Working With Water in Classroom Settings

These engineering challenges in this article call for the use of large tubs of water to create wave tanks. Please consider the following guidelines to ensure safety and sound environmental practice.

- Fill each tank with the minimum amount of water needed to test wave attenuation.
- Place the wave tanks on the ground (out of pathways) or securely on sturdy tables to reduce the risk of them falling.
- Have children practice making waves that do not leave the tank, and provide close supervision during all testing.
- Keep a rag or paper towel next to each tank so that any spills can be cleaned up promptly to prevent slipping.
- If possible, cover and re-use water in the wave tanks throughout the unit to reduce water waste.
- When disposing of the water at the end of the unit, we ask children to fill watering cans to water plants around the school.

Ocean Observing Station Design Brief

Context and Need: You are a team of engineers working with ocean scientists studying long-term changes in the ocean. The scientists need a station that will stay out in the ocean through all types of weather to attach their equipment. They also need the station to hold weight to accommodate batteries, computers, and other instruments that may be added later. The station has to be able to withstand the movement of the water and not collapse or move far away from its initial location.

Challenge: Build an ocean observing station that can stay upright, keep its' water temperature logger in the water, and keep its' wind speed meter and signal light in the air during waves of different heights and frequencies.

Specifications:

The ocean observing station must:

1. Be no larger than 20 cm in height, width, or depth
2. Float (not sit on the bottom) in the wave tank provided
3. Have a securely attached water temperature logger that stays in the water at all times
4. Have securely attached signal light and wind speed meter that stay above the surface of the water at all times (it is okay if they get splashed)
5. Be able to hold two bags of sand (weight of other instruments)
6. Be anchored so that it does not move more than 20 cm from its initial location during waves
7. Be able to withstand 1–4 cm waves and not collapse, sink, fall apart, or be thrown from the tank
8. Be constructed with the materials provided

Artificial Oyster Reef Notebooking Prompts

Artificial Oyster Reef Design Challenge
Science and Engineering Notebook Prompts
(note: each part was provided as a strip of paper for students to glue at the top of a journal page as they reached that section of the challenge)

Part 1

Look at the different designs of artificial oyster reefs. Which one do you think will be most effective at reducing the force of waves on the shore?

reef ball castle shell bag stacked discs

Why?

With your partners, build a model of one of the types of artificial oyster reefs

Part 2

Based on the data from all of the groups, design a model of an artificial oyster reef that *maximizes wave attenuation*. It needs to be *no taller than the water line* and must *have surfaces for the oysters to attach*. On this page, brainstorm at least three ideas. On the next page, draw your group's agreed upon design and explain how it will meet all three criteria.

Part 3

1. Record what was effective about your design and what needs improvement. Include data from our class data table.
2. Improve your design! Discuss and then draw a revised model and use labels and sentences to explain what features will make it more effective.

Summary of Key Assessments

Assessment Type	Notes on Evaluation
Dream & Draw + Final Reflection for each challenge	Starting and ending each challenge with a drawing (or photo) and written reflection allowed teachers and learners to evaluate how learners were expanding and applying their content knowledge (for example, features of wave movement and impact of different structure shapes on wave movement).
Daily notebooking prompts	These served as formative evaluation of understanding of core concepts and of engineering design process. Students referred back to ideas as they engaged in more complex challenges
Data charts and oral explanations	We found it helpful for students to maintain simple data charts for their own design tests as well as having class charts that contained aggregate data. The individual charts, combined with teacher prompted explanations, allows the teacher to assess how well students understand cause and effect relationships and the connection of structure (of the artificial reef or shoreline model) to its function in reducing wave strength.
Detailed living shoreline plan and presentation	Students presented their final plans in one of two ways, either by displaying in the classroom for structured feedback or by orally presenting during a science circle (see Universal Design for Learning). These served as summative assessments which the teacher evaluated for understanding of wave motion, application of design features to solve a problem (reducing wave height/ strength), and understanding of how human structures and natural forces interact.