

WHY CARGO SHIPS CAN FLOAT

You might be wondering how these huge cargo ships can float at all, with all those heavy cargo containers sitting on top of them. Let's do a fun experiment to figure out why big, heavy things like cargo ships can float, but small things, like a penny you drop into the ocean, sink.

Question: Why do big heavy objects like ships float, but small heavy objects sink?

Supplies

Modeling Clay

"Ship" Mold

Marbles ("cargo") in different shapes and sizes

Bucket of water or a beaker

Ruler

Experiment:

- 1) Fill the bucket full of water up until about the bottom of the handle.
- 2) Mold the clay into a ball.
- 3) What do you think will happen if you drop the marbles and the clay ball into the water? **They will both sink.**
- 4) Drop the marbles into the water. Now drop the clay ball into the water.
 - a. What happens? **They both sink.**
 - b. Is there any water displacement? (Measure using the ruler.)
Just a little bit.
 - c. Why do you think this happens?
They both do not push very much water out of the way. This means that there is not enough upward push from the water to support them, which makes them sink.
- 5) Take the marbles and clay out of the water.
- 6) Shape the ball of clay into a "ship" using the mold.
- 7) What do you think will happen when you put the ship back into the water?

8) Put the clay that you shaped into a ship back in the water.

a. What happens?

It floats!

b. Why do you think this happens?

The ship made of clay has a larger surface area than the ball of clay, so it pushes more water out of the way. This means that it receives a strong upward push from the water underneath and displaces more water, allowing it to float. Even though the ship has the same density as the ball, its shape allows it to float.

c. Is there any water displacement? (Measure using the ruler.)

9) Add a “cargo” of marbles onto the ship.

a. What do you think will happen?

b. What happens?

The ship sinks lower into the water, but still floats.

c. Why do you think this happens?

If an object has the same mass and volume but a different shape, that allows for water to be displaced, and for it to float.

i. Did the water displace when you added cargo? **Yes.**

ii. How much? (Measure with the ruler).

iii. Did the water displacement change when you added more cargo?
How much?

10) How many marbles do you think that the ship can hold without sinking or tipping over?

11) Who can design a ship that can hold the most marbles without it sinking?

Conclusion: From this experiment, what can you conclude about why big heavy ships float but small heavy objects sink? **Ships that displace lots of water receive a strong upward push from the water. This push supports the ship so that it floats. The larger a ship is, and therefore the more water it can displace, so the heavier cargo it can carry. Even though a ship weighs thousands of tons, the way it is designed and shaped allows it to float and carry tons of weight on it.**

The basic engineering principle of “buoyancy” and “floating” is called the Archimedes Principle. Archimedes discovered around 250 B.C. that the *weight of a submerged body is reduced by an amount equal to the weight of the liquid displaced by the body.* The people who design these ships are engineers, and this is the basic principle they use to design them.