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ECI 306

**Title:** Density

**Time:** Two 45 minute periods

**Standards:**

**Science**

S-1, C-2, PO-1 Demonstrate safe behavior and appropriate procedures (e.g., use and care of

technology, materials, organisms) in all science inquiry.

S-1, C-2, PO-2 Design an investigation to test individual variables using scientific processes

S-1, C-2, PO-4 Perform measurements using appropriate scientific tools (e.g.*,* balances,

microscopes, probes, micrometers). (See M06-S4C4-02)

S-1, C-3, PO-2 Form a logical argument about a correlation between variables or sequence

of events (e.g.*,* construct a cause-and-effect chain that explains a sequence of events).

S-1, C-3, PO-6 Formulate new questions based on the results of a completed investigation.

Eventually, this will lead to:

S-5, C-3, PO-4 Explain how thermal energy (heat energy) can be transferred by:

* conduction
* convection
* radiation

**Math**

6, NS, 3 Fluently add, subtract, multiply, and divide multi-digit decimals using the standard

algorithm for each.

**Objectives:**

-Using pipettes, the students will layer different colored salt solutions.

-The students will use the formula (D= M/V) to figure out the densities of the four solutions on

their papers.

**Content**

This lesson sets the stage for convection. Even though the solutions have the same materials, the amount of salt in each solution is different. This causes the solutions to have different densities, therefore the solutions can layer. Density is the amount of matter in a volume of material. During the second day, the students will figure out the densities of the different solutions using the formula: density equals mass divided by volume. Once students understand this concept, I will introduce them to how one liquid can have different densities depending on its temperature. Warm fluids are less dense and cold fluids are denser. Air is a gas that behaves like a fluid, so it is possible for air to layer as well. Eventually, this will lead to how the rising and falling of warm/cold air and warm/cold water cause convection currents.

**Multiculturalism & Diversity**

In one scenario, I will be very conscious of how I group my students for labs. I will make sure to have students that struggle to grasp concepts paired with the students that not only grasp concepts more readily, but also are willing to explain them to others in their group that might struggle. This will prove especially beneficial while we are using division to calculate the density of different solutions.

In the second scenario, this lesson will be helpful for ADD students. They will have ample opportunity to leave their seat, come back, and refocus. The groups will make mistakes while stacking and mixed water will need to be emptied into the sink. Also, groups will run out colored solution and will need to get more.

**Lesson Integration**

Math will be the easiest to integrate with this lesson since part of the lesson requires it. In order to figure out the different densities of the fluids the students are going to have to do division of decimals. Students will also need to be able to order decimals from least to greatest. One of the activities requires the students to find a solution of a new fluid and place where it would go in the original four layers.

The second subject that could easily be integrated would be reading. There is a selection on density in the Science text book. One area, in which most students struggle, is reading for information. We will read the selection as a class, and I will stop at various points and discuss the text structure. For example, I will point out how the main idea in most nonfiction selections is actually located within the title or subheading. In addition, we can examine the various details under each main idea. We will also observe and discuss the tables and charts that go along with the reading in order to help comprehension.

**Lesson Format**

Engage

I will start off by asking the class if it is possible to layer different liquids. Most likely some students will say yes and others no. At some point in their educational careers, some of the students will have had a teacher that does an oil and water demonstration. I will also ask for real world examples or examples at home. Possible answers would include oil spills (real world) or how salad dressing separates (at home). The next question to be posed is, is it possible to layer different liquids when they contain the same ingredients?

Explore

Students will be placed into nine groups of four. Each group will receive 4 vials, 4 pipettes, 1 straw, and 1 base. Before the lesson begins, the teacher will create four liquid stations, each containing one colored salt solution and a syringe. Getters from each group will use the syringe to obtain 20 milliliters of each type of solution and place it in each vial. The students will then attempt to stack the solution inside of the straw. This will take the entire first class period. If students finish early, I will give them the challenge to try and find another order, even though one does not exist. (They do not know this though.) For homework, they will need to answer the question at the bottom of the lab page.

Explain

The question students answered for homework the previous night will be discussed as a class. The question basically asked why the different salt solutions were able to be layered. Students will be invited to give different answers and each one will be discussed as a class. The correct answer is each solution has a different amount of salt dissolved in it, causing them to have different densities.

Students will be introduced to the concept of density and its formula. The formula is density = mass/volume. As a class, we will take 25mL of each of the four solutions and weigh them to find their mass. We will then plug the measurements into the above formula and determine each solution’s density. The students will see that the solution with the greatest density ended up on bottom and that each solution was less dense than the solution below it.

Once this is complete and the students have practiced using the formula, they will be given the measurements for a fifth solution and will need to calculate its density on their own. After this is completed, the students will then need to figure out where it would layer in their previous solutions.

Elaborate

We will discuss how this happens in the real world and how temperature also affects density. The colder one material is the greater the density, the warmer something is the less dense it is. We will discuss how water in the swimming pool can layer and that air can do the same thing. In the next lab the students will need to stack colored water based off of temperature and then watch what happens as warm water cools off and cold water warms up. Through this lab students will eventually learn about convection and convection cells.

Evaluate

I will know if the students understood the concept of density if their solutions are stacked in the correct manner and if they tell me that the amount of salt in each solution determined the order.

I will also know if they students grasped the formula if they are able to complete the independent practice at the bottom of the calculations page.

**Assessment**

I will use formative assessment when I check the independent practice section at the bottom of each worksheet.

Performance assessment is also something that can be used. I will use the same colors, but change the density of each solution. As tables, the students will then need to use the formula to determine the density of each new solution and predict how they will stack. Once the predictions are completed, they will be collected and we will stack the solution as a class. This is a performance assessment because the students will be determining the volume of the solution, weighing it themselves, and then calculating the density on their own.