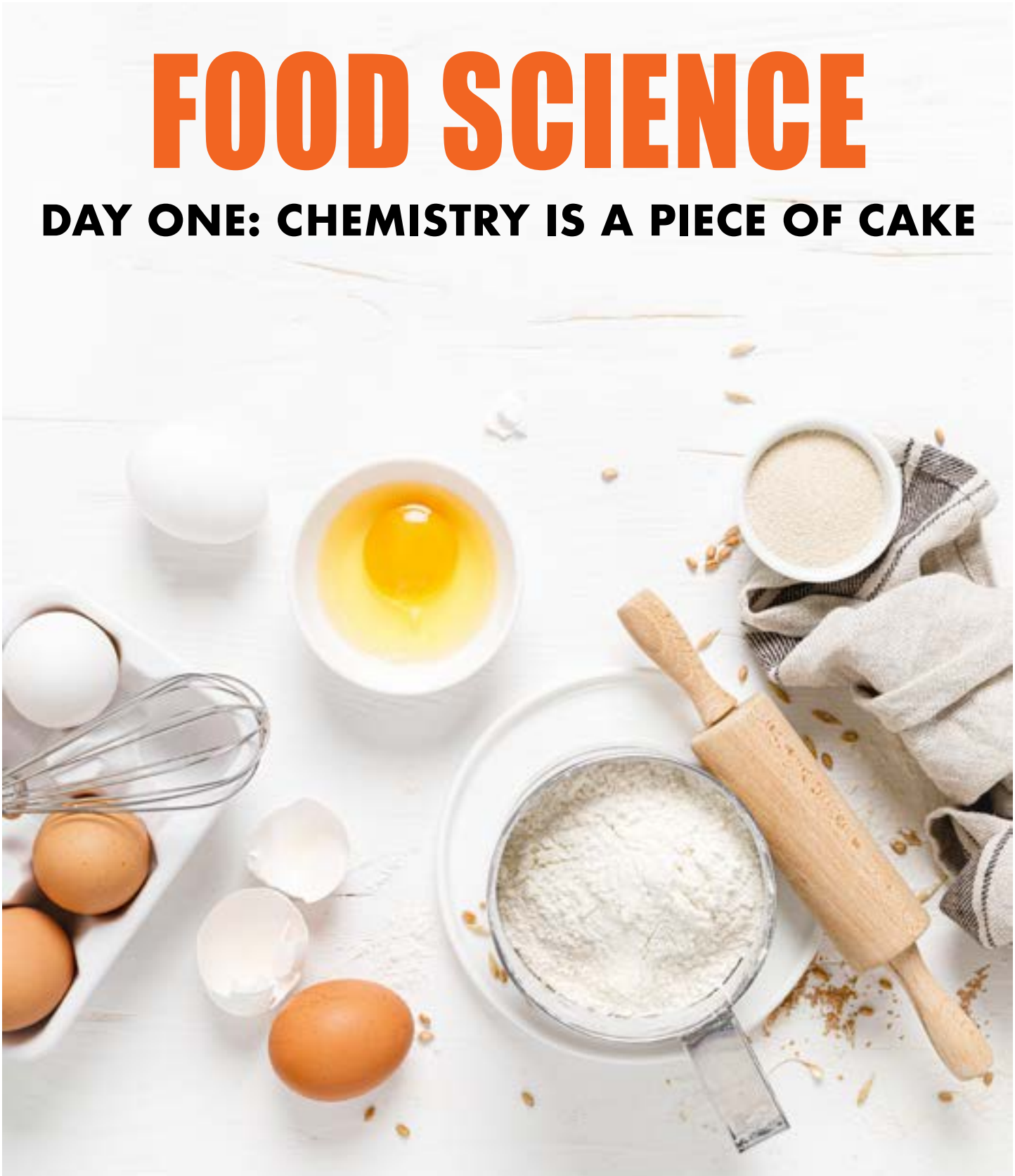
FOOD SCIENCE

DAY ONE: CHEMISTRY IS A PIECE OF CAKE



4-H STEM

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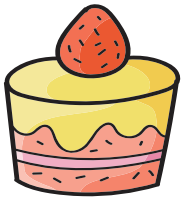
Chemistry is a Piece of Cake

Welcome to Food Science Camp Day One!

This week, you are going to learn about the science behind the food you eat! Today, you are going to learn about baking chemistry by making a homeade cake. Each of the ingredients listed on this handout plays a different role in creating a tasty cake. Chemistry is a lot sweeter than you might think!

