

STEM Sims™

# Boat Builder



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**Do you need an idea for a scientific study?  
Try out one of our ideas or make one of your own.**

**Start learning right now about how the hull of a boat can be shaped to deliver optimal performance in a variety of wave conditions. Take the following brief quiz to see how much you already know about boats and their design. See the bottom of page 4 to check your answers.**

1. About the same time as the Great Pyramids in Egypt were being constructed, Pharaohs had party barges about 150 feet long that they used to host special events.
  - a. true
  - b. false
2. What is the approximate length of the current world record holder for being the smallest powered boat to successfully cross the Atlantic Ocean?
  - a. 10 feet
  - b. 21 feet
  - c. 35 feet
  - d. 46 feet
3. In what year was antifouling paint for ships invented?
  - a. 1847
  - b. 1922
  - c. 1954
  - d. 1972
4. All of the following are possible consequences of adding trim tabs to a boat *except*:
  - a. increasing speed.
  - b. smoothing out the ride.
  - c. increasing fuel efficiency.
  - d. decreasing cockpit visibility.
5. Which culture is most often credited with making the first mounted rudder for a ship?
  - a. Egyptian
  - b. Chinese
  - c. Arab
  - d. French



## Don't Go Down With the Ship

For centuries people have built boats to help them carry goods across waterways. Millions of tons of materials are transported each day using ships. In this activity, your challenge is to design and build a boat that carries the maximum amount of weight. Pull up your anchor and sail away into this investigation of boat building.

### Materials

- 1-sheet of aluminum foil (about 30 cm by 30 cm)
- 1-large bucket or tub
- 1-box of 100 washers about the size of a penny
- Water supply (to fill the bucket or tub)

### Safety

Make sure that you do this activity in a location where water spills will not damage the floor and there is no possibility of an electrical shock. An outside location is preferred. Use caution lifting and moving the bucket or tub filled with water.



### Procedures

1. Fill the bucket or tub about 2/3 full with water.
2. Spend a few minutes thinking about possible designs for your boat. If necessary, try out some simple designs before committing to a final version of your boat.
3. On a separate sheet of paper, draw a plan for your boat's design. Your plan should include a top, side, and end view of your boat. Make sure to include a measurement scale on your plan.
3. Build your boat based on your final design plan.
4. Place your boat in the bucket. If your boat does not float properly, make adjustments to your build.
5. Slowly, one at a time, place washers in your boat. Make sure to distribute the washer load evenly to avoid tipping your boat over.
6. Determine the maximum number of washers your boat can hold before sinking or tipping over.
7. Remove your boat from the water and make modifications to your boat to improve its stability and ability to support a load without sinking.
8. Repeat steps 4 – 6 until you find the best boat design that supports the largest amount of washers.
9. Safely dispose of the water in the bucket and make sure to clean up and dry any water spills. If possible, recycle the aluminum foil used to build your boat.

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## Rubber Ducky Ships

Container ships are responsible for moving cargo across large bodies of water. About 13% of all ocean-going ships are transporting cargo in containers. Currently, Asian countries are the largest builders of container ships and have the ports where the most containerized goods pass through.

These ships specialize in carrying cargo that can be quickly loaded and unloaded without having to open and close numerous doors and hatches. Cargo on these ships is typically loaded into either 20 or 40 foot-long trailers.

Some of the largest container ships can carry around 18,000 TEUs of cargo. A TEU is one container that is 20 feet long by 8 feet wide and 8.5 feet tall. These trailers protect the cargo from the weather as the ship travels across oceans. The trailers are then loaded onto semi-tractors that transport the cargo across the land.

Some estimates state that between 2,000 to 10,000 containers are lost at sea during storms each year. That equates to about \$350 million dollars of goods that went to the bottom of the ocean. In February of 2014, one ship lost over 500 containers due to rough water. Containers packed with light-weight goods, such as potato chips and insulation, floated for some time before sinking. These floating objects posed dangers to other ships traveling through that area due to the risk of collisions with the containers. Some naval forces routinely patrol shipping lanes and shoot floating containers to cause them to sink to keep the shipping channels open. Arguably, the most famous accident was in 1992 when a ship off the coast of Alaska lost almost 30,000 rubber ducks from containers. Even today, these ducks continue washing up on shores as far away as Scotland and Japan.



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Answers: Page 2 Answers: (1) a, (2) b, (3) a, (4) d, (5) b

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