



## Title

It's a cupcake o'clock

## Author

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## Table of activities

School subject	Chemistry
Topic	Carbon and carbon compounds
Age	16 years
Required time for activity	90 minutes
Required materials	Flour, chocolate, milk, eggs, baking soda, baking powder, baking tray
Cultural concept	Baking traditional American cake



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## Teaching concept

*The aim of this activity is to illustrate the influence of baking soda or baking powder on the characteristics of the dough and how the dough rises and becomes airy.*

## Cultural concept

*Cupcakes originate from the United States of America and refers to a light cake baked in a cup. However, historically this term also referred to a cake whose ingredients are measured by a cup. Most cooks in the United Kingdom and North America in the early 19th century were illiterate so their culinary secrets were memorized and passed down from generation to generation. The quantities of the ingredients were measured using standard sized cups to make the process of remembering the instructions for preparing a particular cake easier. In later years, when the standard measures of ingredients known today were established, these recipes became known as 1234 cakes because they consist of following ingredients: one cup of butter, two cups of sugar, three cups of flour and four eggs.*

*However, recipes in the early 19th century record instructions for baking cookies in smaller cups. Cakes were baked in cups to fill the unused space in the oven and that's why they got the name cupcake. Today a cupcake is known as any small, round cake that is about the size of a cup. At the beginning of the 20th century, the appearance of baking trays and silicone molds contributed to mass production and modern methods of baking.*

## Chemical concept

*Thermal decomposition of sodium hydrogen carbonate which makes the dough rise and become airy.*

## Aim of the activity

*The goal of the activity apply students' knowledge of chemistry to understand what happens during preparation and baking cupcakes. By studying the thermal decomposition of baking soda and baking powder, students conclude that these reactions affect the airy structure of cupcakes, cakes and dough in general.*

## Activities

*This activity consists of the following four steps:*

*The first step is to learn about the difference between baking soda and baking powder. Baking soda is a leavening agent used to prepare a variety of cakes. It is formally known as sodium*

bicarbonate and is a white crystalline powder, which is naturally alkaline. Baking soda is activated in combination with an acidic ingredient and liquid. After activation, carbon dioxide is produced, which allows the dough to rise and become light and airy. This is why recipes that contain baking soda also contain acidic ingredients, such as lemon juice. This means that baking soda alone, without the acidic ingredient, cannot raise the dough.

Unlike baking soda, baking powder is a complete leavening agent, containing both the base (sodium bicarbonate) and the acid needed for the product to rise. Baking powder also usually contains cornstarch, as it is added as a buffer to prevent acid-base activation during storage. Much like baking soda reacts with water and an acidic ingredient, the acid in baking powder reacts with sodium bicarbonate and releases carbon dioxide when combined with liquid. There are single and double acting baking powders. Single-acting varieties are usually only used by food manufacturers and are not usually available for household use, and when a recipe calls for baking powder, double-acting powder is most often what is meant. This means that the baking powder creates two separate reactions: the first, when combined with the liquid at room temperature, and the second, when the mixture is heated. The reaction of the thermal decomposition of sodium hydrogen carbonate is:



The second step in the activity is to find a recipe for making cupcakes. After finding the recipe, the students are divided into two groups, so that one group makes the dough with baking soda, and the other with baking powder, which is the third activity. On this occasion, the students record their observations. For example, one recipe recommends that the dough requires 125 grams of plain flour, 40g of cocoa, a pinch of salt, half a teaspoon of baking soda or baking powder, 200g of granulated sugar, 1 egg, 120ml of milk, 120ml of instant coffee, 80ml of oil, 1 tsp. vanilla extract. For the cream, i.e. frosting, you need 200g of cream cheese, 200ml of sweet cream, 1 teaspoon of vanilla extract, 40g of powdered sugar, half of whipped cream and an edible color as desired.

The last step is to research the interesting facts about cupcakes. Some of the interesting things are that cupcakes are often made for celebrations that have a certain theme, and because of their adaptability and simple preparation, they can be made in a variety of flavors and with different decorations. Ida Freund, professor of chemistry, created the Periodic Table of Elements in 1907, where each cupcake was decorated with the appropriate atomic number and chemical symbol. In the United States, October 18th is Chocolate Cupcake Day, November 9th is Vanilla Cupcake Day, and December 15th is Lemon Cupcake Day.