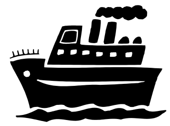
What Floats Your Boat?

Design a Boat that Holds the Most



Materials Needed
- Aluminum foil cut into 6” squares
- Sink, container, or other water container
- Paper or cloth towels,
- Small items for weight

Grade Range
3-5

Topics/Skills
Buoyancy
Density
Scientific Process
Engineering

Learning Standards
NGSS: Physical Science; Engineering Design

Duration
15-45 Minutes

Prep Time
10 Minutes

In this activity, students explore buoyancy by making, and testing, several boat designs to determine which design holds the most weight.

Activity Challenge
Using aluminum foil, mold two different boat shapes and see if they float in water. Then see which boat holds the most weight, without sinking, by adding objects, such as paper clips and coins.

Preparation

1. Fill a sink, or container, with water. Have towels ready to clean up any splashed water.
2. Cut a few 6” squares of aluminum foil. These will be used to make boat models.
3. Gather items to test the buoyancy of the boat models. Marbles, paper clips, pennies, or other small weights, work well.

To Do (Part 1)

1. Using the aluminum foil squares, mold two different boat shapes. Make sure the boats are big enough to hold the small weights collected.
2. Float the first aluminum boat in the sink or container of water. Make sure it floats and test for balance. If it’s not stable, it will not hold the weights.
3. One by one, place small weights in the boat until the boat starts to take on water.
4. Count the number of weights that the boat held.
5. Repeat the process for the second boat.
6. Make a note of how many weights each boat held before sinking.

To Do (Part 2)
1. Based on your observations, design a boat that can hold the most weight.
2. You can either modify the boats already made or use a new 6” foil square to design a new boat.
3. Add weights and test the holding capacity of the boat(s).
4. Keep experimenting. Try a boat with a rounded bottom versus a flat bottom. Try a shape with high sides versus lower sides. Change the boat shape until a model is found that holds the most weight.

Observations

- Which boat design has the greatest holding capacity?
- Why was it able to hold the most weight? Was there a difference between the width and length of each boat? What about the shape of the bottom of the boat? What other boat design factors are important?
- Record the answers in a notebook/science journal.

Extensions

- Try making a larger version of the boat design that held the most weight (e.g., 10”-12” foil square). Test the design to see if the holding capacity has changed.
- Make a bar chart displaying the holding capacity for one boat design and different weights (marbles, pennies). Another option is to make a bar chart displaying the holding capacities for multiple boat designs (e.g., Boat A, Boat B, Boat C).

The Science Behind the Activity

People have been using boats to travel on water for thousands of years. Although they did not fully understand the physics involved at first, early boat-builders still used the scientific process to improve their designs, making larger and larger boats that could hold more and more weight.

The basic principle behind why a boat floats is quite simple: boats are less dense than water. How can that be? Boats are often made of materials, like metals, that are quite dense. Boats are not solid metal but are also part air. The average density of the boat (the aluminum plus the air) is less than the surrounding water. Fluids, like water, exert a force on objects in them that is called buoyancy (the upward force exerted on a submerged object). When the downward force becomes greater than the buoyant force, an object will sink.

Densities:	Water:	1 g/ml
	Air:	.0013 g/ml
	Aluminum:	2.7 g/ml