

LECTURE NOTES

What's really happening while my cookie is baking?

Step one: The dough spreads: As the butter warms, it slackens. The cookie dough begins to liquify and gradually spreads out.

Step two: As the cookie spreads, the edges thin out and set. This, along with the fact that they are fully exposed to the heat of the oven and are constantly reaching hotter areas of the baking pan, causes them to begin to set long before the center of the cookie does.

Step three: The cookie rises: As the butter melts and the cookie's structure loosens, this frees up water, which in turn dissolves baking soda. This baking soda is then able to react with the acidic components of brown sugar, creating gases that cause the cookies to rise up and develop a more open interior structure.

Step four: Once they get hot enough, egg proteins and hydrated starches will begin to set in structure, finalizing the shape and size of the finished cookie.

Step five: Sugar caramelizes. At its hottest areas—the edges and the underbelly in direct contact with the baking dish—sugar granules melt together and liquify before starting to caramelize and brown, producing rich, sweet flavors.

Step six: The Maillard Reaction occurs: Proteins in the flour and the eggs brown along with the sugar in a process called the Maillard Reaction. (The same reaction is responsible for giving your hamburger or bread a brown crust. It produces nutty, savory, toasted flavors.)

Step seven: The cookie cools. Once it comes out of the oven, the process isn't over yet. Remember that liquefied sugar? Well as the cookie cools, that liquid sugar hardens up, which can give the cookie an extra-crisp, toffee-like texture around the edges. Meanwhile, the air inside cools, which causes the cookie to deflate slightly. When fully baked, the structure lent by eggs and flour will help it retain some of its rise.

Popular Edits

Ooey-gooney: Add 2 cups more flour.

Summer tan: Set the oven higher than 350 degrees Fahrenheit (maybe 360). Caramelization, which gives cookies their nice brown tops, occurs above 356 degrees, says the TEDEd video.

Crispy with a soft center: Use 1/4 teaspoon baking powder and 1/4 teaspoon baking soda.

Chewy: Substitute bread flour for all-purpose flour.

Just like store-bought: Trade the butter for shortening. This will increase texture - crispiness - but reduces some flavor - try a 50/50 mix of butter and shortening

Thick and less crispy: Freeze the batter for 30 to 60 minutes before baking. This solidifies the butter, which will spread less while baking.

Cakey: Use more baking soda

Butterscotch flavored: Use 3/4 cup packed light brown sugar (instead of the same amount of combined granulated sugar and light brown sugar).

Uniformity: If looks count, add one-ounce corn syrup and one-ounce granulated sugar.

More flavor: Chilling the dough for at least 24 hours before baking deepens all the flavors.

Popular Cookie Add Ins

- Cereal
- Coconut, shredded
- Dried fruit (raisins, cranberries, blueberries, cherries, ginger, mango, pineapple, currants)
- Miniature marshmallows
- Oreo cookies
- Peanut butter chips (in the baking section)
- Potato chips, plain, crushed
- Toffee candy bars, crushed
- Pretzels, crushed
- Rainbow sprinkles
- White chocolate chips (in the baking section)

COOKIE TEST—WHAT WENT WRONG?

Below are pictures of chocolate chip cookies, gone wrong. Using what you've learned about the importance of each ingredient, analyze the pictures and identify what went wrong in the space to the right of each photo.

Photo one: Cookies merged into each other



Photo two: Cookies baked unevenly



Photo three: Cookies are flat and merged together



Photo four: Cookies are dark brown



Photo five: Cookies are small and hard



Photo six: Cookies are dry on the outside, doughy on the inside



The Scientific Method

Step 1: Ask a Question

Step 2: Research

Step 3: Formulate Hypothesis

Step 4: Test With an Experiment

Step 5: Analyze Your Results

Step 6: If your hypothesis is “true” then you may report your results. If your hypothesis is “false” then you should think about it and go back to step three.

NOTE: The following worksheet is specifically for junior high and/or high school students. Individual teachers will assign points/credit at their discretion. The addition of pictures is vital to maximizing the academic value of this assignment. Please be as thorough as possible with each step.

Title

(Centered, clearly written, concise)

I. Background Information:

State the important concepts and definitions you need in order to complete the lab.

II. Purpose:

Make a statement of purpose or describe what you will investigate.

III. Hypothesis:

An educated guess about what you think the results of the experiment will be. (This is often an if-then statement. For example, if the balloon is inflated, then it will have more mass than the uninflated balloon.)

IV. Materials:

List all equipment and materials, including specific quantities. Remember to include safety equipment like gloves, aprons, or goggles when necessary. Please arrange your equipment and take a picture.

