

## Science Stars: 8<sup>th</sup> grade Lesson Plan

### Rainbow Water Stacking – Density and Salinity

#### Standards

- 8.a. *Students know density is mass per unit volume*
- d. *Students know how to predict whether an object will float or sink.*
- 9.a Plan and conduct a scientific investigation to test a hypothesis

**Suggested time: 30 minutes**

#### Anticipatory set (engage):

Which would you rather carry; an empty bucket or a bucket full of water? Why? (The full bucket has more stuff in it which makes it harder to carry.) What if we took it to space? (It wouldn't weigh anything, but there would still be more stuff in the space.) Which do you think is more likely to float in water – a rock or a piece of foam? (The foam will float because it is less dense than the rock.) Today we're going to talk about floating and sinking but instead of using words like heavy and light, while we'll be using density.

#### Objective:

Students will plan and carry out an experiment which tests the densities of 5 different water samples. After successfully completing the experiment, students will have five colors of water stacked in a straw and understand the relationship between salinity and density.

#### Materials:

For each group of students:

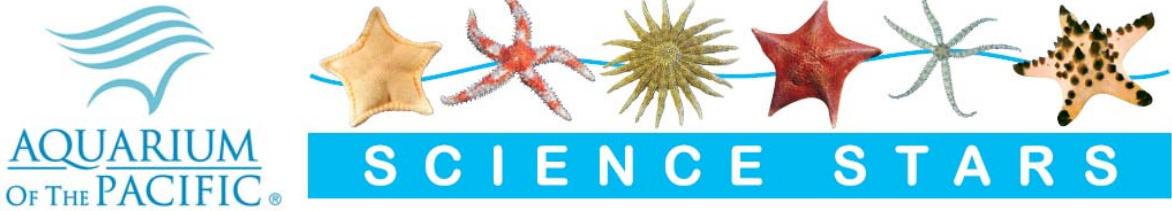
- 5 water samples – clear, green, blue, yellow, red
- Clear straws
- Empty container for “test” water
- Towels for clean-up

#### Prep:

In a large pitcher, mix the same amount of warm water with each of the following amounts of salt to make the 5 solutions:

2 cup of salt	Green food coloring
1 cup of salt	Yellow food coloring
2/3 cup of salt	Blue food coloring
1/2 cup of salt	Red food coloring
No Salt	Clear water

Water samples can be held in any container, but in order to get enough in the straw, the container should be at least a few inches tall.



### **Background:**

Density is measured as mass per unit volume. The more stuff, or mass, that is squeezed into a space, the more dense that object becomes. For example, an empty soda can and a full soda can take up the same amount of space, but the full can is denser since it is filled with more matter. Density, not to be confused with weight, can also be investigated through salinity. Adding salt to a sample of water will result in higher density since there is more mass in the same volume of water.

Salinity is a measure of saltiness or how much salt is dissolved in water. Most of the ocean has a somewhat constant salinity of 35-38 PPT (parts per thousand.) However, places like the Dead Sea have salinity 9 times higher than the ocean (around 333 PPT or 33% salinity.) In order for something to float, it must be less dense than the substance it is floating on. For example, fresh water is less dense than salt water, so it will float on top. A person will have an easier time floating in salt than in fresh water since the denser water holds you up more.

### **Vocab:**

- Density
- Salinity

### **Modeling:**

1. Explain density using a number of examples (cans of soda, rocks and Styrofoam of the same size.)
2. Introduce the term salinity. Ask students to think of places on earth that have different levels of salinity. If necessary, highlight the Dead Sea.
3. Ask students, if there a relationship between salinity and density. Lead students to understand that higher salinity will result in an increased density. Is it harder to float in the ocean or in fresh water? Why?
4. Show students the 5 different water samples. Explain that each water sample has a different salinity.
5. Brainstorm ways to determine which the order of salinity among the 5 samples.
6. Model how to compare to water samples using a straw:
  - Lower the straw about an inch into the first water sample.
  - Cover the straw with your thumb to trap the water in place.
  - Keep your thumb in place and then lower the straw further down into the second water sample
  - Quickly remove and replace your thumb.
  - Keep your thumb in place, and look closely at the straw.
  - What do you see?



6. If the two colors begin to mix, your first color has a higher salinity than the second color and is therefore denser.
7. If the two colors stay stacked; the first color has a lower salinity, and is therefore less dense.
8. Repeat the example again. This time, reverse the order of colors to compare the results.

**Guided Practice:**

Students experiment with stacking and comparing two colors at a time until they can stack all 5 colors in the straw.

**Check for understanding:**

If green stays stacked below blue, which color is denser? (Green is denser and therefore has a higher salinity.)

How can the clear water float on top of every other color? (Fresh water is less dense than any of the salt water samples and can therefore float on top of the other colors.)

Would it be easier to float in the Dead Sea or the ocean? (The Dead Sea because the high salinity makes the water denser and holds you up even better.)

**Independent practice:**

*Do layers actually form in the ocean as they did in the straw? YES!*