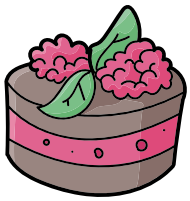
Just like in the human body, water aids in dissolving other components, providing a medium to preform required chemical reactions. Water has a high heat capacity which allows it to control the internal temperature of the cake during baking, which keeps the dough moist. Water is essential in all pastries, but why don't many recipes call for water? It's because most of the water that dough needs can come from wet ingredients such as melted chocolate, milk and eggs.

Flour makes up the builk of a cake. Gluten is what makes the ingredient special, it consists of proteins that hold the structure of a cake together as it rises. Gluten-free alternatives are also available for those who are allergic! Sugar is most commonly thought of as a sweetener, but in baked goods it also has other functions! Sugar undergoes a series of complex browning reactions when the temperature reaches above 350 degrees farenheit, this is how many baked goods get the brow crust. The reactions are known as Maillard reactions or carmelization.



Baking soda and baking powder are very similar. Baking soda contains one ingredient, sodium bicarbonate. Baking powder is the same, but has added acids. Baking powder and baking soda are what cause the cake to rise, because they produce carbon dioxide. We call these leavening agents. The main role of eggs is to bind together other ingredients. The whites of eggs protect the air bubbles during the baking process, forming a cooked layer around them and preventing them from bursting. This ensures that the cake is free from lumps.

Oil and sour cream are different forms of fat. Fat is critical in controlling the chemical environment of baking. The main role of fats is to ensure the sugar and flower are properly mixed during processing, as well as preventing too much water absorbtion by the flour. Fats achieve this due to its hydrophobicity, meaning it does not mix well with water.



The oven provides energy for chemical reactions to take place. Once the dough is placed in the oven, energy in the form of heat speeds up the chemical processes, releasing carbon dioxide and expanding the dough. At 140 degrees farenheit, water vapor begins to form, which further expands and aerates the dough as moisture escapes. The coagulation of egg proteins occurs at 176 degrees farenheit, which also corresponds to gluten losing its stretchiness, causing the pastry to set. Finally, around 320 degrees farenheit, the browning reactions that were mentioned before take place within the now moslty dried surface. There is something called nucleophilic amine and amino acids in the dough that attack the carbonyl on the sugar, producing the aromas and flavors that only baked goods conjure.

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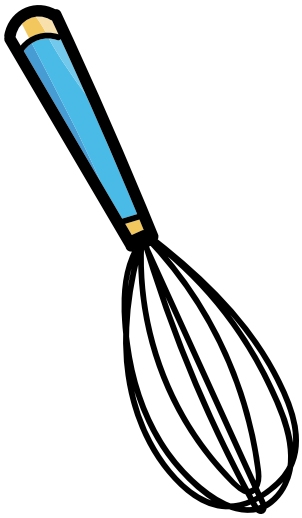
Resources:
SemanticScholar.Org The Chemistry of Baking

Chemistry is a Piece of Cake

Ingredients:

- Cooking Spray
- 1 Cup Unsweetened Cocoa Powder
- 2 ½ Cups All-Purpose Flour
- 2 Cups Sugar
- 1 ½ Teaspoon Baking Powder
- 1 Teaspoon Baking Soda
- 1 Teaspoon Salt
- 3 Large Eggs
- ¾ Cup Vegetable Oil
- ½ Cup Sour Cream
- 2 Teaspoons Vanilla Extract
- Cake Pan



Instructions:

- Preheat oven to 350 degrees farenheit
- In a bowl, combine 1 cup cocoa powder and 1 ½ cup hot water. Set aside.
- Add 2 ½ cups of flour and 2 cups of sugar to a seperate bowl.
- Add 1 ½ teaspoon of baking powder and 1 teaspoon of baking soda to the mixture.
- Add 1 teaspoon of salt and mix.
- Add 3 eggs and 2 teaspoons vanilla extract.
- Mix in ¾ cup vegetable oil and ½ cup sour cream to the mixture.
- Finally, add the cocoa powder and water mixture and mix everything together.
- Coat a cake pan with cooking spray and pour the mixture into the pan.
- Bake for 30-40 minutes or until a toothpick can be inserted and comes out clean.

Challenge!

Complete the Spot The Difference activity attached at the bottom of this handout. Share the activity with a family or friend and see if they can find the same differences as you!

Civic Engagement

Check out this fair entry idea! Category: 4-Science & Nutrition Fair Exhibits Section 4308
The Oklahoma and Tulsa State Fair entry descriptions can be found here:
http://4h.okstate.edu/events-and-activities/state-events-activities/oklahoma-state-fairs

Want to Learn More?

If you enjoyed today's activity, visit 4-h.org/parents/curriculum/food-science/ to learn more about baking chemistry and food science! After you finish making your cake, share it with us on FlipGrid and let us know what you learned on the Microsoft Form linked below!

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Resources: FoodNetwork.Com Basic Chocolate Cake

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