Baking Science:
Cookie Science: Thin, Crisp and Chewy
In this lab students research the question:
What ingredients and methods will make a cookie thin, crisp or chewy? They will:
1. Bake the Whole Wheat Sugar Cookie recipe and three to six of the variations to determine what gives the result—crisper, softer or chewier.
2. Control fat temperature in the creaming procedure.
3. Hold a Tea Party to discuss the reasons for their results. (See Tea Party guidelines in Appendix.)
4. Option: View Alton Brown’s “Three Chips for Sister Marsha,” on-line (You-Tube™) or order DVD.
5. List five tips for baking cookies, found at chsugar.com and dominosugar.com – Baking Tips/Everyday Baking/ Cookies and Brownies

To state a hypothesis for each cookie variable.
Suggest ingredient and/or method change(s) that might result in a chewier, softer or crisper cookie.

Chewy Cookie:
Substitute __________________
Increase __________________
Decrease ________________
Method change(s): ____________________________

Crisp Cookie:
Substitute ________
Increase ____________
Decrease ______________
Method change(s): ______________________________________

Soft Cookie:
Substitute _______________
Increase _______________
Decrease _______________
Method change(s): ______________________________________

Teacher: Assign variables to test for puffy/softer, thinner/crisper and chewier cookies.

NOTE: Need two-day or longer option? Freeze cookie dough, landolakes.com/expert-advice/make-ahead-cookie-baking-tips-freezing-cookies/

Lab Team 1: Bake control recipe above.
Lab Team 2: (Soft/Puffy)
Variable: Prepare recipe, substitute shortening for butter (higher melt point, more fat = more rise)
Lab Team 3: (Soft/Puffy)
Variable: Prepare recipe, substitute cake flour for all-purpose flour (lower protein flour ties up less moisture = more steam, more puff)
Lab Team 4: (Thinner/Crisper)
Variables: For ½ cup fat: cream 5 tablespoons butter with sugar; while creaming, drizzle in 3 tablespoons vegetable oil

Lab Team 5: (Thinner/Crisper)
Variables: For egg, substitute ½ beaten egg + 1 tablespoon milk

Lab Team 6: (Chewier)
Variable: Melt or brown the butter before creaming/mixing with sugars; use dark brown sugar

Lab Team 7: (Chewier)
Variables: Use bread flour instead of all-purpose (creates more gluten); use egg yolk only mixed with 1 tablespoon milk (egg white dries/stiffens baked goods, so omit egg white, use milk)

Teacher note: If time allows, add another method variable will make a difference: chill the scooped cookie dough – place baking sheet with scooped cookies in freezer, covered, for a half hour before baking to make cookies puffer and chewier.

Whole Wheat Sugar Cookie
Preparation time: 10 minutes Baking time: 10 minutes
Yield: 2 dozen (1 oz/28 g) cookies

Ingredients Measurements Weights
Granulated sugar, divided 1 cup 7 oz/200 g
Butter or margarine ½ cup (1 stick) 4 oz/115 g
Large egg 1 1.67 oz/50g
Whole white wheat flour 2 cups 8.5 oz/240g
Baking powder 1 teaspoon 4.75g
Baking soda ½ teaspoon 2.4g
Ground nutmeg ½ teaspoon 2.25g
Low-fat milk 3 tablespoons 1.5 oz/42ml
Vanilla extract 1 teaspoon 3.5g
Orange peel, grated* 1 ½ teaspoons 3.5g

To coat each drop cookie:
Sugar 2 tablespoons 0.9 oz/25g
Ground cinnamon 1 teaspoon 0.08 oz/2.25g

*Baker tip: Orange peel should be grated – “zested” – just to, but not into, the white that’s under the colored peel.

Directions:
1. Line half-sheet pans (18 X 13-inch baking pans) with parchment paper. Preheat oven to 375º F.
2. Cream the sugar and butter together until light. Add egg; beat until light.
3. In separate bowl, whisk the dry ingredients together to mix thoroughly. Add to creamed mixture.
4. Add milk, vanilla and orange peel. Blend well.
5. Drop 1-inch cookie dough balls into cinnamon/sugar mixture. Place on lined cookie sheets about 2 inches apart; flatten evenly with a glass or cup.
6. Bake at 375º F. 8 to 10 minutes or until golden brown. Cool on wire racks.

Source: Stafford County Flour Mill, hudsoncreamflour.com
Kansas Wheat, kswheat.com

Teacher: Assign variables to test for puffy/softer, thinner/crisper and chewier cookies.
Cookie Lab Results Chart

Record results: Place an X where you would best describe the cookie.

<table>
<thead>
<tr>
<th>Team 1</th>
<th>Chewiest</th>
<th>Chewy</th>
<th>Soft/Puffy</th>
<th>Soft</th>
<th>Thin/Crisp</th>
<th>Crispest</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control cookie ____________________________________________________________</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

| Team 2 | Shortening _____________________________________________________________ |
| Team 3 | Cake flour ____________________________________________________________ |
| Team 4 | Oil for part of butter _______________________________________________ |
| Team 5 | Less egg/milk _________________________________________________________ |
| Team 6 | Melted butter _________________________________________________________ |
| Team 7 | Bread flour/ egg yolk + milk __________________________________________ |

Compare the results to your hypothesis ideas with the actual results in a verbal or written discussion.

First Experience:
Low-Fat Spice Snack Cake

In this lab students will:
1. Confirm knowledge on the function of sugars in baking.
2. Apply the use of two sugars, granulated and dark corn syrup, to produce a cake suitable for breakfast, coffee or tea, or snacking.
3. Create a more tender product by blending wheat flour and corn starch to reduce the gluten strength in the flour.
4. Learn and apply the Food and Drug Administration’s definition of low-fat and reduced-fat used for product labeling.
5. Create a drizzle and apply it as a simple glaze effect that has fewer calories than a fully frosted cake.

For Teacher:
Before you begin, hand out the following terms to students and have them hold a Sweet Tea Party (See Appendix/Tea Party) OR describe and use each term in a descriptive sentence, story or paragraph.

- Crystals
- Tenderizes
- Low-fat
- Flavor
- Yeast food
- Caramelization
- Powdered sugar
- Attract moisture
- Aeration
- Stabilizer
- Drizzle
- Spread
- Creaming
- Maillard reactions
- Dark corn syrup

Supplies Needed: For each recipe prepared or each team provide:

For Comparison: One package Spice Snack Cake mix (9X9-in) with price
Nutrition Facts Label from ready-to-spread frosting

Today’s “low-fat” is called Smart Snack baking!
Go-to recipes for in-school culinary Bake Sales, Homebaking.org/PDF/smart_snacks_bakersdozen.pdf