

SNC1D/1P Atoms, Elements and Compounds/Exploring Matter

Teacher Demo: Coke versus Diet Coke

Topics	Timing
physical property: density chemical changes gas tests	preparation: 15 min demonstration: 10 min

Specific Expectations

SNC1D

A1.5 conduct inquiries, controlling some variables, adapting or extending procedures as required, and using standard equipment and materials safely, accurately, and effectively, to collect observations and data

A1.10 draw conclusions based on inquiry results and research findings, and justify their conclusions

C2.2 conduct an inquiry to identify the physical and chemical properties of common elements and compounds (e.g. magnesium sulfate, water, carbon, copper II) [PR]

C2.3 plan and conduct an inquiry into the properties of common substances found in the laboratory or used in everyday life (e.g. starch, table salt, wax, toothpaste), and distinguish the substances by their physical and chemical properties (e.g., *physical properties*: hardness, conductivity, colour, melting point, solubility, density; *chemical properties*: combustibility, reaction with water) [IP, PR, AI]

SNC1P

A1.5 conduct inquiries, controlling some variables, adapting or extending procedures as required, and using standard equipment and materials safely, accurately, and effectively, to collect observations and data

A1.10 draw conclusions based on inquiry results and research findings, and justify their conclusions

C2.2 use an inquiry process to identify the physical and chemical properties of common elements and simple common compounds, including gaseous substances (e.g., sulfur is a yellow solid; sodium chloride is water soluble; nitrogen gas is colourless, odourless, and very unreactive) [PR, AI]

C2.4 investigate and distinguish between the physical and chemical properties of household substances. (e.g. starch, table salt, wax, toothpaste) [PR, AI]

Introduction

This demonstration reviews the concept of density. It examines why certain objects float or sink in water and highlights some interesting information about cola versus diet cola soft drinks.

Materials

2 large beakers (4 L) or a fish tank
water

3 cans of pop (2 regular Coke and 1 Diet Coke)

Safety Considerations

None

Procedure

1. Fill two large beakers with water.

Part One

2. **Predict/Explain**

Ask students to predict what will happen if you place the regular Coke can in one beaker of water and the Diet Coke can in the other beaker of water. Ask students to justify their prediction with a reasonable explanation.

3. **Observe**

Place the can of regular Coke in one beaker and the can of Diet Coke in the other beaker. Note that the regular Coke can sinks and the Diet Coke can floats.

4. **Explain**

Have students revisit their initial predictions and make any adjustments necessary.

Part Two

5. **Predict/Explain**

Next, take two regular Coke cans and ask students to predict what will happen when they are placed in the beakers of water. Ask students to justify their predictions with an explanation.

6. **Observe**

Place one regular Coke can in each beaker, but as you place the second Coke can in the beaker be sure that an air pocket forms beneath the can. This is accomplished by putting the can in vertically. Now the first Coke can sinks and the second Coke can floats.

7. When the students realize that an air pocket was formed, place both cans so that there are no air pockets. This time both Coke cans will sink.

8. **Explain**

Have students revisit their predictions and make any adjustments necessary.

What happens?

In Step 3 students should observe the Coke can sinking and the Diet Coke can floating. In Step 6 students should see one Coke can sinking and one Coke can floating. In Step 7, students should observe both Coke cans sinking.

How does it work?

The can of regular Coke sinks because it is more dense than water. The can of Diet Coke floats because it is less dense than water. This difference is due to the fact that regular soft drinks contain a considerable quantity of sugar. Sugar solutions are more dense than water. Diet soft drinks do not contain much, if any, sugar. Instead they contain a sweetener called aspartame which is 200 times sweeter than sugar. The mass of aspartame required to sweeten diet soft drinks is therefore much less than the mass of sugar required to sweeten regular soft drinks. As a result, a can of diet cola is less dense than a can of regular cola because it contains less mass in the same volume.

Teaching Suggestions/Hints

1. Before you do this demonstration, make sure that the regular soft drink sinks and the diet soft drink floats. There can be inconsistencies that cause this not to happen in all instances. As well, be sure to practice Step 6.
2. After Step 6 discuss the importance of controlled variables. Some students may suggest that you also trapped air under the Diet Coke can, and may want to see that part of the demo repeated, being sure that no air is trapped.

Next Steps

Have students predict what will happen to various other types of soft drinks (e.g., Pepsi, Diet Pepsi, club soda, grape soda) and match the results with the nutritional information for each drink. This demonstration could also launch a discussion about the pros and cons of diet drinks.

Additional Resources

1. A detailed explanation of this demonstration -
<http://www.middleschoolscience.com/dietcoke.htm>
2. A short video of this demonstration - <http://www.youtube.com/watch?v=MzsORE0ae10>