

Density Demonstration: Coke vs Diet Coke



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Objectives:

- to list similarities of given objects
- to list differences of given objects
- to brainstorm and find a solution as to why Diet Coke floats and Coke sinks
- to define the term density
- to see how much sugar we consume drinking one can of soda

Materials:

- coke and diet coke
- water
- fish tank
- sugar
- nutra sweet

Procedure:

1. Pass the cans of coke around the room. Have each student take a good look at each can and ask them to make careful observations about what they see.
2. Ask the students to name as many similarities as they can about the 2 cans of coke. Make a list on the board.
3. Ask the students to list as many differences as they can about the 2 cans. Add to list
4. Some answers they may come up with.....

Similarities

1. are made by the same company
2. have the same shape
3. made of aluminum

Differences

1. one is red, the other is silver
2. one is diet, one is regular

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|--|------------------------|
| 4. are sealed shut | 3. one has nutra sweet |
| 5. have the same amount of liquid - 12 fl oz | 4. etc... |
| 6. similar weights | |
| 7. contain water | |
| 8. contain carbon dioxide | |
| 9. both have caffeine | |
| 10. etc... | |

1. Place the regular coke into a small tank of water.
2. Place the diet coke into the water. (Look surprised and take both out. Have a student come up to verify that the cans are still sealed and have not been tampered in anyway!)
3. Place back into water. Ask the students to explain why one is floating.



Possible responses:

- they weren't filled right at the plant
- the red paint is heavier than the silver paint, or vice versa
- one is flat, the carbon dioxide must have leaked out
- nutra sweet is lighter than sugar
- etc.....

The "Why":

Show the students what 39 g of sugar looks like (I found it effective to show the sugar in a small beaker while holding it next to the can so they can see how much space it would take up in the can) next to approx *100 mg (on an index card) of Nutra sweet. Explain that ALL that sugar is in the regular Coke can, and that small amount of Nutra Sweet is in the Diet Coke can. Explain that a small amount of Nutra Sweet is needed to make the

Diet Coke sweet because it is so concentrated. Most students are surprised to actually SEE how much sugar there is!

Discuss how more "stuff" (matter) is crammed into the same amount of space, or **VOLUME**, and that increases the **MASS**. The relationship of Mass to Volume is **Density**. The more items (matter) you place into a defined space, the denser it becomes. For example, New York City is DENSELY populated because there are a lot of people in a small area. 20 people in an elevator is DENSER than 2 people in an elevator.

The Density of water is **1g/cm³**. An object will float if the density is less than 1. An object will sink if its density is greater than 1.

***Note:** According to the Coca Cola company : "a soft drink sweetened with aspartame (8 oz., ranges from approximately 10 to 85 mg)" A can has 12 oz, so I approximated 100 mg for measuring purposes since my triple beam balance has a 0.1g bar. You can also say that there are **39,000 milligrams** of sugar in a can of regular Coke!!!

Extension:

Weigh the Coke and Diet Coke to determine mass of each can. Using water displacement, find the volume of each can. Use the formula $D=M/V$ and see if you can determine their densities. Is Diet Coke's density less than 1? Is regular Coke's density greater than 1?

Does this work for all Diet sodas? Try different brands, for example Pepsi, Dr. Pepper, Sprite, etc. Have the kids form predictions and test them out!

