MAE 3127 - Fluid Mechanics Laboratory
Tin Foil Boats

(Total points = 100)

_____,_____
Last Name First Name

_____
Date

According to GWU Code of Academic Integrity, I pledge that I have neither given nor received unauthorized assistance on this work.

_____,_____
Student's Signature Date

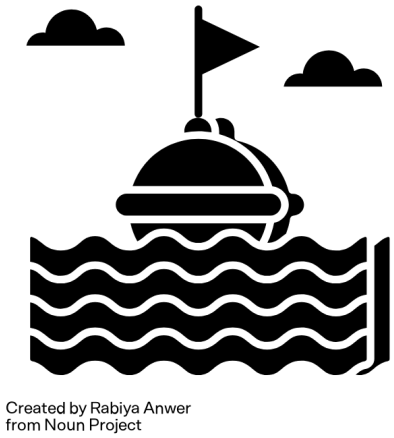

Figure 1: Buoy by Rabiya Anwer from Buoy Icons, Noun Project (CC BY 3.0)

Objective

To create a boat from a square of tin foil (15 cm $\times$ 15 cm) that can hold as much mass as possible without sinking.

Supplies

1. **Aluminum foil (standard kitchen type):** A square of tin foil that measures 15 cm $\times$ 15 cm will be provided. The foil has a standard thickness of aluminum foil (0.16 mm thickness), **not** the heavy-duty type.
2. **Bucket, large bowl or basin of water:** A vessel of water significantly larger and deeper than the boat. This could be as simple as filling the bathroom sink or a mixing bowl.
3. **Small weights:** As many pennies as we can find will be provided. If you don't have a lot of pennies on hand, use other coins, paper clips, or rice. Anything that has a relatively small mass per unit can be added a little at a time.
4. **Measurement and Recording:** A ruler (optional, for measurements), a weigh-scale and a Python program will be provided.

Procedure

1. **Build the Boat:** Make a boat from your square of tin foil (about 15cm x 15cm).
2. **Shape the foil into a boat:** Try a simple rectangular tray and experiment with up to two other different boat shapes.
3. **Review your design:** Ensure the boat is watertight and edges are folded up to form sides.
4. **Measure the mass of your boat** Hint: It is the mass of the tin foil
5. **Test Initial Buoyancy:** Gently place the boat on the waterś surface. Observe if it floats.
6. **Measure the mass of one penny**
7. **Add Mass Gradually:** Slowly add weights (pennies of known mass) one at a time into the boat. After each addition, observe and record whether the boat continues to float or begins to sink.
8. **Measure and Record:** Count and record the total number of pennies added before the boat sinks.
9. **Record Boat Shape and Size:** Note the shape and size of the boat, and try variations to see which design holds the most weight.
10. **Discuss Results:** Calculate the total mass your boat could support before sinking.

Discuss the following questions with your TA in the lab:

1. Will the tin foil float? What is its density?
2. How can we measure the volume of the boat?
3. **How do you relate your findings to the buoyancy principle:** An object floats when the upward buoyant force equals or exceeds the downward force from its weight.
4. Discuss the role of shape, surface area, and volume in increasing buoyancy with your TA.

Action Items

☐ Enter your data into the table below and the Python program that your Teaching Assistants will have on their computer. You will need to measure the mass (in grams) that sinks your boat, and the volume of the boat (in mL).

Trial #	Boat Shape (Rectangle, Bowl or Other)	Dimensions (cm)	Volume (cm^3)	Weight Supported (g)	Sunk (Y/N)	Observations
1		____×____×____				
2		____×____×____				
3		____×____×____				

Table 1: Aluminum Foil Buoyancy Experiment Data

☐ Work with your TA to visualize your data in a Python program provided to you.

Note: For this lab, you do not need to write a report. The only two deliverables are:

☐ Sign the GWU Academic Integrity Pledge and return these pages to your TA.
☐ The picture of your boat through the assignment link on Blackboard.