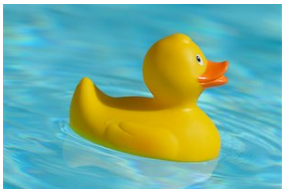
Buoyancy: Float or Sink?



- Gravity pulls everything downwards, including floating objects and water
- The material with the greater **density** (weight per size) ends up on the bottom.
- You can change the shape of an object, trapping air pockets to make it have a density less than water. This will allow even a large, heavy object like an iron ship to float!

Part 1: What Makes an Object Float or Sink?

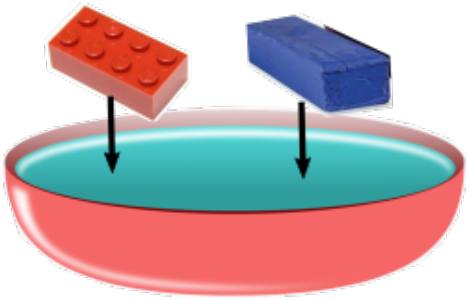
We will test some hypotheses about what determines whether an object floats or sinks.

Hypothesis #1: Floating is determined by **size.** An object will sink if it is big enough.

Make a prediction: Suppose this hypothesis is true.
Imagine testing **2 objects the same size.** Circle the outcomes below that are possible. Cross out any that would contradict our hypothesis. (Poll)

A) Both objects float.
B) Both objects sink.
C) One object sinks and one floats.

Now test the hypothesis:
1. Use modeling clay to make a block the same size (or a little smaller than) your Lego block.
2. Put both in a bowl of water. Circle your observations: (and put them in our shared sheet)



Lego block:	floated?	sank?
Modeling clay block:	floated?	sank?

What can we say about Hypothesis #1? Is it possible that floating or sinking is determined only by the size of the object?

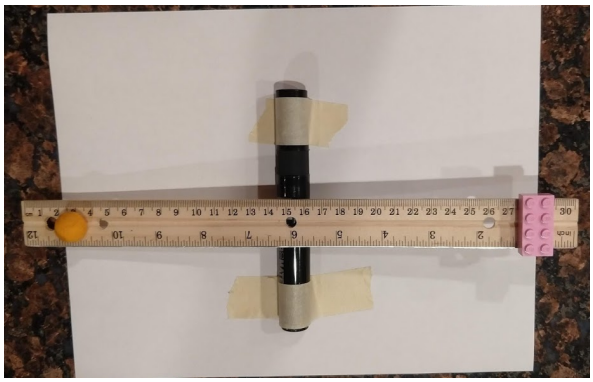
Hypothesis #2: Floating is determined by **weight**. An object will sink if it is heavy enough.

Make a prediction: Suppose this hypothesis is true.
Imagine testing **2 objects of the same weight**. Circle the outcomes below that are possible. Cross out any that would contradict our hypothesis. (Poll)

A) Both objects float.
B) Both objects sink.
C) One object sinks but one floats.

To test this hypothesis, we first need to engineer a device to compare the weight of 2 objects.

1. Tape a thick marker to the table.
2. Lay a standard ruler across it, so the 6 inch mark is exactly centered on the marker.
3. Place a small ball of modeling clay on the 1 inch mark.
4. Place a Lego brick on the other side of the ruler. Slide it closer to the end until it exactly balances the ruler.



Poll: If the Lego brick and the clay ball have the exact same weight, where do you think the brick should be to balance the ruler?

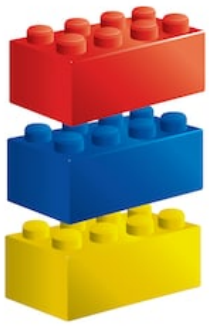
5. Add or subtract pieces from your clay ball until it weighs exactly the same as the Lego brick.

Now let's test Hypothesis #2:
6. Put both the clay ball and the Lego brick in a bowl of water. Circle your observations: (and put them in our shared sheet)

Lego block:	floated?	sank?
Modeling clay ball:	floated?	sank?

What can we say about Hypothesis #2? Is it possible that floating or sinking is determined just by the weight of the object?

7. Try attaching 3 Lego blocks together.



Which is **bigger in size**: 3-brick object clay ball
Which has **more weight**: 3-brick object clay ball
Do you predict the 3-brick object will: Float Sink

Test your prediction and find out if you were right!

So what is it about Lego bricks that makes them float, while the modeling clay keeps sinking? Hint: what's does the inside of the Lego brick look like? The inside of the clay ball?

The density of a material is how much weight it has for a given volume (size). A small, heavy object has higher density than a large light object.

An object floats if its density is less than the density of water

Which has lower density: air water

Lego bricks have many air bubbles trapped inside them. The density of the brick with all those bubbles is less than that of water – so the bricks float, no matter how many of them you stick together.

Go back to your Lego-sized block of modeling clay. Try to figure out – what can you do to it to make it float? Don't peek at the next page until you've thought about it yourself!

1. Flatten the clay block into a thin pancake.
2. Fold up the sides to make a clay "boat".

Could you get it to float?

What happens to your boat if water starts to get inside it? Why?

Part 2: Density of the fluid

1. Pour fill your tall glass three-quarters full with water. Gently place the egg inside

Did the egg: float? Sink?

From what we now know, how does the density of the egg compare to the density of water?

egg less dense than water
egg more dense than water

2. Take the egg out. Add 1-2 tablespoons of salt to the water and mix thoroughly. Put the egg back in.
Did the egg: float? sink?

How does the density of salt water compare to fresh water?

Salt water is more dense salt water is less dense same density

3. Take the egg out. Carefully pour a 1-2 inch layer of oil over the salty water.

Based on what you see, which is correct?
(a) Oil is more dense than water
(b) Oil is less dense than water
(c) Oil and water have the same density

4. Make a prediction: where will the egg end up if you place it into the cup with salty water and oil?
Try it! Were you right?