

Improving K–12 Science Instruction Through Professional Development in Project-Based Learning

Make Chem Possible (MCP) Project-Based Science Lesson Plan Template

Note. This lesson plan template is adapted from the instructional format currently used at Make Chem Possible (MCP) for afterschool programs, STEM camps, and classroom partnerships. The template will be used throughout the professional development intervention to help participants design NGSS-aligned, inquiry-based, and project-based science lessons. Participants will use this format during workshops to develop, revise, and evaluate density-focused lessons appropriate for their grade-level bands.

****Template Exemplar: Missing information will be completed during PD.**

<u>Day/Theme:</u> <u>Dream Big Science Camp</u>	<u>Date:</u>
<u>Teacher ID:</u>	<u>Grade:</u>
<u>Experiment Name/ Science Concept:</u> : Design a boat that floats and holds the most weight (pennies/washers).	
<u>Key word:</u> Buoyancy is governed by density: materials denser than water sink; less dense structures that displace more water float	
<u>Chemistry Element:</u> Hydrogen in water. The arrangement of materials and sealing (chemistry of surface tension, wettability) affects how water interacts with the hull	
<u>Big Question:</u>	
<u>Differentiation Strategies:</u> • Younger kids (5–7): focus on guided roles and simpler measurement (tall/short; float/sink). Provide templates and more teacher assistance. • Older kids (8–11): add quantitative tests (record cm of stretch; test tower failure force by counting washers; compare number of washers supported and calculate approximate mass supported). Encourage iterative redesigns and mini-reports.	
<u>NGSS Standard(s)</u>	
<u>Inquiry-Based Investigations:</u>	
<u>Materials:</u> Materials (for ~20 kids) • Heavy-duty aluminum foil (12"×12" sheets) — 30 sheets (20 + spares) • Plastic tubs (large, to test multiple boats at once) — 4 • Washers or pennies for weighing — ~1000 washers (or 2000 pennies) • Craft foam sheets or craft sticks (for reinforcement) — 20 sheets / 200 sticks • Modeling clay (for ballast) — 2 lb	

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- **Duct tape & masking tape — 3 rolls**
- **Scissors — 6 pairs**
- **Rulers — 5**

Procedure with Observation Chart Checklist:

Step-by-step

1. Explain buoyancy: an object floats if it displaces a volume of water whose weight is equal to the object's weight (Archimedes' principle). Discuss shape and stability.
2. Give each student/team a sheet of foil and optional foam or sticks to strengthen hull.
Challenge: design a boat that holds the most washers without sinking. Predict how many washers your boat will hold.
3. Build (20–25 min).
4. Test: place boat in tub and add washers one at a time until water spills or boat sinks.
Record number of washers.
5. Debrief: Which hull shapes worked best? Did a wide, shallow boat hold more than a narrow, tall one?

Conclusion Prompts/Reflection questions: