Saltwater Density

Vanderbilt Student Volunteers for Science

Training Presentation

2018-2019 VINSE/VSVS Rural

Important!

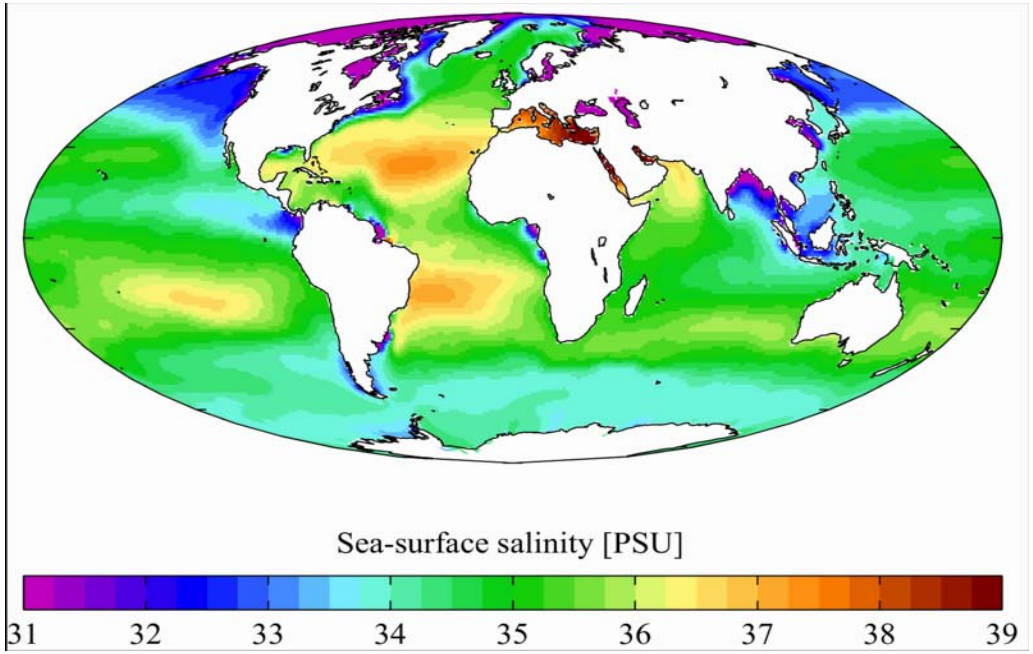
- Please use this resource to reinforce your understanding of the lesson! Make sure you have read and understand the entire lesson prior to picking up the kit!
- We recommend that you work through the kit with your team prior to going into the classroom.
- This presentation does not contain the entire lesson—only selected experiments that may be difficult to visualize and/or understand.

I. Introduction - Saltwater in the Ocean

- Tell students that:
  - Oceans and seas contain considerably more salt than freshwater.
  - If the salt in all of the earth's seas could be removed and spread evenly over the Earth's surface, it would form a layer more than 500 feet thick or 40 stories high!
  - Seawater is actually really complex and contains at least 72 elements, most in very small amounts.
- Ask the students why the ocean contains so much salt but lakes, streams, and rivers have very little.
  - The salt in the ocean comes from the gradual process of weathering and erosion of the earth's crust as well as wearing down of mountains.
  - Rain and streams then transport the salt to the ocean.
  - As time passes, the seas are getting saltier, and salts from erosion builds up.

I. Saltwater in the Ocean

- **Salinity** is the amount of dissolved salts in water
  - Have the students look at the map in their instruction sheet
  - The key at the bottom measures salinity. The average salinity of water in the ocean is 35. 35 means 35 grams of salt in 1000 grams (1 kilogram) of water. The higher the number, the more salt that ocean contains.
  - Tell the students if the ocean's salinity is not the same everywhere
  - Ask them where the saltiest area is. The Red Sea and the Persian Gulf



II. Density Information and Activities

- Share that density is a **property** of solids, liquids, and gases. We will be exploring the densities of **liquids**.

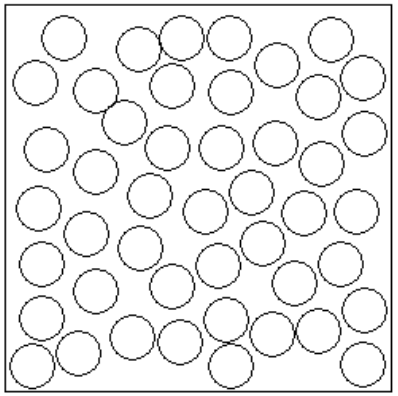
Poly-density bottle demonstration

- **Tell students that a liquid with low density will float on top of a liquid with a high density.**
- Demonstration:
  Shake the poly density bottle and then let the students observe what happens.
  - The two liquids will gradually separate.

