Create a sailboat

Materials

- 2+ straws
- 2 pieces of scrap: cardboard pieces, paper, cloth, sponges, empty bottles, or anything around your home
- 8” x 11” piece of aluminum foil or plastic wrap
- 2+ toothpicks, skewers, or popsicle sticks
- tape
- scissors

Identify the problem

Our goal in this activity is to design and construct a sailboat that floats and can move—with some help from the wind, of course.

First, let’s brainstorm what enables things to float. Imagine you have a basketball and a bowling ball. If you toss them both into a lake, the bowling ball would sink, right?

This is because the bowling ball has a much higher density than the basketball. Density is the relationship between mass (how much matter something contains) and volume (how much space it takes up). Because the basketball is hollow and filled with air, the average density of it is lower than the density of water—it floats.

Create a list of items that float and compare similarities between them. As an example, leaves, empty water bottles, and feathers all float on water. They have a large surface area and are both lightweight and waterproof. Find inspiration in these items when creating your own sailboat!

Map out your design

Gather materials you think would help you create your sailboat. It can be anything in your house, but remember that your sailboat will need a few key pieces:

Hull—The body of the ship

Sail—The component that catches the wind and allows the ship to move forward

Mast—The long, upright pole that holds the sail

As you start designing your boat, think about how different materials could affect the flotation, waterproofing, sturdiness, or speed of your ship. View the photo above and see how different all three boat designs are—one is made from wood to be extra sturdy, one is made from only a cup, and one is made from straws to be a very lightweight and waterproof boat. Although they're each made from different materials, they all float and can catch the wind to move forward.

Create your sailboat

1. Create the hull of your sailboat. Most ships feature a hollow, lightweight hull. Consider whether you need to make this material waterproof and how you could achieve that.

2. Design the sails of your sailboat. This design must be able to capture air, so you'll want to find a material that doesn't let a breeze through.

3. Attach the sails to the mast, then attach the mast to the hull. A mast should be sturdy enough to hold itself up even as the wind blows.

Test the design

Once you've completed your design, release your sailboat into a body of water. This can be a lake, a pool, your bathtub, or a filled sink. Use a straw to blow air into your sails and watch your sailboat sail!

Does the ship glide smoothly over the water? Does it stay upright even during strong winds? Is it waterproof?

Modify and test again

Change your design if it didn't reach your goal or if something unexpected happened. Testing, measuring, and modifying are key elements in engineering. Sailboats have a long history of going through this process—the first sailboats originated about 6,000 years ago, but they're still being modified today as technology evolves!

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Create a sailboat

Teacher/parent guide

Additional challenges and hints for students (optional)

- Task your student's sailboat to carry heavier loads and see how they can alter the design to handle the extra weight.
- Apply a material constraint: count the number of items your student used in their sailboat, then challenge them to create a new sailboat with fewer materials.
- In manufacturing, diagrams are created so that any new manufacturer can recreate the same exact product by following detailed pictures and instructions. Have your student create a manual for their sailboat design with a focus on precise directions.

STEM lessons

Engineering processes

- Identifying a need
- Researching the problem
- Designing a solution
- Creating a prototype
- Testing the design
- Modifying as necessary

Mechanical engineering

- Creating a mechanical design
- Testing the product for performance

Natural forces

Density: the relationship between the mass and volume of an object

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