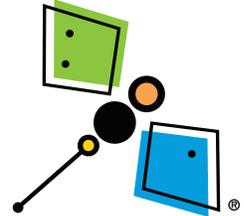


DragonflyTV: GPS Activity 6

Sail On!



California Science Center
Los Angeles, CA
californiasciencecenter.org



Sailboat Design

We're Max and Brian, and we both love to sail. When we're not sailing in our 15-foot boats, we sail models. We even sail them when we visit the California Science Center. There's a cool sailboat exhibit here, where you can make models of different shapes, sizes, and sail types. Our question was: Which kind of boat sails faster, a single-hull or a double-hull?

We found a single-hull model and a double-hull model and raced them at the California Science Center. The double-hull won! But we noticed that the two models didn't have the same sail, and they didn't weigh the same, and they didn't have the same amount of boat surface touching the water. We adjusted the models so each of these factors was the same for both boats. The double-hull still won, but just barely. We decided to race each other in our real boats out on the bay to settle the score.





Icebreaker

Discover how the shape of an object, not just its weight, determines whether it floats or sinks!

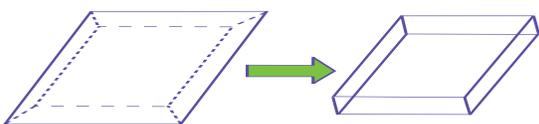
DragonflyTV Skill: Experimenting



1 hour

Guide your kids as they

- 1) Fill the bucket with water.
- 2) Wad the foil into a ball.
- 3) Put the foil ball into the water bucket. Observe whether it sinks or floats.
- 4) Take the foil ball out of the water. Open it up into a flat sheet again, and fold up the sides to make something shaped like a tray.



- 5) Now set it in the bucket. Observe whether it sinks or floats.
- 6) Carefully place pennies into the foil boat. How many pennies can you place in the foil boat before it sinks? Have a contest to see who can float the most pennies using a 12-inch square sheet of foil.

You'll need:

- a large bucket (5-quart ice cream pail, or even a 5-gallon bucket)
- aluminum foil, in squares approximately 12 inches on a side
- some pennies

DFTV Science Helper

Encourage kids to be creative in the ways they shape the foil. Remind them that boat hulls come in all kinds of shapes. Even a cone-shaped piece of foil might make a great way to float pennies!



To see another activity about sinking and floating that you can try, visit http://pbskidsgo.org/dragonflytv/superdoit/material_density.html



Investigation Sail Car Design

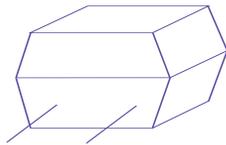


2-3 hours

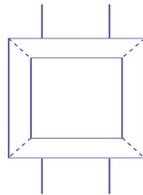
Here's a fun and simple way to test the effectiveness of different kinds of sails, using a sail car instead of a sailboat!

Guide your kids as they

- 1) Construct a basic sail car. Follow these steps. Begin by cutting out four wheels from the corrugated cardboard. The wheels can be 2-3 inches (5-8 cm) in diameter. After they are cut, you can place a rubber band around the edge of each wheel, to help the wheel grip.
- 2) Carefully poke two skewers through the bottom half of the Styrofoam container. (See Figure 1.) One skewer should be located toward the front of the container and the other one toward the back.



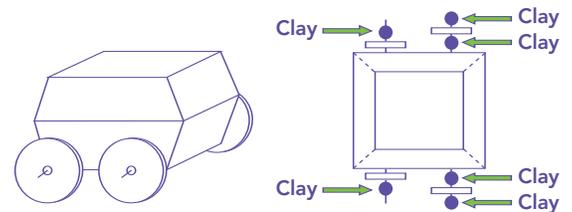
Side View



Overhead View

figure 1

- 3) Carefully poke holes in the center of the cardboard wheels. The holes should be just large enough so the wheel spins freely on the skewer. Slide the wheels onto the skewers. You may need to stagger the front and back wheels so they don't touch. You can use small balls of clay to keep the wheels from sliding off the skewer. (See Figure 2.)



Wheels added

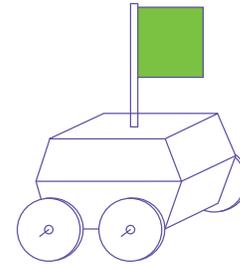
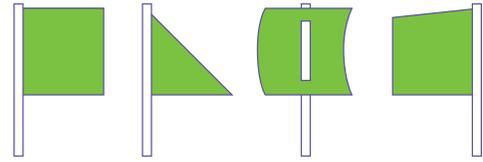
Overhead view,
with staggered wheels
and clay

figure 2

You'll need:

- fast-food sandwich container (Styrofoam or clear plastic)
- wooden food skewers, approximately 6 inches long, 3 for each car
- tape
- stiff construction paper
- scissors
- clay
- corrugated cardboard (from an unneeded box)
- rubber bands, 1/4 inch wide, approximately 8 inches in circumference
- pennies, to add weight to the car
- stop watch
- a household fan

- 4) Cut a sail out of construction paper. See the diagram for sample sail shapes. Attach the sail to the last skewer, and poke it into the top of the sail car. Secure it with tape, if needed.
- 5) Begin the real experimentation. Set up the fan on a smooth hard floor, set the car in front of the fan, and watch the sail car take off! Record the time it takes the car to travel a distance of, say, 15 feet (or perhaps 5 meters). Conduct several trials, as race times will likely vary. Make adjustments to your sail car, such as adding weight, increasing the size of the sail, or pointing the sail in different directions. Develop the fastest sail car you can. Have a competition with some friends, and see whose sail car is the champion racer!



DFTV Kids Synthesize Data and Analysis

If you have a lot of kids building different sail cars, use the variety to look for trends. Find lightweight, medium-weight, and heavy-weight cars, that seem to be similar in all other respects. Race them, and make a plot of race time versus car weight, for example. Do a similar analysis for wheel size or any other characteristic of the sail cars that is sensible.



Keep Exploring!

Now that your kids know the basics of making a sail car, have them experiment with using other objects for the car's body. Try fashioning a sail car out of a 2-liter soda bottle or a milk carton.