. They will troubleshoot as necessary by making sure electricity flows into the motor to make the vehicles move by propeller or gears. They will be using their planned investigations from the previous lesson in order to guide their process. While this involves the usage of instructions initially, students can be permitted to use a variety of other materials outside those listed in order to make improvements to their design and add a higher level of inquiry to the process.

**GRADE LEVEL(S):** 4, 5, 6

SUBJECT AREA(S): Science, energy, solar energy, rudder, propeller, motor, troubleshooting

#### ACTIVITY LENGTH: 1 hour

#### LEARNING GOAL(S):

Students will follow step-by-step instructions to build their solar boats. They will troubleshoot as necessary by making sure electricity flows into the motor to make the vehicles move by propeller or gears. Students will determine different data points that are useful in the determining the most effective design for a solar powered boat. Students will undergo the process of redesign, noting why they made changes to particular variables on their boat and noting how these changes played out.

#### **NEXT GENERATION SCIENCE STANDARDS:**

- 4-PS3-2. Make observations to provide evidence that energy can be transferred from place to place by sound, light, heat, and electric currents.
- 4-PS3-4. Apply scientific ideas to design, test, and refine a device that converts energy from one form to another.
- 3-5-ETS1-1.Define a simple design problem reflecting a need or a want that includes specified criteria for success and constraints on materials, time, or cost.
- 3-5-ETS1-2. Generate and compare multiple possible solutions to a problem based on how well each is likely to meet the criteria and constraints of the problem.
- PS2-1 Apply Newton's Third Law to design a solution to a problem involving the motion of two colliding objects.
- PS2- 2 Plan an investigation to provide evidence that the change in an object's motion depends on the sum of the forces on the object and the mass of the object.

#### STUDENT BACKGROUND:

Students should understand the fundamentals of energy, energy transfer, circuits and that light hitting a solar panel generates electricity.

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## Materials List (30-person class)

- Printouts of each instruction sheet: Airboat, Speedboat, & Surface Submarine
- (9-10) Solar boat kits
- "Adult" scissors (work best to cut plastic bottles)
- Awl, if available, to poke holes in plastic bottles
- (2) 16-18 oz (reused) plastic bottles for each surface submarine
- (2) 16-18 oz (reused) plastic bottles for each speed boat
- (2) 16-18 oz (reused) plastic bottles for each air boat
- (1) 2 liter recycled bottle for each air boat
- Sunlight or other light source
- Large tub or basin for testing leaks
- Water source

### Vocabulary

- **Rudder:** a means of steering a boat, usually in the form of a pivoting blade under the water, mounted at the stern (rear) of the boat.
- **Motor:** a machine that converts electrical energy into motion and can be used as a power source to move a vehicle.
- **Propeller:** spiral blades attached to a revolving shaft that causes a boat or an aircraft to move by the backward thrust of water or air.

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# **Lesson Details**

Prep

- Decide on your methods for grouping your students. I found that groups of 2-3 students was ideal
- I highly recommend finding parent volunteers or extra staff members to help with this activity.

### Activity – Build Solar Boats

- Have students follow step-by-step instructions to build the vehicle they are assigned to (solar air boat, surface submarine, or speed boat versions).
- Have printed directions made for each of the groups. I laminated the directions for each of the teams.

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- Note that the students creating the solar surface submarine will have additional steps to finish since the base of their vehicle is the solar speedboat.
- Once vehicles are created have groups bring vehicle to light source to check that propellers are free to spin.
- If possible, test the vehicles in large tote of water for leaks and rudder adjustments.

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