Foil Float Challenge
Remote Learning, Grades K to 2, and 2 to 4 (with some caregiver assistance)

Summary

The purpose of this challenge is to make a rectangular prism “boat” from aluminum foil that will float as many coins as possible. Maximum capacity is that capacity just below which the boat sinks. You count the number of each type of coin at which the boat last floated and calculate a total mass it held. Students use a piece of aluminum foil that is 6 inches square in area (15 cm square). You will explore ideas of buoyancy and stability to aid in maximizing floatation of your boat. If you don’t have U.S. coins available, you can use other coins or other small standard-sized objects and research their unit mass (how much each of them weighs).

This challenge was inspired by a golf ball floatation challenge in Building to Teach. The difference here is that we are trying to do this with smaller items that a typical home might have. And by using metric units, we (hopefully) arrive at some interesting conclusions about buoyancy!

Simple rectangular prism-shaped vessel filled with various coins.
This version held 142 grams of mass before sinking.
Can you guess the volume of the rectangular prism (in cubic centimeters)?

Learning Goals

1. Careful planning and construction of your foil boat can result in a successful vessel that holds many coins without tipping and sinking.

2. Basic understandings around buoyancy, density and volume/displacement of water.

What You'll Need (Materials and Tools)

6-inch square piece of aluminum foil
Cooking pot or basin
Water to fill basin roughly 3 inches (7.5 cm) deep
Dish towel
Assortment of U.S. or other coins
Ruler or tape measure, metric preferred
Pencil and lined paper

Buoyancy

Please see this video for an explanation of buoyancy in terms of density and volume. You will explore buoyancy through this activity.

Instructions

1. Tear off a 6-inch (15 centimeters, cm) piece of aluminum foil from a aluminum foil dispenser. You will fold that piece in half and then cut or carefully tear the larger piece until a 6-inch (15 cm) square piece remains.

2. Fold your aluminum foil into a rectangular prism (box-like shape) that you think will float a lot of coins. Make sure that you don't cut or tear the inside of the foil. It will be a little flimsy, and this is OK.

3. Measure the length, width and depth of your rectangular prism in centimeters, and record it below. If you only have a ruler with inches then get help from your parent or care provider to divide the reading in inches by 2.54. It is OK to use a calculator for this.

   Length = _____ cm Width = _____ cm Depth = _____ cm

   Vol. = length (cm) * width (cm) * height (cm)

   = _____ cm * _____ cm * _____ cm

= _____ cm^3

4. Place your foil into the water and test that it floats fine without any load (coins or other objects that have mass). Start carefully adding coins, starting with heavier ones first.

5. Continue adding coins, being careful to evenly load the bottom of the foil prism so the prism does not deform too much and the boat doesn't start to "take on" water. Don't make waves!

6. Continue slowly and carefully adding coins until the foil **just** swamps with water and sinks to the bottom!

7. Pull the foil and coins out. Pour the water back into the basin and sort and count the coins out on the dish towel by denomination.

8. Refer to the Mass Calculation Worksheet at the end of this document, and either print it out or re-create it on lined paper with pencil and ruler. From your coin count in Step 7, calculate total mass in grams (g) just before sinking. Get help from your parents or care providers as needed on this step.

9. Compare the volume in cubic centimeters (cm^3) from Step 3 above to the mass in grams (g) calculated in Step 8.

   How do they compare? Write them out. What is the difference? Are they close in magnitude?

   Would you expect the volume and mass to be similar in magnitude since we are using the metric system and are floating an item in water?

   Would you expect a foil boat with volume 150 cm^3 and a payload of mass 140 g to float? Why or why not?

Mass Calculation Worksheet for Estimating Mass at Time of Sinking

Notes on Calculations used in Table Below:

1. Unit Mass (grams, g) = the mass of 1 (unit) of each type of coin or object. I found these values from online searches.

2. Subtotal Mass (g) = Quantity * Unit Mass (g).

3. Total Mass (g) = Subtotal Mass (g) of all coins and objects (i.e. add them together)

Aluminum Foil Boat Version:_____

Coin/ Object	Quantity	Unit Mass (g)	Subtotal Mass (g)	Source of Unit Mass Value
Example: Canadian Quarter, 2000-Present	12	4.4	52.8	Saskatooncoinclub.ca
U.S. Penny		2.5		mdmetric.com
U.S. Nickel		5.0		mdmetric.com
U.S. Dime		2.268		mdmetric.com
U.S. Quarter		5.67		mdmetric.com
U.S. Half Dollar		11.34		mdmetric.com
U.S. Dollar		8.1		mdmetric.com
Other:				
Other:				
Other:				

Total Mass at Time of Sinking, in g:
