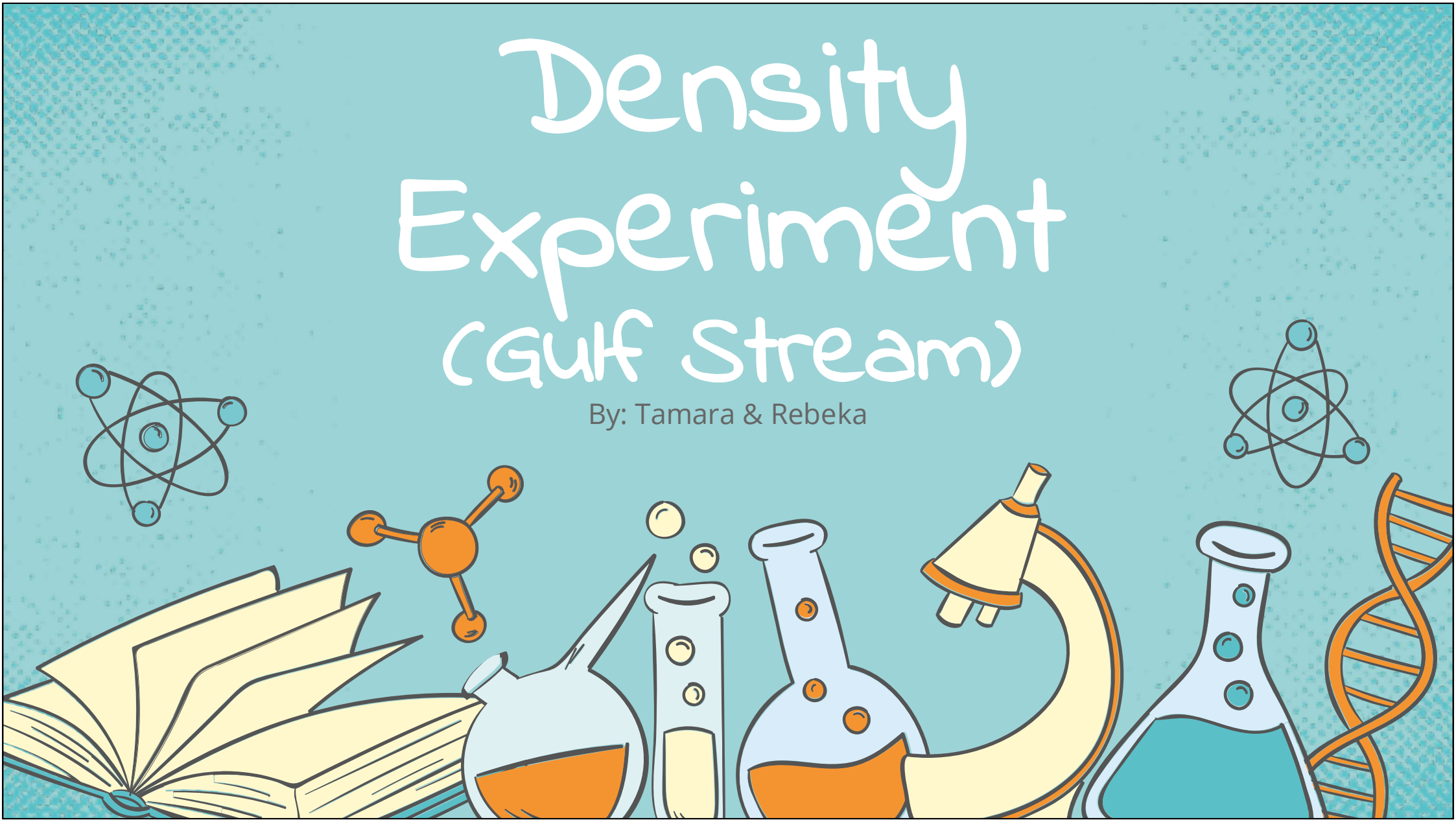
Density Experiment (Gulf Stream)

By: Tamara & Rebeka



Problem Question

Can we show the difference in the density of water that can be found around the Gulf Stream in just a test tube?

Hypothesis

Our hypothesis is that we will be able to show the difference of water density in a test tube although we are going to have to modify a few things, including the color of the water so the difference is more visible.

Research and experiment:

Research

For the research, we found:

The volume, mass and density of the water in the Dead Sea because using the density of a saltwater in the Gulf of Mexico or around the golf stream wouldn't be dense enough to show the difference in our experiment.

The density, volume and mass of water.

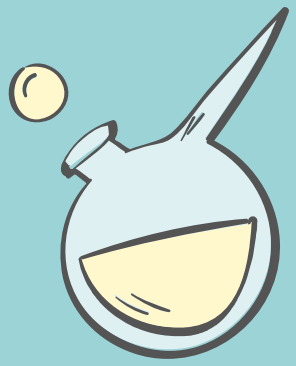
The density, volume and mass of sand.

Due to the research we knew that the sand had the highest density, which meant that it would stay at the bottom of the test tube. The salt water has the second highest density which meant that it would stay above the sand. Normal water has the lowest density which meant that it would stay at the top of the test tube. If we'd do the experiment correctly we should be able to see the differences. The only problem we faced, was that both salt water and normal water are clear and although salt water is a little bit whiter due to the salt particles that dissolved in it, it would still be hard to see the difference therefore we colored the salt water using a purple crystal and left the normal water as it was.

Materials used in experiment:

Sand

Density- 1,63g/cm3
Volume- 100ml=100cm3
Mass- 163g



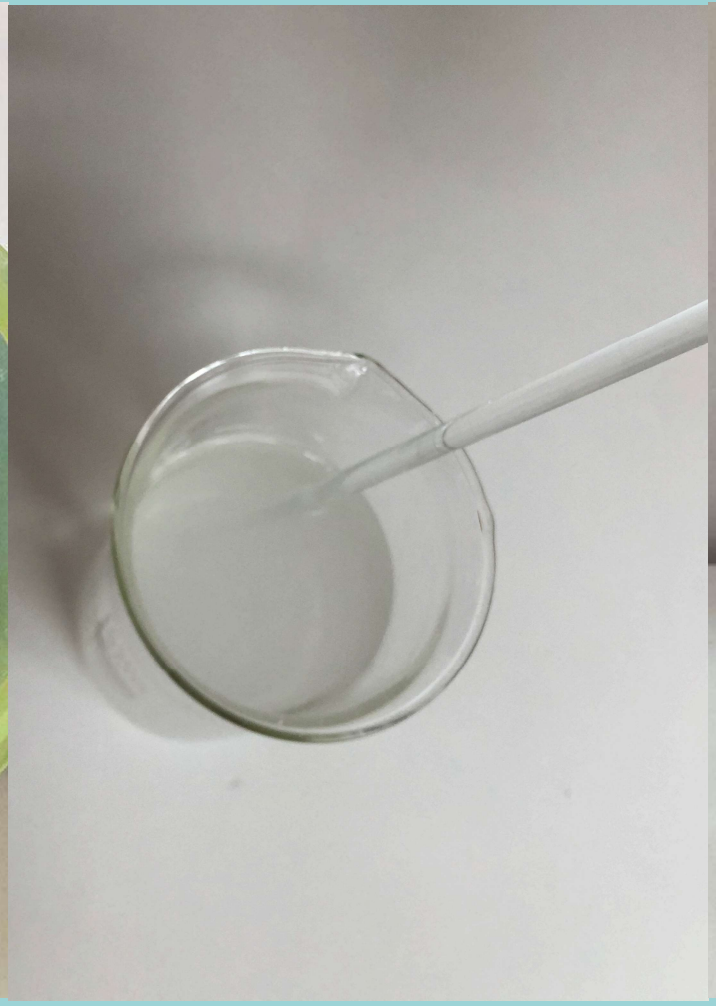
Salt water

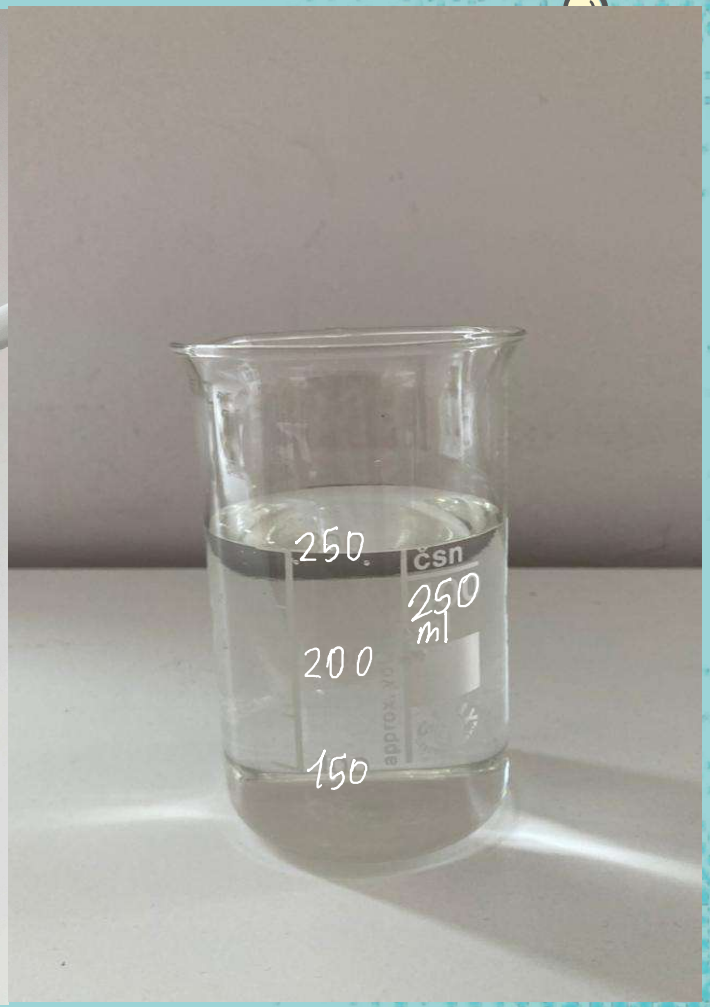
Density- 1,140g/cm3
Volume- 285ml=cm3
Mass- 315g

water

Density- 1g/cm3
Volume- 75ml=cm3
Mass- 68g

SAND SALT WATER WATER





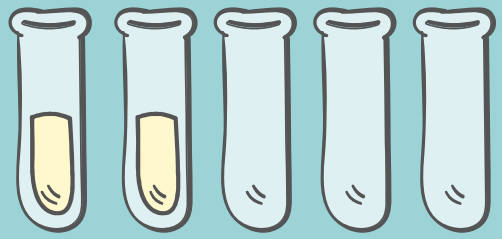
Salt water solution

Water

250ml

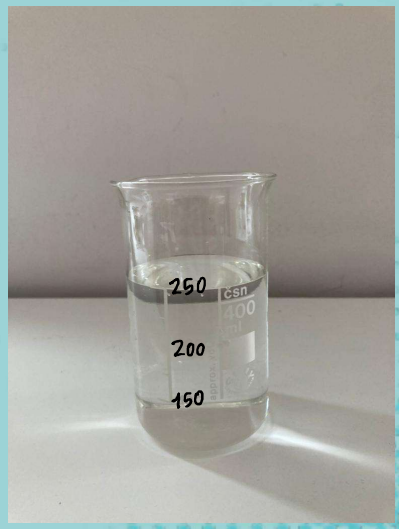
Salt

34,64ml

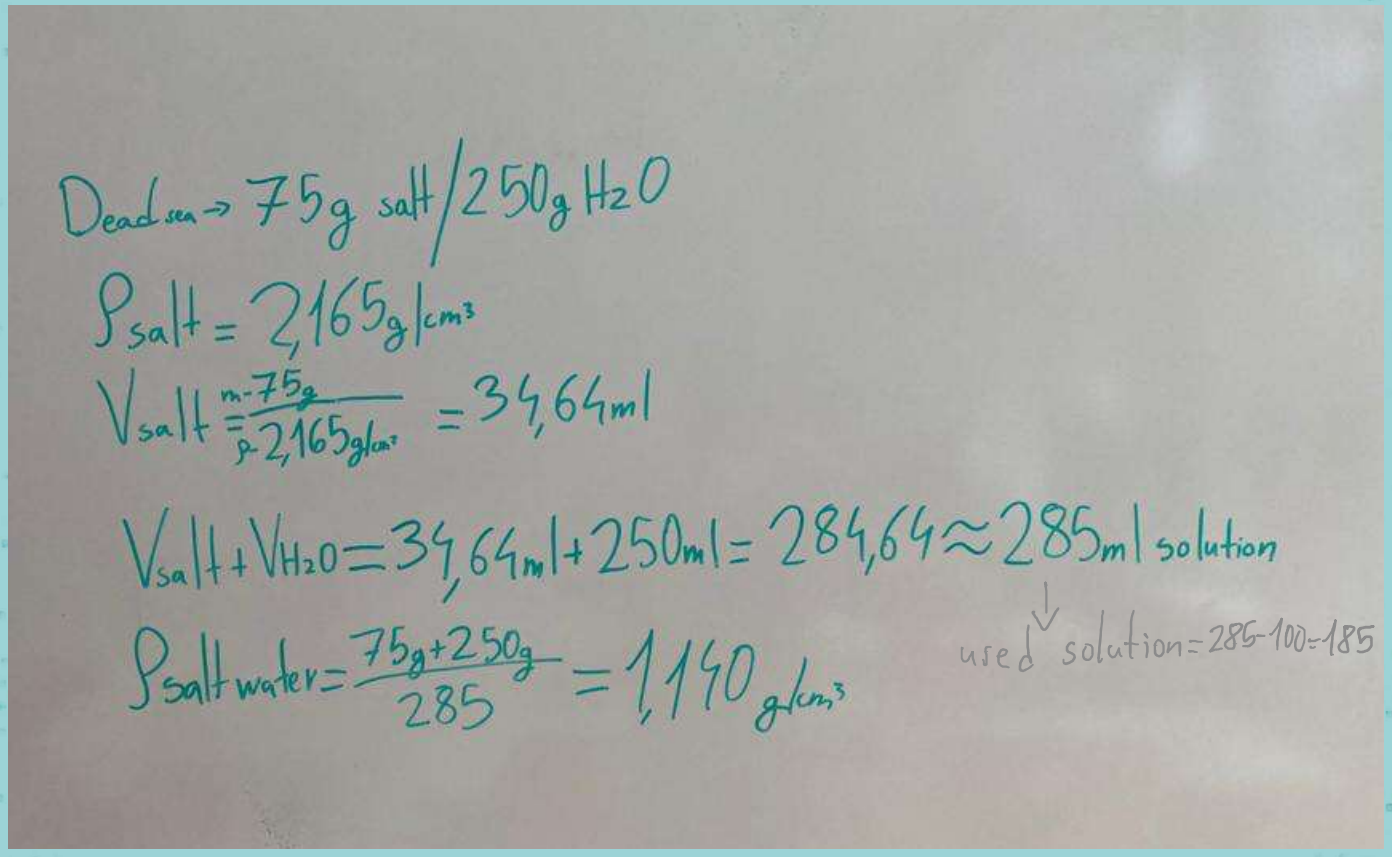


We used 34,64ml of salt for 250ml of water. We got an approximate 285ml solution. We only use 185ml in our experiment.

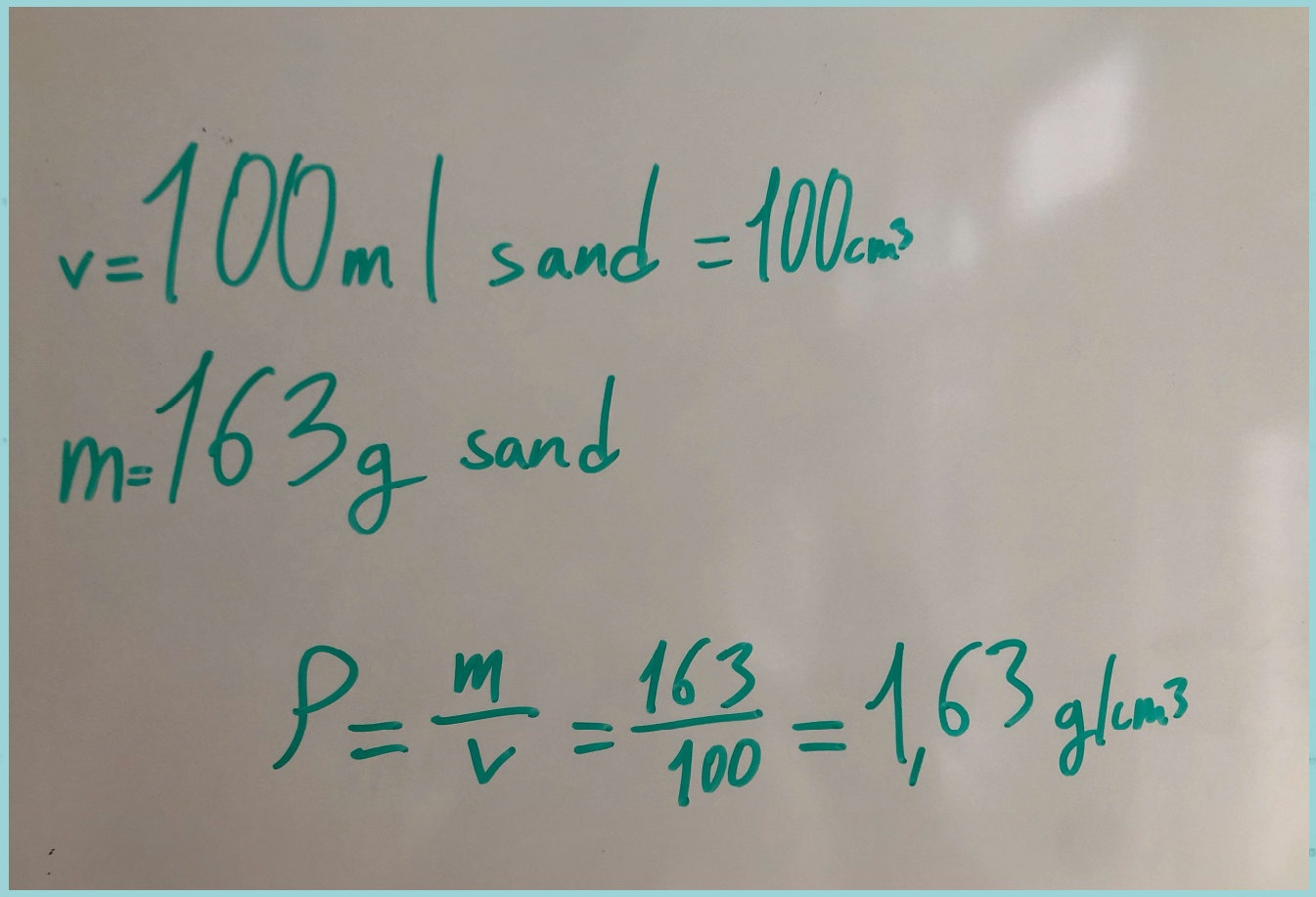
34.64ml



Formula used for salt H20 calculations



Formula for sand calculations

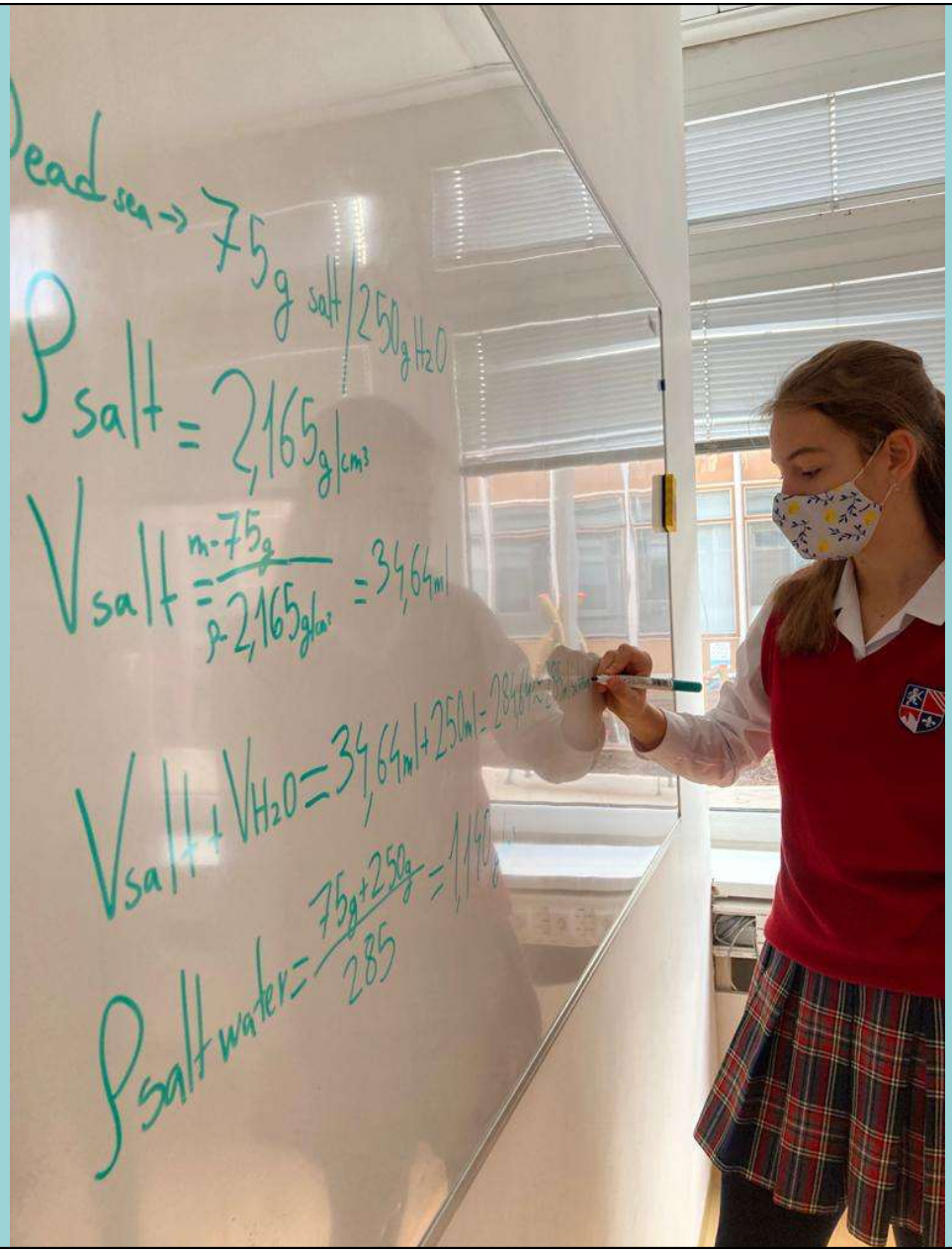


Formula used for water calculations

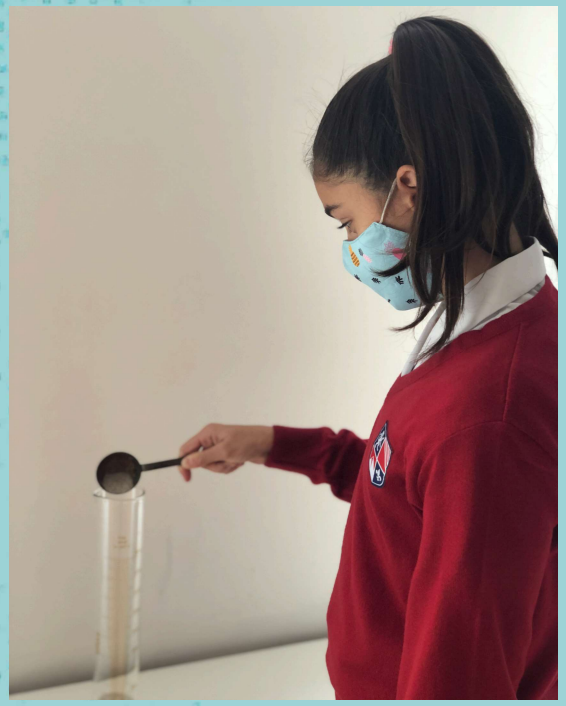
$V H_2O = 75ml = 75cm^3$

$m H_2O = 75g$

$\rho H_2O = 1g/cm^3$


Dead sea → 75 g salt / 250 g H2O
ρ salt = 2,165 g/cm³
V salt = m = 75 g / ρ 2,165 g/cm³ = 34,64 ml
V salt + V H2O = 34,64 ml + 250 ml
ρ salt water = 75 g + 250 g / 285

Layering



Sand

As the first layer we poured in 100ml of sand.

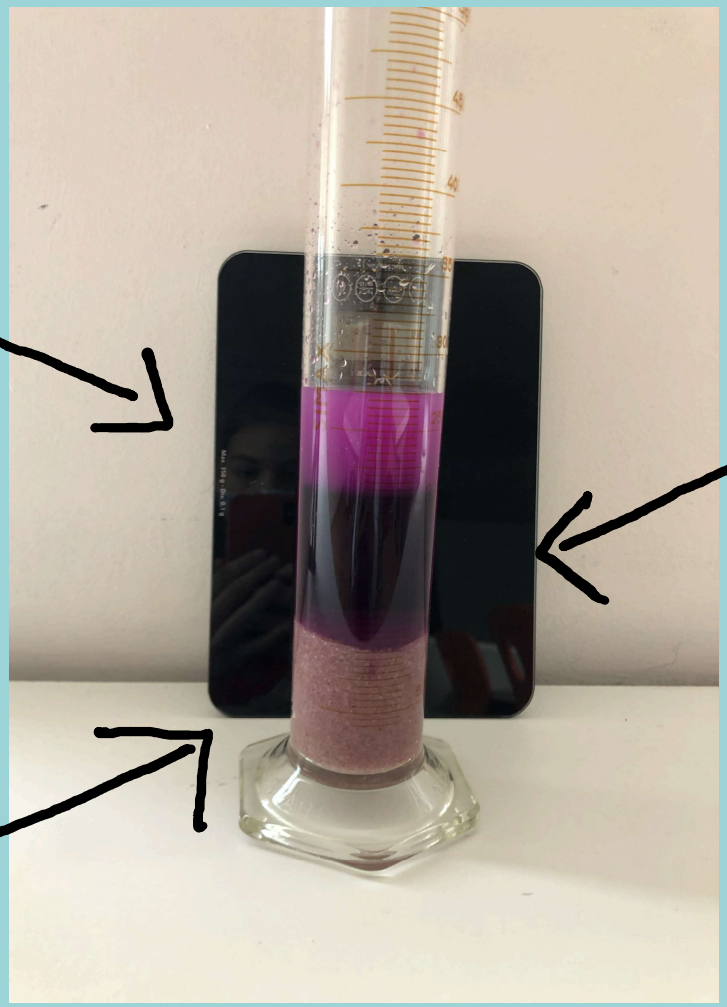
Salt water

The second layer we poured 100 mL of our salt water solution in. We colored it with a crystal so we could see the difference in density more clearly.

water

As the last layer we carefully poured in 75ml of normal water with a syringe to make sure it doesn't mix with the salt water.

