

PATRIOTS POINT

★ HOME OF THE USS YORKTOWN ★

Cargo Conundrum: Container Ship Challenge

Objective: To have a hands-on experience with density, volume, stability and buoyancy; connect importance of these concepts to engineering and man-made world

Note: This activity can be a simple exploration of floating, sink and stability or can become complex through experimental design, adding mathematical equations and relationships between mass, volume and density.

Background:

- In the late 1800s there was a concern for ships that were packed with too much with cargo and sinking. Lines were painted on the hulls of ships to mark where the waterline should be. These lines told captains and crew if the ship was overloaded. Learn more about Plimsoll lines here: <http://oceanservice.noaa.gov/facts/plimsoll-line.html>
- Where a ship sits in the water can be adjusted with ballast. In the past stones were often used. Today, water is used.
- In some cases, it is necessary for ships to sink! When the aircraft carrier USS Yorktown was decommissioned and brought to its present location in Charleston Harbor, it was “sunk” using 10 million gallons of harbor water as ballast into a 27 foot deep channel to become a museum.
- Aquatic animals also regulate where they sit in the water using organs such as gas bladders or fatty tissue.

Materials Needed:

- Different sized “Tupperware”-like containers; make sure they have a lid that fits- these are the container ships
- Natural materials such as rocks, sticks or even items such as coins, washers and other found house-hold materials to act as balance and cargo (more “realistic” for cargo could be toy cars, etc)
- access to water and a large container/tub/sink to hold water
- marker and tape or permanent marker to draw plimsoll lines

Activity Goal & Steps:

The main idea is to balance your “ship” using ballast inside and cargo placed on the top of the lid. Can you, with your cargo, fill your ballast so it sits at your various plimsoll lines?

1. tub or sink should be filled with enough water such that a the smaller containers chosen have adequate room to float or sink
2. To mimic Plimsoll lines use a marker to draw several lines across the side of your ship. Label them to more easily distinguish.

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3. Leaving the interior of the container “ship” empty, place “cargo” on top of “ship”. Set in water and observe. It might flip over or float.
4. Remove the lid and cargo and place ballast on the interior. Replace lid and cargo. Observe. Where is your “container ship” sitting in the water in relation to your Plimsoll lines? Can you adjust the ballast so that your ship sits with the waterline at each of your Plimsoll lines?