



Assignment Discovery Lesson Plan Junkyard Wars: Wild Watercraft

Subject

Physical Science

Grade level

6 – 12

Duration

One or two class periods

Objectives

Students will

- develop a hull design that helps boats travel quickly; and
- test their hull design in a class race.

Materials

- Small battery-powered fan
- Insulation board (a blue, Styrofoam-like product available at home improvement stores) or similar waterproof hard foam
- Modeling clay (or similar material to temporarily attach fans to the boat)
- Water channel (such as a rain gutter)
- Scissors or utility knives for cutting the board

Procedures

1. Tell students that they will be testing hull designs to see which one allows them to travel faster in water.
2. Begin by demonstrating the experiment to the class.
 - Cut a block of the foam; make sure it is narrower than the channel.
 - Using modeling clay, attach the fan to the foam. This makes a boat.
 - Measure the mass of the boat with the fan.
 - Fill the water channel with water.
 - Turn the fan on and place the boat in the channel.
 - Show students how the fan propels the boat along the channel.
 - Repeat and time the progress of the boat between two points.
3. Explain that the challenge is for students to build a boat that will travel faster through the water than the one you used in the demonstration. While they

can and should change the design of the hull, their boat must have the same mass as the demo boat.

4. Divide the class into small groups, and provide each one with blocks of foam identical to that used in the demonstration. Tell the students to shape the blocks (hulls) with scissors or utility knives. To keep the mass of the boats constant, you may need to help them add small masses to make up for any foam they trim off.
5. Hold an informal contest. Time each group's boat as it sets sail to travel down the channel. You may wish to offer prizes for the fastest times.
6. Discuss as a class which shapes worked best. Have the students write descriptions and draw pictures of the best designs. Encourage students to determine what the fastest boats had in common. They must look for important design elements that would be universal to all boats.

Evaluation

Use the following three-point rubric to evaluate students' work during this lesson.

- **Three points:** Students worked cooperatively during the experiment; thoughtfully shaped their hulls; fully participated in the class discussion; wrote good descriptions and drew accurate pictures of the best designs; were able to determine what the fastest boats had in common.
- **Two points:** Students worked somewhat cooperatively during the experiment; gave limited thought to shaping their hulls; participated somewhat in the class discussion; wrote okay descriptions and drew somewhat accurate pictures of the best designs; needed guidance to determine what the fastest boats had in common.
- **One point:** Students did not work cooperatively during the experiment; gave no thought to shaping their hulls; did not participate in the class discussion; wrote poor descriptions and drew inaccurate pictures of the best designs; were not able to determine what the fastest boats had in common.

Vocabulary

hull

Definition: The frame or body of a ship or boat; does not include the masts, yards, sails, and rigging

Context: From the block of foam, shape your boat's hull.

mass

Definition: The intrinsic quantity of matter in a body regardless of its volume or of any forces acting on it; an object's resistance to changes in speed or direction of its motion

Context: As you shape your hull, you will need to add trimmed off portions to it so that the mass stays the same.

propel

Definition: To force or move an object forward

Context: In this experiment, you will use a small battery-powered fan to propel your hull through the water.

Academic Standards

The National Science Education Standards provide guidelines for teaching science as well as a coherent vision of what it means to be scientifically literate for students in grades K–12. To view the standards, visit <http://books.nap.edu>.

This lesson plan addresses the following science standards for grades 5–8:

- Science as Inquiry: Abilities necessary to do scientific inquiry, Understanding about scientific inquiry
- Physical Science: Motions and forces, Transfer of energy
- Science and Technology: Abilities of technological design, Understandings about science and technology

This lesson plan addresses the following science standards for grades 9–12:

- Science as Inquiry: Abilities necessary to do scientific inquiry, Understanding about scientific inquiry
- Physical Science: Motions and forces, Interactions of energy and matter
- Science and Technology: Abilities of technological design, Understandings about science and technology

Credit

Ann L. Hammersly, physics teacher, Chaparral High School, Scottsdale, Arizona