



Erupting Diet Coke® with Mentos®

by Teisha Rowland, PhD

ACTIVE TIME

20-30 minutes

TOTAL PROJECT TIME

20-30 minutes

KEY CONCEPTS

carbonation, physical reactions, gases



Have you ever seen the Diet Coke® and Mentos® experiment, which is all over the Internet, and wondered what makes the reaction work? You might think that there is some ingredient in a Mentos candy causing a chemical reaction with the soda, like the way baking soda reacts with vinegar. But the amazing eruption that takes place when Mentos are dropped into Diet Coke is not a chemical reaction at all! Instead it is a physical reaction. That means that all of the pieces of the reaction are there, but that they are simply re-arranged. And changing some factors may cause a larger or smaller physical reaction to take place — see for yourself!

Credits

Teisha Rowland, PhD, Science Buddies

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Materials

- Wax paper
- Cutting board
- Knife
- Eye protection, such as safety goggles or glasses
- Index cards (2)
- Tape
- One roll of Mentos (at least 8 candies)
- Two-liter bottles of Diet Coke (2)
- An outdoor area at least two meters from buildings

- Optional: Video camera and a tripod or helper



Prep Work

1. Make a Mentos cartridge to hold the candies for you before you drop them into the Diet Coke bottle by rolling an index card into a tube, slightly larger than the diameter of a Mentos candy. Tape the tube together on the side.



2. Be sure to wear eye protection when putting the Mentos candies into the Diet Coke!
3. Wear clothes that you would not mind having a little Diet Coke splashed on to — this activity can get a little messy!

Procedure

1. Place a Diet Coke bottle in an outdoor area, at least two meters from any buildings or anything hanging above the area, such as eaves, overhangs, or wires. Make sure that the bottle is level and stably standing straight up.
2. If you want to video tape the reactions, set up the video camera so that it can see the bottle and a height equivalent to at least the first story of a building.
3. Carefully remove the cap from the bottle and place the flat index card on top, covering the hole.
4. Add four whole Mentos candies to your cartridge, put on your eye protection, and start the video camera if you want to record the eruption.
5. Place your full cartridge on top of the flat index card. Line up where the opening of the bottle is with the opening of your cartridge. Quickly pull out the flat index card, releasing the Mentos candies into the bottle. Quickly step back without tipping the bottle over or disturbing the reaction.



How quickly did the reaction start to happen, and how quickly did it stop? About how high did the eruption go? How much Diet Coke is left in the bottle?

6. When the bottle stops spouting, stop recording.
7. Place a piece of wax paper on top of a cutting board. On the wax paper, carefully use a knife to crush and cut four Mentos candies into many small pieces. An adult may need to help with cutting up the Mentos candies.



How do the crushed Mentos compared to the whole Mentos? Do you think they will sink through the Diet Coke in a similar or different manner? Why might this matter?



8. Remove the used Diet Coke bottle and place a new Diet Coke bottle in the same position, making sure that the bottle is level and stably standing straight up. Carefully remove the cap from the bottle and place the flat index card on top, covering the hole.
9. Add your four crushed Mentos candies to your cartridge, pouring them in from the wax paper. Put on your eye protection and start the video camera.

- Place your full cartridge on top of the flat index card. Line up where the opening of the bottle is with the opening of your cartridge. Quickly pull out the flat index card, releasing the crushed Mentos into the bottle. Quickly step back without tipping the bottle over or disturbing the reaction.



How quickly did the reaction start to happen, and how quickly did it stop? How high did the eruption appear to go? How much Diet Coke is left in the bottle? Is it more or less than the amount that was left when you used whole Mentos candies?

- When the bottle stops spouting, stop recording. If you video taped the reactions, you can watch your videos now. Which reaction went higher, the one with whole Mentos or the one with crushed Mentos?

Cleanup

Hose off any part of a building that was splashed with Diet Coke.

What Happened?

As the Mentos candy sinks in the bottle, the candy causes the production of more and more carbon dioxide bubbles. This leads to the classic Mentos and Diet Coke eruption. The speed at which the Mentos falls through the Diet Coke can affect how large the eruption is. Because Mentos candies are rather dense, they sink rapidly through the bottle, causing a fast, large eruption. However, since there are air spaces between the small pieces, the group of crushed Mentos candies are not as dense as the whole Mentos. This causes the crushed Mentos to sink slower and consequently they create a smaller eruption. The smaller eruption should leave more Diet Coke in the bottle than the larger eruption (with the whole Mentos candies) did.

Digging Deeper

A carbonated beverage is packed full of dissolved carbon dioxide gas, which forms chemical bonds with water. While the soda is in the bottle, the gas is kept in solution by the bottle's pressurized conditions. When you pour some soda into a glass, the gas stays trapped by the surface tension of the water. But those gas bubbles want to escape, making it no wonder that soda makes you burp!

To create bubbles, the carbon dioxide needs to interact with itself, which means that its bonds with water in the Diet Coke must be broken. A Mentos candy can help with this. Although a Mentos candy may look smooth, if you looked at it under a microscope you would see tiny bumps coating the entire surface of the candy. This rough surface allows the bonds between the carbon dioxide gas and the water to more easily break, helping create carbon dioxide bubbles and cause the classic Mentos and Diet Coke eruption. As the Mentos candy sinks in the bottle, the candy causes the production of more and more carbon dioxide bubbles. Additionally, the newly-made bubbles that rise up from the candy react with carbon dioxide (still dissolved in the soda) to cause more carbon dioxide to be freed and create even more bubbles. This results in the amazing eruption.

For Further Exploration

- Find an exterior wall of a building with no windows and set a Diet Coke bottle at the base of the wall. Use a tape measure and blue painter's tape to mark off the height from the top of the bottle in meters. Then do this activity three times, with the bottle in front of the tape-marked wall, videotaping it each time. When you review the recordings, use slow motion and pause the recording when the spout is at its maximum height. Using the tape marks in the background, estimate the height of the spout. Calculate the average height for the whole Mentos and the crushed Mentos. What is the difference in height of the eruptions?
- What other factors affect the size of the Mentos and Diet Coke eruption? You can try testing different kinds of carbonated beverages, different kinds of candies with different shapes and textures, or using other things to start the reaction, like rock salt, pennies, or dice. Which beverages, candies, or other things cause the largest and smallest

eruptions? Why do you think this is?

- Do this activity again but instead of testing whole Mentos vs. crushed Mentos, compare warm Diet Coke to cold Diet Coke. Does temperature affect the height of the eruption?

Additional Resources

Project Ideas

- **Coke® & Mentos® - Exploring Explosive Chemistry!** (http://www.sciencebuddies.org/science-fair-projects/project_ideas/MatSci_p023.shtml)

Science Careers

- **Materials Scientist and Engineer** (<http://www.sciencebuddies.org/science-engineering-careers/engineering/materials-scientist-and-engineer>)
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