Build an Oil Tanker

Grade Level: 8-12
Length: 75-90 Minutes over two days
www.pwsrcac.org/lessons

By Katie Gavenus, Children of the Spills, http://childrenofthespill.org

NGSS Standards

HS-ESS3-4 Evaluate or refine a technological solution that reduces impacts of human activities on natural systems.

Crosscutting Concepts

Structure and Function The way an object is shaped or structured determines many of its properties and functions.

Related Resources

Rubric Build an Oil Tanker

Pair With Model Oil Pipeline Lesson; Basic Properties of Oil Lesson

Overview

It is challenging to safely construct, operate, and navigate an oil tanker.

Objectives

- Students will build an oil tanker using design requirements.
- Students will test their abilities to navigate their oil tanker through treacherous waters.

Materials

Pencils
- ☐ Scratch Paper
- ☐ Duct Tape
- ☐ Cardboard
- ☐ Garbage Bags
- ☐ Caulking
- ☐ Food Coloring (or small floating objects such as ping pong balls)
- ☐ Pool or body of water
- ☐ Personal Floatation Devices
- ☐ Oars or Paddles
- ☐ Items for Obstacle Course (hoops, ice, beach balls, lane dividers)
- ☐ Manila Folders
- ☐ Large Bucket of Water or Kiddie Pool
- ☐ Build an Oil Tanker Rubric

Notes

Background

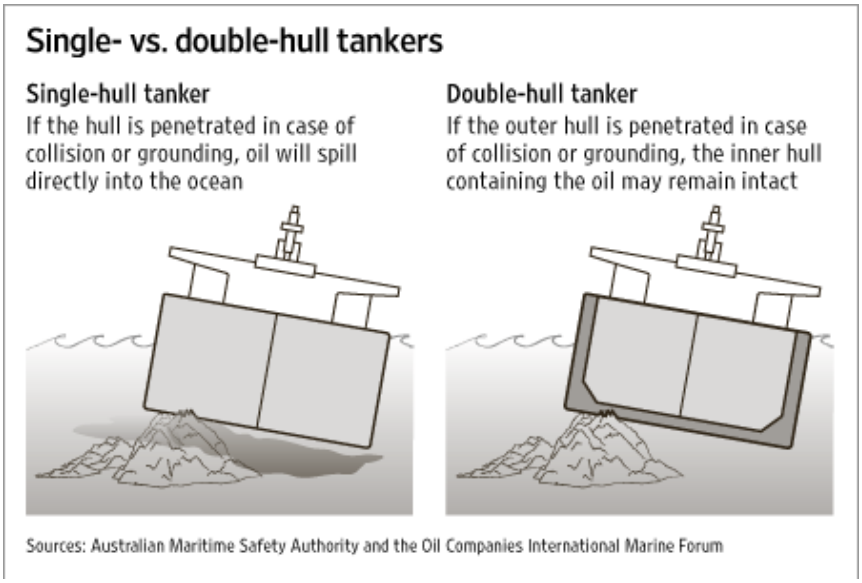
In this activity, students work in teams to design and construct an oil tanker that can safely navigate through an obstacle course. Students will learn about the requirements for operating oil tankers in Prince William Sound. For a more advanced lesson, incorporate kits from Sea Perch or have students build their own remotely operated tankers with model boat engines.

Preparation

1. Decide on the location for your testing and obstacle course.
2. If you will be using a pool, speak with the pool director about your lesson and decide what to use for simulated oil: water with food coloring, small floating objects, or something else. Also discuss objects that can be used for the obstacle course.
3. If possible, set up the obstacle ahead of time.
4. Prepare a large bucket of water or small kiddie pool for students to sue to test their prototypes before constructing their final tankers.

Introducing the Lesson

Explain to students that their challenge is to construct a tanker that can safely transport oil and a crew. The course will be 50 feet long, and will involve various obstacles that will need to be navigated around. Show them the image below of a double-vs. single-hull tanker.



