

Penny Boat Challenge

Overview:

Participants will experiment with buoyancy and design a boat out of aluminum foil to hold the greatest number of pennies and still remain afloat.

Goals:

- Learn about buoyancy
- Experiment to keep a boat afloat

Time Required: 30 minutes

Materials:

- Orange
- 30x30 cm sheet of heavy duty aluminum foil for each group
- Pennies (or other small weights that are uniform in size)
- Paper towels or towels to dry pennies
- Large plastic tub about half full of water to test boats (may use additional tubs as needed for testing)

Vocab: buoyancy

Procedure:

1. Introduce the activity by showing students an orange. Ask them if they think it would sink or float.
2. Gently place the orange on top of the water in the bowl. Discuss “What happened?”
3. Next peel the orange. Now ask students, “Will it sink or float?”
4. Place the orange in the water again. Discuss “What happened?”
5. Discuss: “Why did the orange float with the peel on, but not with the peel off?” Give students a portion of the rind to observe. Discuss what they notice.
6. Explanation: The rind of the orange contains lots of tiny air pockets which help the orange float, similar to a life jacket. When you remove the rind, or take off the life jacket, the orange sinks.
7. Bonus Fact: Scurvy was a common disease among pirates and sailors. Scurvy is caused by a lack of Vitamin C, commonly found in lemons, limes, and oranges!
8. Introduce the term: Buoyancy. Ask, What does buoyancy mean?
9. Explain to students they will be designing a boat to hold the greatest number of pennies and stay afloat.
10. Explain the rules to students:
 - a. Each group will receive only ONE sheet of heavy duty aluminum foil that measures 30cm x 30cm.
 - b. You will not receive a replacement for ANY reason!
 - c. Pennies are the only items that will be added to the boat.
 - d. Once water enters the boat, or if any part of the boat touches the bottom of the container, your turn is over.



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- e. The last penny will NOT be counted in the total amount held.
 - f. Students will have 5 minutes to plan and 10 minutes to build their boats.
11. Once boats are completed, explain the procedures for testing boats:
- a. One member of your group will be responsible for adding the pennies to the boat.
 - b. Two members of the group will be responsible for keeping count and watching for signs of water entering the boat.
 - c. Once you are finished testing, record your total number of pennies.
 - d. It is your responsibility to collect all used pennies and dry them thoroughly for the next group. Pennies must be DRY for the test.
12. Clean up and discuss reflection questions.

Reflection:

1. How did you solve this problem?
2. What worked? What didn't work?
3. What would you change if you had a chance to do this activity again?

Extension / Adaptations:

1. Adjust time for planning and building as needed.
2. Give students another opportunity to apply what they have learned and build a second boat to test.

Adapted from the following lesson:

LaRosa, Liz. "Penny Boat Challenge." *Middle School Science*, 2015, <https://middleschoolscienceblog.files.wordpress.com/2015/07/pennyboatchallenge-rulesregulations-1.pdf>

Blackford, Kathy, and Stacy S. Cochran. "Experiment 5: Orange Float." *Science Fun with Kitchen Chemistry*, Ohio State University Extension, Columbus, OH, 2014.

Resources:

Price, Catherine. "The Age of Scurvy." *Science History Institute*, 31 May 2023, sciencehistory.org/stories/magazine/the-age-of-scurvy/.

Mocomi Kids, et al. "What Is Buoyancy?." *Mocomi Kids*, 27 Feb. 2020, mocomi.com/buoyancy/.

