ILLINOIS Extension

4-H Club GO TO Resources

August 2019

Foil Boats Engineering Challenge

Lesson Objectives:

Design and build a boat from aluminum foil that can hold as many pennies as possible before sinking or capsizing

Time: 20 minutes

Equipment and supplies:

- Shallow plastic bin
- Water
- Towels
- Pennies or other weights
- Aluminum Foil

Preparations:

- Review Lesson
- Gather equipment and supplies
- Cut the foil into uniform squares. The foil squares can be anywhere from 4”x4” to 12”x12”. Keep in mind that larger squares make larger boats, which may require more pennies to sink. Fill your plastic bin with a few inches of water. Have towels ready.

Ask questions to get participants thinking about why objects sink or float:

- Think about different boats you have seen. What is the same about them? How are they different? (Similar shapes or materials, different means of propulsion, etc.)
- What makes a boat float? (Boats weigh less than the water they push aside)

Instructions:

Ask participants more focused questions about buoyancy. What happens to a full glass of water when you add a bunch of ice cubes to it? What happens to a ship when more and more weight is added to it?

Introduce the design challenge.

- Give each person or team a square of aluminum foil.
- Give participants as much time as they need to build their boats. They may test them to make sure they float before adding weight.
- Start adding weight to the boat. Make sure to distribute the weight evenly.
- Participants should put pennies one by one into the boat. Have them keep track of how many pennies they use.
- Keep adding weight until the boat sinks.
- Make observations along the way. Does the boat change shape, spring a leak, or lean in one direction?

Troubleshooting:

If the boat doesn’t remain upright, consider a wider design. If a boat sinks before you think it should, make sure you are distributing weight evenly. Wide, flat-bottomed boats will hold the most weight. If participants are frustrated, give them hints but try not to blatantly tell them how to build their boat.

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Questions to ask after the activity.

- What kind of real-world boat did your boat look like?
- How many pennies was your boat able to hold? Did it matter how or where you placed the pennies in your boat?
- After testing your boat, did you make any changes to the shape of your boat? Why or why not?
- What shapes seemed to work the best?
- What could you change to make your boat hold more weight before sinking?
- Did your boat tip over before it sank? And if so, what changes did you make to stop this from happening?
- Why do the pennies float when placed in the boat but sink when placed directly into the water?

Engineering Connections

For a boat to float, it needs to weigh less than the same amount, or volume, of water. To make this happen, engineers must build boats so that they have giant pockets of air inside of them. If you think about a huge cargo ship or cruise ship, you will realize that most of the ship's interior is open space. The weight of the ship is spread out across a large area so that compared to the same volume of water, the water weighs much more than the ship.

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Sources & Additional Lesson info:

4-H Club GO TO Resources is being offered to 4-H clubs in Boone, DeKalb and Ogle Counties as a way to enrich and enhance 4-H experiences and programming at the club level. It is the goal of the Extension staff to assist 4-H leaders and officers in providing simple hands-on activities on a monthly basis that can broaden the 4-H club experience and as a result heighten positive youth development.

Resources: Based on the Discover E Foil Boat Design Challenge found at: https://www.discovere.org/

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