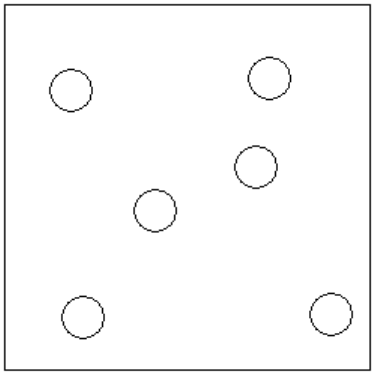
  Ask students what happened, and why they think that it happened.
  - The two liquids have different densities.
  - One of the liquids is denser salt water (lies below the beads on the bottom).
  - The other liquid is less dense rubbing alcohol (lies above the beads on the top).
  - These 2 liquids do not mix, they form layers (salt water on the bottom & rubbing alcohol on the top)
  - The beads also have different densities:
    - The blue beads are more dense than the white beads and less dense than the salt water (they float on the salt water).
    - The white beads are less dense than the salt water and blue beads, but more dense than the rubbing alcohol (they float on the blue beads but not on the rubbing alcohol).

IIB. Density Background Information

- Ask the students if they know what density is.
  - Density is the amount of mass in a given volume.
  - D=m/v
- Have students look at the pictures on their instruction sheet. Explain the difference between high density and low density.
  - High density means there is a lot of material in a given space
  - Low density means there is little material in a given space.
  - Ask students to give you some examples of high density objects and low density objects. (see lesson)



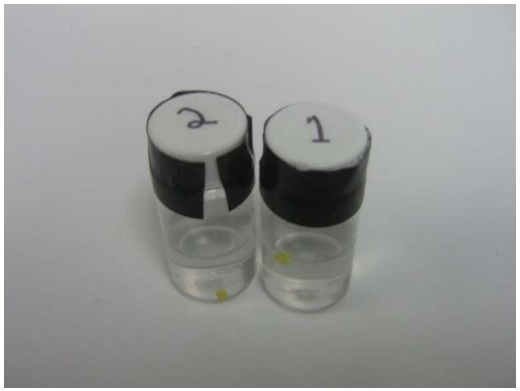
High Density



Low Density

IIC. Floating/Sinking Beads

- Pass out the 2 vials with a bead in each and tell students to NOT open the vials
  - Ask the students why the bead floats in one but sinks in the other.
    - Vial 1 has a liquid more dense than vial 2
  - Tell the students that there is saltwater in vial 1 and tap water in vial 2
  - Ask them if the bead is more/less dense than the saltwater/tap water



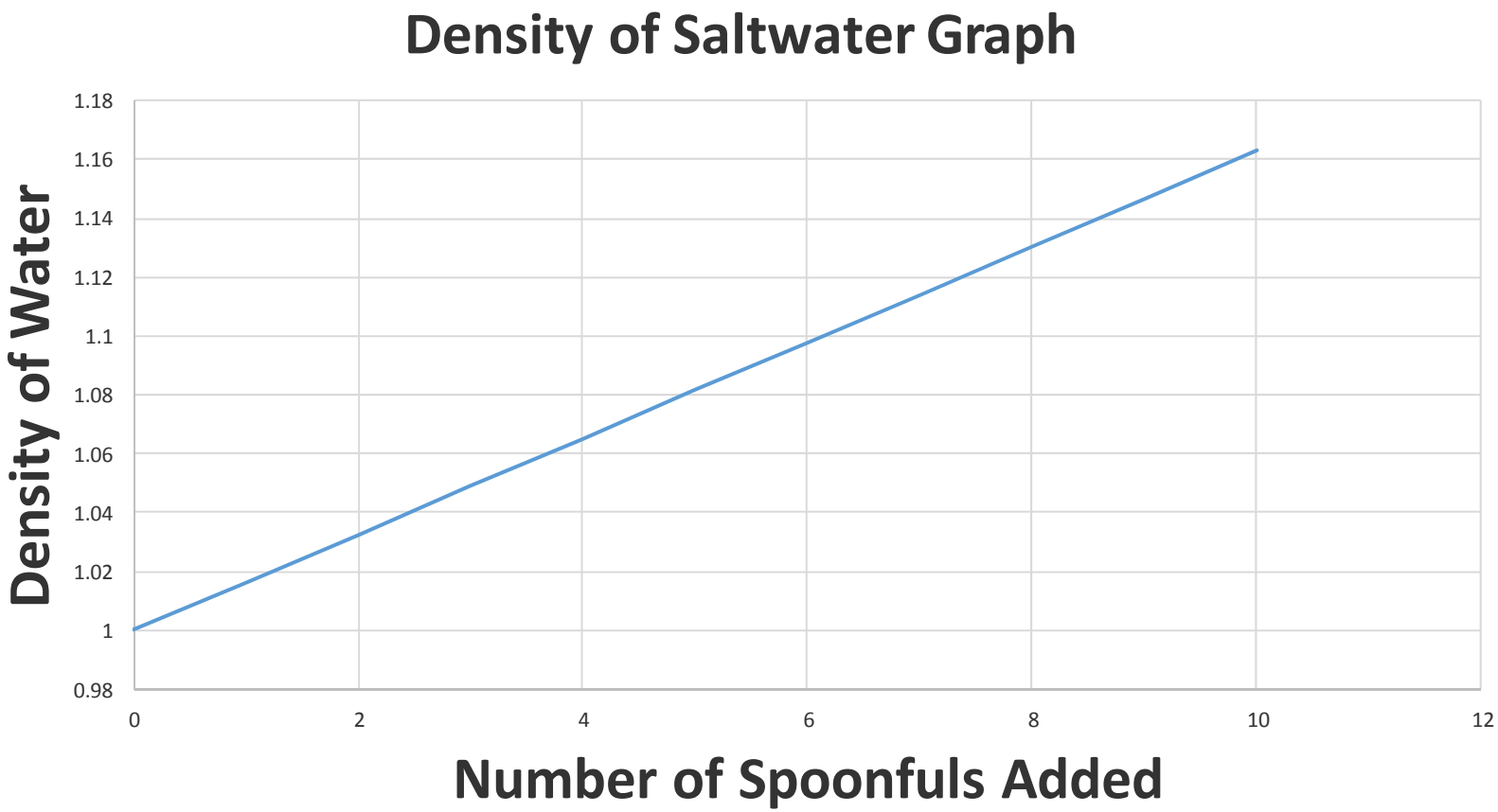
Ask students why they think **saltwater is denser than regular water.**

