Ocean Layering: Density, Salinity, Temperature, and Circulation

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Demonstration: Density Column

There are many different density column activities available online. This is a 6-layer column adapted from the Spangler Science Labs 7 layer density column: http://www.stevespanglerscience.com/experiment/seven-layer-density-column.

Goal:

Introduce the idea that liquids can have different densities and can sink and float on top of each other.

Instructor Prep:

- Obtain materials: Corn syrup, vegetable oil, baby oil, dish soap, rubbing alcohol, water, food coloring and a tall skinny container such as a 500 mL graduated cylinder.
- Pour the same amount of rubbing alcohol, dish soap, water, vegetable oil, and baby oil into its own beaker or cup. Use a little more than 100 mL of each if using a 500 mL graduated cylinder. The corn syrup can be poured directly from its container. Pouring layers 2-6 from beakers or cups is recommended so that they are poured slower than squirting them out of their original containers. The different layers are less likely to mix if they are poured slowly.
- Dye the water and rubbing alcohol using food coloring. Each layer should be a different color.

Demo:

Pour layer 1: corn syrup. Density ~ 1.33 g/cm^3.

Pour layer 2: dish soap. Density ~ 1.03 g/cm^3. Have the students guess what the liquid is to get them involved. Explain that the layers are separate and the soap is floating on top of the corn syrup. Tilt the container side to side so they can see it's a liquid. What does this mean about the soap? The soap is less dense than the corn syrup.

Pour layer 3: water. Density ~1.00 g/cm^3. Pour this layer slowly as it will make soap bubbles. Now there are three liquids floating on top of each other.

Pour layer 4: vegetable oil. Density ~ 0.91 g/cm^3. Pour this slowly so that it does not come into contact with the soap layer or they will mix. At this point you may have a layer of corn syrup, soap, water+soap, water, oil, then soap bubbles.

Layer 5: rubbing alcohol. Density ~ 0.87 g/cm^3. The rubbing alcohol pops all of the bubbles on top, and may sink through or mix with the vegetable oil.

Layer 6: baby oil. Density ~ 0.82 g/cm^3. This floats on top.

Conclude:

Some number of layers will be visible, with six being ideal. Explain that you know something about the density of these layers based on where they are in the column. The lightest liquid is on top, and the heaviest is on the bottom. The main point: liquids can have different densities just like solids can. Liquids can sink and float just like solids can.

Clean up:

Everything can be poured down the sink. The corn syrup at the bottom takes a minute or two and some soap to get rid of. To reuse the container between classes, not all of the corn syrup needs to be cleaned out.

Extension:
- Put different objects in the density column and see what layer they float in. Can you find objects that are the same densities as each of the layers?