



# Boat Building Unit

**Overview:** Ever since we were younger, cardboard boxes have entertained us. There is just something about a big box that sparks the imagination. With a knife, some markers and duct tape, you can create some cool things. Teams of 4 will design, construct, and possibly race some cardboard boats.

**Goal:** Students will learn about design thinking and physics to construct a boat to be paddled by students in the water.

**Unit duration:** 5 weeks

**By the end of this unit, students will be able to:**

- Explain the principle of buoyancy
- Create a model of a boat that successfully supports two average students.
- Design a boat
- Explain design thinking and the problem-solving method

## Materials

- Large plastic sheet.
- Corrugated Cardboard
- Elmer's Wood Glue
- Duct Tape
- Long Straight Edge (rule, yardstick, measuring tape)
- Cutting Implement (utility knife, box cutter, tin snips)
- Pens & Pencils
- Binder clips or clamps
- Paint, paint brush and/or markers. (optional)

## Resources

- Students are encouraged to use problem solving skills.
- They can Google boat design pictures.
- <https://www.instructables.com/id/AHOY-Cardboard-Boat-for-Racing/> This is another boat building unit to provide pictures and further explanation.

## Criteria or Final Contest Rules

- Teams of 4 (can be adjusted depending on class size)
- Only use the materials provided.
- Final product must be able to... (feel free to add or subtract criteria according to class size, location and whether this is a competition of sorts [race, design challenge, etc.] )

## Timeline

- 2 months prior: Planning/budget - get in contact with DIDI for supplies.
- 1 month prior: Order supplies, organize space, recruit students.
- 2 weeks prior: Finalize plans for structured activity.
- 1 week prior: Determine space and location.

## Activity Overview

Week	Activity	Activity outline	Guiding questions
1	<b>Planning</b> <b>Note: Ex. 60lbs of mass displaces about 1 cubic foot of water. Add up the weight of all the crew and material. Divide by 60. This will give the number of cubic feet the boat will displace or sink into the water.</b>	<ul style="list-style-type: none"> <li>• Explore designs for boats</li> <li>• What size will your boat be?</li> <li>• How much weight will it need to hold?</li> <li>• Do you want a speed boat or a fun boat?</li> <li>• Take into consideration the length and width of the boat, how will it affect agility and mobility.</li> <li>• What cool features could be added to the boat? Will there be a theme to your boat (titanic, pirate ship, battleship, canoe, etc.?)</li> <li>• Ex. Weight of crew and material =600lbs.</li> </ul> <p>Divide by 60. =10 cubic feet. Boat can be 5ft long X 2ft wide X 1ft tall = 10 cubic feet. **These measurements are an estimate, they may need to be adjusted.</p>	<p>What makes a boat float? How do I calculate the buoyancy?</p>
2	<b>Design</b> <b>Note: Longer boats are faster for straight-away, but are harder to turn around corners. Smaller boats are more agile but may not be as fast.</b>	<ul style="list-style-type: none"> <li>• Start creating a design for the boat</li> <li>• Create drawings</li> <li>• Map out the use of materials.</li> <li>• What will be needed to create your design?</li> </ul>	<p>How big do I need to make the boat?</p> <p>What are the size requirements for two students?</p>
3	<b>Construction</b> <b>Note: Cardboard that doesn't have any folds or bends in it will be best. Folds in unwanted areas will weaken the boat.</b>	<ul style="list-style-type: none"> <li>• Build the boat using materials provided.</li> <li>• If painting or drawing a design, paint cardboard first.</li> <li>• Cut cardboard according to design layout.</li> <li>• Bend card where necessary using a yard stick or tool to make a clean crease.</li> <li>• Tape, glue and clamp where necessary.</li> <li>• Reinforce areas with cardboard, glue and tape where necessary.</li> <li>• Using plastic, waterproof your boat.</li> </ul>	<p>How do we make the boat? What should we do first (second, third...)? What are some things we need to be aware of when it comes to the durability of the boat?</p>
4	<b>Construction and Test</b>	<ul style="list-style-type: none"> <li>• Continue building your boat.</li> <li>• Once completed, test your boat in the water.</li> <li>• Be careful not to harm your initial design.</li> <li>• Identify any problems with your boat.</li> <li>• Find solutions to the problems by re-working the design and identify what materials will be needed to correct the problem.</li> </ul>	<p>How does the boat perform?</p> <p>What can I do to make it better?</p>
5	<b>Redesign and Test, Develop Final Presentation</b>	<ul style="list-style-type: none"> <li>• Implement solution.</li> <li>• Re-test the boat in the water</li> <li>• Continue work until boat can float and operate the way you want.</li> <li>• Feel free to race the boats or have</li> <li>• Create PowerPoint or poster explaining the design process (with pictures).</li> <li>• Plan a presentation where each team member has a part.</li> <li>• Talk through the process and how you came to your final product.</li> <li>• Teams present</li> </ul>	

## Judging Criteria

Category	Criteria	Scale	Score
Design	Floats with specified # of students Is waterproof Creative design/theme	4-5 – Excellent 2-3 – Satisfactory 1 – Unsatisfactory 0 - Missing	
Methodology	Boat resembles plan	4-5 – Excellent 2-3 – Satisfactory 1 – Unsatisfactory 0 - Missing	
Construction	Boat is built according to specifications No extra materials used Follows design	4-5 – Excellent 2-3 – Satisfactory 1 – Unsatisfactory 0 - Missing	
Creativity	Design/theme shows creativity	4-5 – Excellent 2-3 – Satisfactory 1 – Unsatisfactory 0 - Missing	
Presentation	Clear and professional Thoughtful responses to questions PowerPoint or Poster – clarity and aesthetics	4-5 – Excellent 2-3 – Satisfactory 1 – Unsatisfactory 0 – Missing	
		Total	