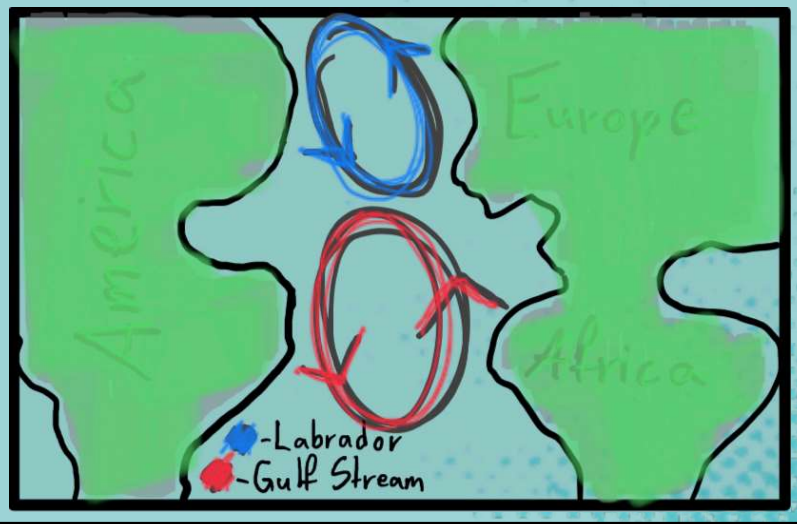
Result



Result

THEORY: The result that we got just confirmed our hypothesis, meaning that we could see the differences in densities of sand, salt water and water even if it was shown just in a test tube. This experiment is an imitation of how the water around and in the Gulf Stream looks like.

We know that currents are made by the difference in density of the salt water and freshwater as well as that the Gulf Stream is a current that runs deeper than the Labrador current. If the amount of freshwater will keep on increasing, it is highly probable that the Labrador current and the Gulf Stream would crash into each other. This would cause them to start circulating in an oval shape. It would bring a lot of catastrophic consequences with it! Now we understand the difference in the density of water isn't made up and it's an important part of the stream network.

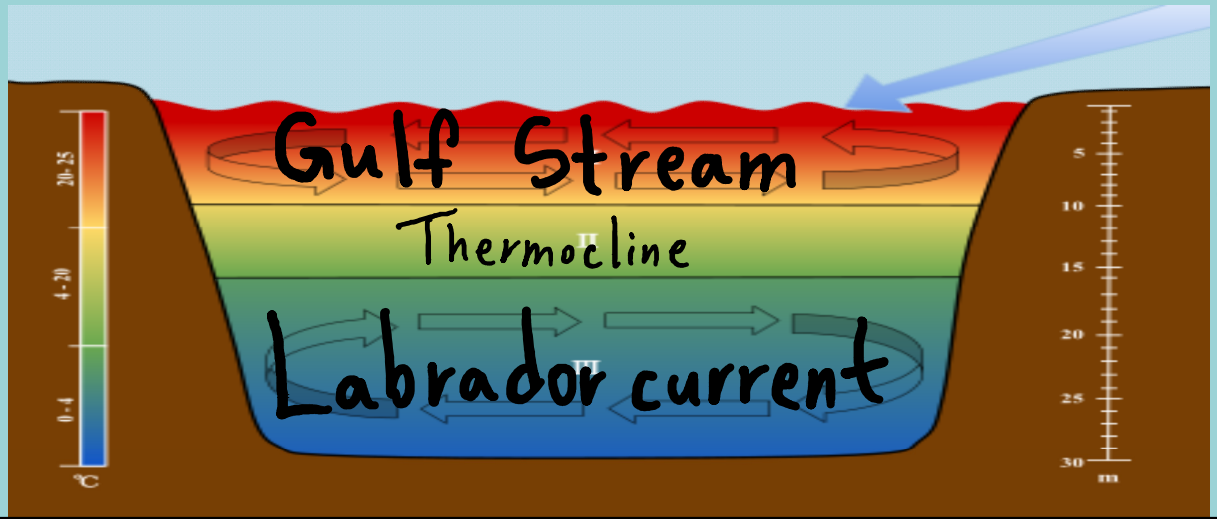


Why doesn't the Pacific and Atlantic ocean mix?

There are many factors that contribute to the fact that the Pacific Ocean and the Atlantic Ocean don't mix. How's that possible?! Well the Pacific and the Atlantic are next to each other and their waters don't mix. If you though that the world has only one ocean and that its parts are just named differently, you thought wrong. Almost between all the ocean is a kind of invisible wall that is dividing the water and preventing it from mixing. There are multiple reasons why this is happening: haloclines (borders between waters with different salinity) between oceans don't have such a high difference in salinity therefore we see it as a vertical invisible wall rather than a horizontal line, inertia (an objects ability to resist changes in motion) in simpler words we can say that the earth is moving and all the moving objects will be acted upon the coriolis force, this prevents the Pacific and Atlantic from mixing. Another influencer on the division of water is the strength of molecules connection and since the two oceans have completely different strengths of molecule connections they rather not bother wasting their time and mixing.