Activity

1. Divide students into groups of 2-4.
2. Provide them with a copy of the Rubric and explain the project rules.
   a. All crew must be aboard the tanker (unless you are constructing an ROV).
   b. Five gallons of "oil" must be safely navigated from the beginning terminal to the end terminal.
   c. Only cardboard, plastics bags, tape, and caulk may be used to construct the tanker.
3. Provide each group with materials for tanker construction.
4. Encourage students to use scratch paper to sketch out designs, and to build and test manila-folder prototypes. They can test their prototypes in a kiddie pool or large bucket of water.
5. As they work on their tanker, remind them to come get five gallons of "oil" (either water with good coloring or small floating objects) that needs to be stored within the tanker.
6. When all tankers are completed, move to the pool/body of water for testing. If you are not testing in a pool, all participants need to wear Personal Flotation Devices while on the water.
7. Set up the obstacle course with items such as beach balls, lane dividers, hula hoops weighted down, large chunks of ice, rocks, etc.
8. Launch the first tanker and test the crew's ability to navigate the obstacle course. Unless you are using SeaPerch or model boat motors, the tanker will be propelled by human power; the crewmembers should board the tanker and attempt to paddle it through the obstacle course.
9. Make note of any obstacles the first tanker hits and watch closely for leaking "oil."
10. Repeat with remaining tankers.

Wrap-up

Once everyone has dried off, debrief the experience with students. Ask students to identify the most difficult aspects of constructing their tanker. Is this realistic? Identify the tankers that were most and least successful. What characteristics made them so successful (or not so successful)? Ask students whether or not it was easy to navigate a tanker.

Have each group discuss among themselves and decide upon at least one change they would make to their tanker to make it more durable

and/or easy to navigate around obstacles. Ask groups to present their ideas for improving their tanker to the group.

Was this a realistic simulation? Review the rules for operating a tanker in Prince William Sound (https://www.pwsrcac.org/announcements/30-years-after-exxon-valdez-how-has-oil-transportation-changed-in-prince-william-sound-since-1989/). Discuss the requirements for escort tugs. Based on their experience navigating in the pool, do students think escort tugs are a good idea?

Assessment

Use the Build an Oil Tanker Rubric to evaluate the group projects and assess student understanding. Students who meet the performance expectation will demonstrate during discussion that they are able to evaluate and refine a technological solution in tanker design to reduce the impact of human activities on the environment.

Pair With

- Basic Properties of Oil Lesson Plan
- Model Oil Pipeline Lesson Plan

Build an Oil Tanker Grading Rubric

Teacher Name: _____

Student Name: _____

CATEGORY	4	3	2	1
Construction -Materials	Appropriate materials were selected and creatively modified in ways that made them even better.	Appropriate materials were selected and there was an attempt at creative modification to make them even better.	Appropriate materials were selected.	Inappropriate materials were selected and contributed to a product that performed poorly.
Construction - Care Taken	Great care taken in construction process so that the tanker is sturdy, functions well, and follows plans accurately.	Constuction was careful and accurate for the most part, but 1-2 details could have been refined for a more functional product.	3-4 details could have been refined for a more functional product. Some evidence that a plan was developed and followed in the construction of the tanker.	Construction appears careless or haphazard. Many details need refinement for a strong or functional product.
Modification/Testing	Clear evidence of troubleshooting, testing, and refinements based on data or scientific principles. Students present well-thought out ideas afterwards of further potential refinement(s).	Clear evidence of troubleshooting, testing and refinements. Students present one idea afterwards of a further potential refinement.	Some evidence of troubleshooting, testing and refinements.	Little evidence of troubleshooting, testing or refinement.
Function	Tanker functions extraordinarily well, holding up under atypical stresses. Tanker successfully navigates course.	Tanker functions well, holding up under typical stresses, but does not avoid all obstacles in course.	Tanker functions pretty well, but deteriorates under typical stresses. Tanker leaks "oil" or cannot maneuver well.	Fatal flaws in function of tanker with complete failure under typical stresses. Tanker sinks.
Group Work	The group functioned exceptionally well. All members listened to, shared with, provided feedback, and supported the efforts of others. The group (all members) was almost always on task!	The group functioned pretty well. Most members listened to, shared with, provided feedback, and supported the efforts of others. The group (all members) was almost always on task!	The group functioned fairly well but was dominated by one or two members. The group (all members) was almost always on task!	Some members of the group were often off task AND/OR were overtly disrespectful to others in the group AND/OR were typically disregarded by other group members.