V. Procedure:

Make a list of the steps in the experiment. You may need to draw a labeled diagram of the apparatus or set-up.

VI. Data/Observations:

1. Qualitative Data: observations (Please include pictures of your observations.)
2. Quantitative Data: numbers/amounts, often listed in a table (Please include pictures of your observations.)

VI. Conclusion:

In paragraph form, restate your purpose and hypothesis and explain how you completed the lab. Evaluate your hypothesis based on your data and state whether or not it was correct. Mention any possible sources of error or things that may have had an effect on the accuracy of your experiment. Explain what you learned and the conclusion you came to in your own words. Culinary students should also include a taste evaluation. Make sure you include all those culinary descriptors: chewy, crispy, cakey, bitter, acidic, sour, well balanced, metallic, burnt, salty, gooey, "butterscotchy", caramelized.

Remember, if you followed the Procedure and your experiment did not turn out according to your Hypothesis, this is not failure, it just means you need to take a second (or third, or fourth) look at your hypothesis.

EXAMPLE— Chocolate Chip Cookie Experiment

I. Background Information:

There was a Chef demo covering the creaming method, the function of each ingredient in the recipe, and the necessary equipment needed.

Creaming method: the process of creaming room temperature fat and sugar to create air pockets within a baked product to assist during leavening. Additionally, once eggs are added, the creaming method involves making an emulsion of the fat (and sugar) and the moisture in the eggs. Lastly, the dry ingredients are added to limit gluten formation.

Leavening: a substance used in dough or batter to make it rise. Examples include Chemical: baking soda and baking powder, Natural: yeast and Physical: steam.

Emulsion: An emulsion is a mixture of two or more liquids that are normally immiscible (not mixable or able to blend).

Gluten: a substance present in cereal grains, especially wheat, that is responsible for the elastic texture of dough. Gluten forms when water combines with flour and coaxes the two wheat proteins glutenin and gliadin to combine and form gluten.

II. Purpose:

Since baking soda needs acid in order to activate, I would like to test the original recipe and substitute baking powder to evaluate the final outcome.

III. Hypothesis:

If baking powder is used in the place of baking soda, then there will be no effect on the finished cookie.

IV. Materials:

See recipe, scale, rubber spatula, parchment paper, sheet pan, portion scoop.

V. Procedure:

Pull butter and eggs from the refrigerator to warm up to room temperature, 1 hour prior to making cookies. In a mixing bowl, with a paddle attachment, cream butter and sugar together until light and fluffy. Emulsify eggs into sugar and butter mixture, one at a time. In a separate bowl, combine dry ingredients and whisk to combine. Incorporate dry ingredients into wet ingredients and mix just until combined. Stir in vanilla and baking chips by hand.

VI. Data and Observations

Qualitative Data: observations (Please include pictures of your observations.)

The cookie dough looked just as expected, but the hypothesis specifically relates to baking.

The cookies did not have as much spread as anticipated, and were thicker by 1/8 inch.

Quantitative Data: numbers and amounts, often listed in a table. Include photos of your observations, when possible.

CONTROL RECIPE:

Creaming of butter and sugar: 5 minutes

Emulsification – eggs: 1 minute

Leavening Agent: Baking Soda

Cookie size: 2 oz. scoop

Baking Time: 10 minutes

Temperature: 350 Degrees

CONTROL RECIPE OBSERVATIONS:

Raw cookie dough diameter

Raw cookie dough height

Baked cookie diameter

Raw cookie dough height

TEST RECIPE:

Creaming of butter and sugar: 5 minutes

Emulsification – eggs: 1 minute

Leavening Agent: Baking Powder

Cookie size: 2 oz. scoop

Baking Time: 10 minutes

Temperature: 350 Degrees

TEST RECIPE OBSERVATIONS:

Raw cookie dough diameter:

Raw cookie dough height:

Baked cookie diameter:

Raw cookie dough height:

VI. Conclusion:

My original hypothesis was that the substitution of baking soda with baking powder would not make a difference. My original hypothesis postulated that since baking powder already has acid in it, it would not need the acid from the brown sugar, thus, would not make any difference in baking. My unexpected outcome was that the cookie had less spread, but surprisingly the baking chips were more visible. Additionally, there was a significantly lighter color to the test recipe cookies over the control recipe. The flavor was very similar to the control recipe, but the texture had a cake-like consistency, where the control recipe had a thinner, more chewy texture, but was crispy around the edges.

EXPERIMENT WORKSHEET

Purpose. I wonder ...

Hypotheses: I think ...

Materials:

Procedure:

Results:

Conclusion: I learned that ...