Why wouldn't the Gulf Stream and the Labrador current mix even if they bumped into each other?

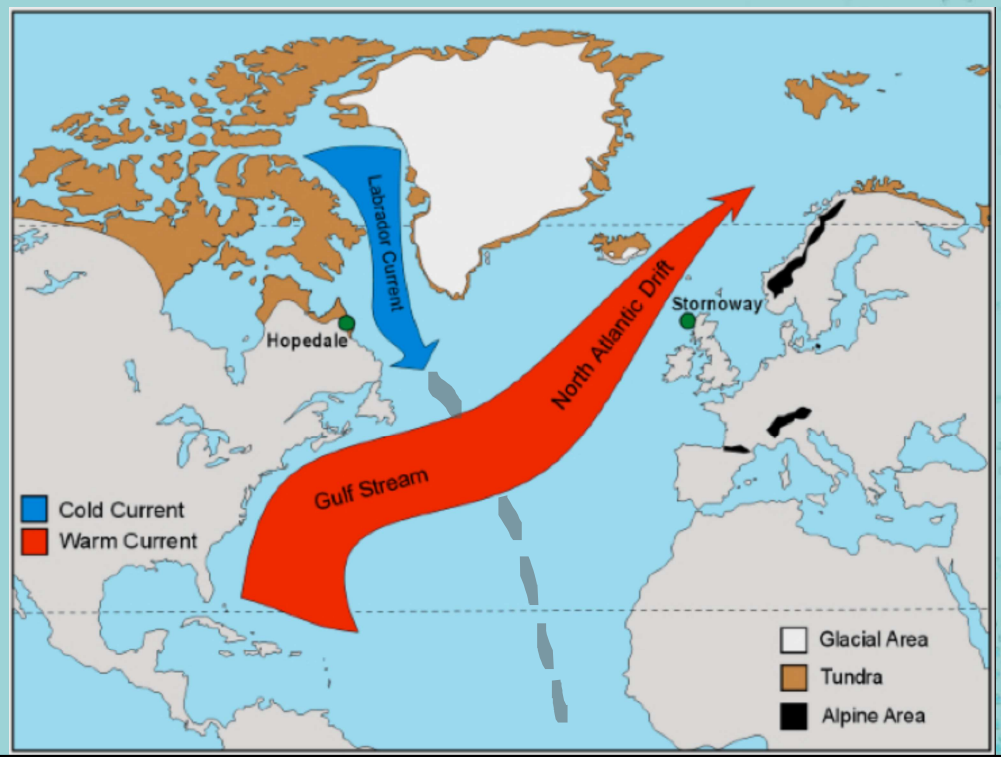
There are also THERMOCLINES- borders between waters with different temperatures. This is could be one of the main reasons why the Gulf Stream and the Labrador current wouldn't mix even if they bumped into each other. The Gulf Stream is a hot stream and brings warm water with it, while the Labrador current is a cold stream. Another main influencer would be the HALOCLINE which in this case is only 0,1% of a difference between the Gulf Stream and the Labrador current.

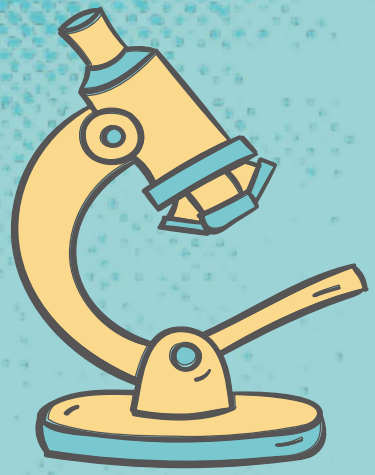
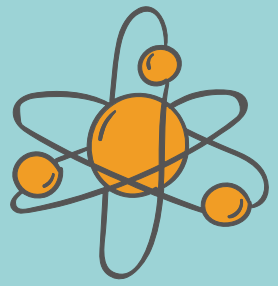
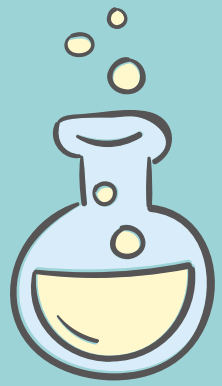


One more experiment:

This whole topic about why wouldn't the Gulf Stream and the Labrador current mix even if they bumped into each other is another topic on its own. That's why we aren't going talk about that any more in this presentation because we would need a whole new experiment for it to show the reasoning.

Since the Labrador current is colder and has higher salinity, it flows underneath the Gulf Stream. If the salinity becomes equal they will flow in oval shapes and probably bump into each other so why wouldn't they mix…




THANKS!

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