

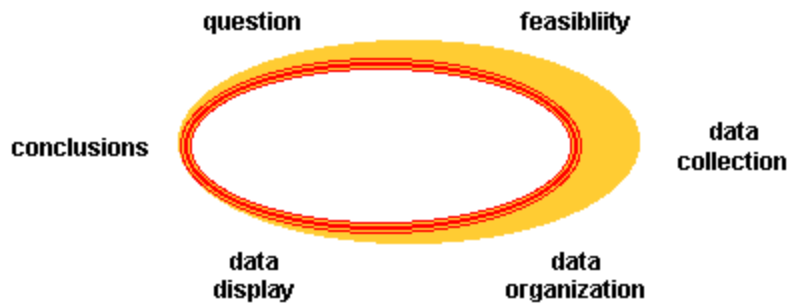
## Designing An Aluminum Barge

**LEARNING AREA:** Inquiry & Research  
**EDUCATIONAL LEVEL:** Middle School  
**CONTENT STANDARD:** Controlled Experiments

A student shall design and conduct a controlled experiment or investigation and interpret the results by:

1. Using relevant information to generate a hypothesis or frame a question in a given topic;
2. Defining the controls, variables, and sample size or number of repetitions;
3. Setting up a method to test the hypothesis;
4. Determining how to record and organize data;
5. Conducting experiments and recording data;
6. Analyzing data and evaluating the hypothesis; and
7. Identifying areas for further investigation.

### Large Processes/Concepts-----



### NEXT STEP: Assessment Task

## Designing An Aluminum Barge

### Assessment Task-----

#### Description:

This activity is part of a unit of study of Marine Transportation. Barges are designed to transport various materials from port to port along rivers and waterways. After studying locks and dams, dredging restrictions, and how those affect barge design, the students will design and build a model barge.

#### Products/Evidence of Learning:

1. Design a barge;
2. Construct a model;
3. Calculate buoyancy;
4. Test barge model;
5. Write a summary of test results.

#### Overview:

After studying hull design, students will design, construct, and test a barge to determine maximum buoyancy. Students will follow set laboratory procedures and complete a report of their findings.

#### Problem:

A manufacturer needs to ship washers from Port A to Port B along the river. The channel is dredged to a depth of two (2) inches. He/she needs a barge that will hold as many washers as possible without sinking.

#### Solution:

Using a 12" x 12" square of aluminum foil, the students will design and construct a barge to hold as many washers as possible.

#### Procedure:

1. Each student (or team of students) will design a barge using only one piece of aluminum foil (12" x 12") to best solve the problem.
2. Students will then proceed to construct his/their barges using only the materials that have been provided.
3. The student(s) will then calculate the maximum displacement of their barge when fully loaded by determining the volume of the barge (multiply the length x width x depth to determine the volume of the barge. Remember, you cannot use a figure greater than 2" for the depth of your barge as this is the depth the river is dredged.) Multiply the volume of the barge times the weight of water (62 lbs./sq. ft.) to determine the theoretical maximum load for the barge.
4. Place the barge in a tub containing 2" of water. Start loading it with washers until it sinks or touches the bottom of the tub. Weigh the washers to determine the actual load held by the barge. Compare the actual load held by your barge to the theoretical load calculated in Step 2.
5. Write a short report on the performance of your barge describing the shape and construction features of your barge and your loading strategies. Analyze how and why your barge failed and what you would change if you were given a second chance.

### NEXT STEP: Checklist

## Designing An Aluminum Barge

### Checklist-----

STUDENT	TEACHER	
_____	_____	Showed design that meets project specifications
_____	_____	Completed construction of a barge
_____	_____	Correctly calculated theoretical displacement of barge
_____	_____	Properly loaded and tested the barge design
_____	_____	Provided a summary of the findings in written form.