

**Title:** Float My Boat

**Synopsis:** Students will build a floatable boat out of 5 by 5 foil squares. Later, students will test their structure based on sturdiness by placing pennies into the boat.

**Purpose:** For students to think outside the box to construct a sturdy boat and should consider making multiple boats before finalizing their boat. Overall, students will understand the importance of how trial and error can lead to open doors and new ideas. Therefore, collaborating ideas to build the sturdiest boat.

**Next Generation Science Standards:**

*(Due to the nature of this lesson the standards below represent general disciplinary core concepts)*

**Overall Science and Engineering Practices**

Planning and Carrying Out Investigations

- Planning and carrying out investigations to answer questions or test solutions to problems in 9–12 builds on K–8 experiences and progresses to include investigations that provide evidence for and test conceptual, mathematical, physical and empirical models.

Constructing Explanations and Designing Solutions

- Constructing explanations and designing solutions in 9–12 builds on K–8 experiences and progresses to explanations and designs that are supported by multiple and independent student-generated sources of evidence consistent with scientific ideas, principles, and theories.
- Students who demonstrate understanding can:

**3-5-ETS1-1.** Define a simple design problem reflecting a need or a want that includes specified criteria for success and constraints on materials, time, or cost.

**3-5-ETS1-2.** Generate and compare multiple possible solutions to a problem based on how well each is likely to meet the criteria and constraints of the problem.

**3-5-ETS1-3.** Plan and carry out fair tests in which variables are controlled and failure points are considered to identify aspects of a model or prototype that can be improved.

**Objectives:**

- Students should use their creativity and think outside the box.
- Student should engage in teamwork and work together.
- Students should understand the importance of trial and error.
- Student should try their best with the least amount of materials.

**Introduction/ Near-Peer Information:** Encourage students to work together to efficiently come up with the sturdiest product in a limited amount of time. Jobs today engage teamwork and expect their employers to complete their task in a given time and budget.

**Materials:**

- One roll of foil
- One big clear bowl
- 200 pennies
- Paper towels
- Water
- Visual timer on board

**Career Connection:**

- Engineer
  - o *Test and build multiple tools and machinery.*
  - o *Work around employees with different backgrounds*
- Scientist
  - o *Testing different experiments to find a solution*
- Researcher
  - o *Testing different experiments to find a solution*
- Any Career
  - o *All jobs require teamwork and collaboration. Combining multiple ideas into one project can make a huge difference ( two heads are better than one)*

**Setting up the Lab:**

1. Cut up the roll of foil into 5 by 5 pieces. (2 pieces per team)
2. Fill the big clear bowl about  $\frac{3}{4}$  full with water.
3. Place the roll of paper towels next to the clear big bowl.
4. Place the 200 pennies next to the clear big bowl

**Instructions for students:**

1. Your teacher will assign you into a team with no more than 3 to 4 people.

2. Before building, draw a sketch of your design on the worksheet.
3. Use the 5 by 5 foil squares to build a boat that can float and hold the most pennies
4. You will be given one trial round and one final round. Make sure your trial boats are different from the final.
5. During each round, you will be given 5 minutes to construct your boat.
6. After each round, you will be able to test your boat with the help of a Near Peer or teacher.
7. You must get an approval from your teacher to continue to the final round once you've test one trial rounds.
8. Be creative and show us what you got!

**Helpful Hints:**

- This is a wet lab, so be prepare to get your hand and arm wet!
- Keep reminding the students to fill out their worksheet.
- Let the students designate one team member to drop the pennies into their boat during testing.
- Before they build their first structure, give them 5 minutes to sketch out a drawing and share their ideas with their teammates.
- After each round when the 5 minutes are over, ask the students to raise their hands. So you know no one is working on their boat past the 5 minute mark.

**Questions to Engage the Students:**

- How was the trial different from the final?
- How many pennies did it take to sink your boat?
- After the first trial round, what needed to be changed?
- How did your boats sink in each round?
- How did everyone's ideas get involved in your boat?

## Float My Boat

1. Before building your boat, draw a sketch of your design and share your ideas with your teammates. You have 5 minutes!

Rounds	Number of Pennies	Change that needs to be made to improve the results for the next trial.	

Trial 1		
Final		

2. Record your results in the chart below.
3. Summarize your results and how your boat changed throughout this challenge.