

WHAT FLOATS YOUR BOAT (K-G2)

In this workshop, students will explore how things float. The Works Museum’s educators will guide students in experimenting with the buoyancy of materials and the shapes they take. Students will work with a limited set of these materials to create a boat that carries weight, which they will get to take home. See p. 3 for standards this workshop supports.

SCIENCE CONCEPTS

Buoyancy is how things float.

- Some light materials float nearly all the time.
- **Heavy materials** like metal usually do not float. But people can make them float if they are the right shape or if they have help from more buoyant materials.
- Some materials float only under certain circumstances and may change as they become wet or suffer damage.

Boats are good examples of objects that serve many functions. When building these objects, it’s important to think about the specific job we need it to accomplish.

- Many people use boats for transportation, and they may move with sails, motors, or oars.
- Boats may also be used to hold cargo or weight. Some boats must hold a lot of weight, like freighters, while boats like kayaks must hold only a little weight.
- There is no such thing as a perfect boat, just one that does the job it needs to do—no more, and no less.

Educators will stress the [Engineering Design Process](#) to students.

- Students will spend much of their time testing their boats and changing their designs.
- They will investigate weak areas of their boats to determine why and where their boats start to sink, and strengthen and improve on their first attempts.
- Educators will stress that the cyclical process of design, create, test, and redesign is more important than attempting to achieve a strong boat on the first try.



BEFORE YOU VISIT

What are some things that float?	Students will have many ideas. They may name many kinds of boats. They may also think about leaves, plastic toys, paper, or bath toys. Ask them about various classroom items. It may not be obvious if something will float without testing it.
What kinds of things don't float? Is there a way to make them float?	Most heavy materials like metal or rocks don't float. But we can sometimes build them in special shapes that hold air or surround them with more buoyant material to make them float anyway.
Why do boats sink? What is happening?	Most boats are shaped to hold some amount of air like a cup. If that cup fills with water instead, most boats will sink.

AFTER YOU VISIT

Questions

- What is the difference between a boat and a raft? How were rafts good at floating, and how were they bad? How were boats better or worse at floating?
- If you could start your boat over from scratch, what would you do differently this time? What would you do the same?

Activities

- Students have only limited materials to build with during the workshop. What other materials from around the classroom might be good for boat-building? Students can continue to improve on their boats after they leave.
- During the workshop, we ask only about how our boats can hold weight. But it's natural for many students to think about propulsion, and how boats move. Could students add or even reuse materials that will allow their boats to move? Help brainstorm which materials make good sails or oars.



CAREERS THAT USE ENGINEERING

Marine engineer: These engineers are modern-day boat builders. They develop new styles and types of ships and boats. They design not only the overall structure of the boat, but also its propulsion, electrical, and other systems. They might build just one experimental vessel, or they might figure out how to make a whole line of ships for a company. They might build boats first on a computer, but they will also build models and sample ships for testing before declaring them ready to face the high seas.

Aeronautical engineer: Many of the same skills used to build boats go into making planes and high-altitude vessels. Whether floating in air or in water, these engineers tackle the same problems of how to make heavy materials like metal fly or float. They must create designs that move easily through the air, and they can use many different kinds of propulsion to make them go. Like other builders, aeronautical engineers may use computers to help plan their designs, but also build many test versions in the pursuit of making a final and successful vessel.

Carpenter: For people who like working with their hands, carpentry is a field with many different kinds of work. Carpenters might be responsible for creating and building furniture, like cabinets and tables. Or they might do the physical work of building a house.

Learn about [more careers](#) that use engineering!

MINNESOTA ACADEMIC STANDARDS FOR SCIENCE K-12

0.1.1.21 Use observations to develop an accurate description of a natural phenomenon and compare one's observations and descriptions with those of others.

1.1.1.1.1 When asked "How do You Know?", students support their answer with observations.

1.1.3.2.1 Recognize that tools are used by people, including scientists and engineers, to gather information and solve problems.

2.1.1.2.1 Raise questions about the natural world and seek answers by making careful observations, noting what happens when you interact with an object, and sharing the answers with others.

2.1.2.2.1 Identify a need or problem and construct an object that helps to meet the need or solve the problem.

2.1.2.2.2 Describe why some materials are better than others for making a particular object and how materials that are better in some ways may be worse in other ways.

2.2.1.1.1 Describe objects in terms of color, size, shape, weight, texture, flexibility, strength and the types of materials in the object.

2.2.2.2.1 Describe how push and pull forces can make objects move.

2.2.2.2.2 Describe how things near Earth fall to the ground unless something holds them up.