- *Saltwater has a higher mass because of the added salt but still occupies the same amount of space in a container that regular water would, and hence is denser.*
- Ask students if the bead is more or less dense than regular water. *More*
- Ask students if the bead is more or less dense than saltwater. *Less*

III. Separation Challenge

- Tell students that we can gradually change the density of the water by adding salt to it.
- Tell students to look at the Density of Salt Water graph and explain that the density of water increases as more salt is added.
- Ask students: What do you think will happen to the beads when salt is added to the water?
- *Since the beads have different densities, they will float in different densities of salt water.*

Density of Saltwater Graph



III. Separation Challenge

Pass out the 100 mL jars containing 100 mLwater and beads to each pair.

Tell students to:

1.Tap all of the floating beads gently to see which ones float and which beads sink to the bottom. Some of the beads float initially because water has a high surface tension. Tapping the bead exerts enough force to break the surface tension.

2.Tell students that the beads have different densities: (See observation sheet)

Bead	Approximate Density
#1, white, oval	< 1.00g/mL
#2, blue, cylindrical	1.05-1.07g/mL
#3, yellow, ylindrical	1.13-1.16g/mL
#4, clear, cylindrical	> 1.276g/mL

3. Record on their observation sheets which beads are floating and which are at the bottom of the cup. *The round whitish beads should be the only ones floating at this point.*

4. Ask students to predict the order that the beads will float.

III. Separation Challenge

3. Fill the spoon with salt and then use the popsicle stick to level off the top.

4. Add one level spoon of salt and then stir the water with the coffee stirrer, until they can no longer see salt particles.

5. Record what happens. Have any more beads floated to the top?

There shouldn't be any beads floating to the top.

6. Have students repeat this step. Record what happens after each spoon is added.
7. After 10 spoons have been added, have students screw lid onto jar so that no water will leak.
8. VSVS members will place the jars back in the kit UPRIGHT (please).

Results

- Ask students if their predictions were correct.
  - The white beads floated initially, because their density is less than one.
  - The beads floated in the order of their densities, white, then blue, then yellow.
  - The clear beads never floated. The students should have noticed that salt stops dissolving in the water. This is called a saturated solution.
- Ask students if they can think of a way to make the clear beads float.
  - *We could use liquids more dense than saltwater for the clear beads.*
- Tell students to look at the Density Table for Recyclable Plastics (on their Handout) and determine what kinds of plastics might have been used in this lesson.

Review

- Ask students why saltwater is more dense than freshwater? *Saltwater has a higher mass than the same volume of freshwater*

- Ask students: If a solid floats in a liquid, is it denser or less dense than the liquid? – *Less*
- If it sinks -*more*