**Mentos Post Lab Reading and Questions**:

**Introduction**

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| Mentos1 |
| The Diet Coke® and Mentos® eruption can be several meters high! (Wikipedia, date unknown)  |

The Diet Coke® and Mentos® experiment is all over the Internet, but how does it work? You might think that there is some ingredient in a Mentos® candy that is causing a chemical reaction with the soda, like the way baking soda reacts with vinegar. But this 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.

The first half of the story is something called a saturated solution, which is in this case is a carbonated beverage or soda pop. All of the bubbles in a soda pop that make you burp come from carbon dioxide gas that is dissolved into the soda solution. While the soda is in the bottle, the gas is kept in solution by the pressurized conditions inside the bottle. But after you pour some soda into a glass, the gas bubbles stay trapped in the solution by the surface tension of the water. No wonder soda makes you burp— those gas bubbles are just sitting in there waiting to escape!

The second half of the story is something called a nucleation site. Looking at a piece of Mentos® candy, you may think it is very smooth. But if you were to look under a microscope, you would see tiny bumps coating the entire surface of the candy. Each tiny bump acts like a nucleation site, a place where this physical reaction can get a kick start. Each tiny nucleation site becomes a place where a bubble of carbon dioxide gas can form and escape the solution. Multiply that by all of the tiny bumps on a Mentos® and you have yourself a geyser!

The main explanation to the phenomenon, which by the way tells why the ‘experiment’ works with any sparkling beverage, is based on chemistry. What happens (in the case of a ‘chemical fountain’) is that the pores (openings) in the Mentos® candy help **nucleation** of carbon dioxide molecules which are dissolved in the beverage, which results in a fast formation of **bubbles**, resulting in the ‘geyser effect’ – nucleation is also what you observe when you see bubbles forming in a cup of Champagne. Of course, the faster the bubbles form, the faster they will escape from the bottle, ultimately creating this foaming mixture that can be projected meters away!

A detailed study conducted at [Appalachian State University](http://www.appstate.edu/%22%20%5Ct%20%22_blank%22%20%5Co%20%22Appalachian%20State%20University) in Boone, North Carolina, by Dr. [Tonya S. Coffey](http://www.phys.appstate.edu/coffey/index.html%22%20%5Ct%20%22_blank%22%20%5Co%20%22Tonya%20Coffey), showed that, in addition to the candy roughness and porosity, a second factor that deeply influences the success or failure of a coke fountain: the surface tension of the liquid directly influences the bubbles formation rate, and a liquid containing an artificial sweetener (such as aspartame in diet coke) has a lower surface tension than a liquid containing a natural sugar. Furthermore, the gum arabic contained in Mentos® candies also brings a contribution to lowering the surface tension of the mixture.

It was also observed that, contrary to what is frequently believed, no acid-base reaction is involved (actually, there is no base in a Mentos® candy, and the pH of the beverage does not change during the course of the ‘reaction’), the caffeine present in coke has hardly any influence on the result, contrary to the speed at which Mentos® candies sink into the liquid, which turns out to be of great importance!

In summary, the chemical geyser is due to the presence of a rough, porous ‘material’, in addition to chemicals that decrease the surface tension of the liquid, which contains dissolved carbon dioxide: these are the three basic ingredients of this funny recipe.

**Terms, Concepts, and Questions**

* Physical and chemical reactions
* Nucleation sites
* Carbon dioxide
* Surface tension
* Solution

**Questions.** Write answers on a separate sheet of paper.

1. What makes the Diet Coke® suddenly form a geyser?
2. How do nucleation sites provide a place for the carbon dioxide gas to escape the solution?
3. Why is this experiment a physical reaction and not a chemical reaction?
4. Why are colored Mentos® less likely to produce a vigorous reaction?
5. Can you think of a “practical use” for this type of reaction?
6. How does this article compare to the Myth Buster’s explanation?

**References**

<http://www.chemcafe.net/mentos-diet-coke-geyser-heterogeneous-catalysis-in-popular-culture/>

<http://livebinders.com/play/play_or_edit?id=45232>

<http://www.youtube.com/watch?v=zGMxEr2AxHM> (Mythbusters Clip)