



COURSE 2:

Food Production, Nutrition and Health

KITCHEN SCIENCE TO SHELF



**food and
nutrition sciences**

PREPARATION FOR TOMORROW





CONTENTS

Project Overview	3
------------------------	---

Lessons

Day 1: How are sugar crystals formed?	4
Days 2-3: What is food chemistry?	6
Day 4: What is the chemical structure of sucrose?	10
Day 5: (Project Roll-out) Do you understand our project?	13
Day 6: How is candy classified?.....	15
Day 7: What are the stages of candy texture? How are the candy stages related to temperature?.....	17
Day 8: What are common food additives in candy? Why are they there?	20
Days 9-10: How do the ingredients end up in the final candy product?	23
Day 11: How are we going to make a new candy product?.....	26
Day 12: What are the current trends in the confectionary industry?	28
Day 13: What do the nutrient claims on food labels mean?	30
Day 14: What is a target market?	32
Day 15: What are the key marketing principles?.....	34
Day 16: How is the price of the product calculated?	36
Day 17: How do I create a nutrition label for a new product?	38
Day 18: What are the components of a product package?.....	40
Days 19-20: What are the elements of a commercial?	42
Day 21: How is candy made?	45
Day 22: Why is my product the best?	46

Appendices

Appendix 1: Daily Bell-Work Journal	48
Appendix 2: Daily Exit Tickets	49
Appendix 3: What is Sugar?	50
Appendix 4: Research Notes.....	52
Appendix 5: Crystal Carbohydrates	53
Appendix 5.1: Crystal Carbohydrates Background	59
Appendix 6: Project Management Log: Team Tasks.....	60
Appendix 7: Essential Question	61
Appendix 8: Candy Temperature Chart.....	62
Appendix 9: Cold Water Candy	63
Appendix 9.1: Cold Water Candy Test.....	65
Appendix 10: Common Food Additives in Candy	66
Appendix 11: Enzyme Lab	68
Appendix 12: Farm to Table Map Rubric	69
Appendix 13: Chocolate and Candy Remain Recession Resistant	70
Appendix 14: Nutrient Claims on Food Labels	73
Appendix 15: Pricing Scenarios	77
Appendix 16: Gummy Candy Background Information.....	78
Appendix 17: Sample Calculations	79
Appendix 18: Nutrition Facts Panel	80
Appendix 19: Candy Prototype Rubric	81
Appendix 20: Self-Reflection on Project Work.....	82
Appendix 21: Collaboration Rubric.....	83
Appendix 22: Project Presentation Audience Feedback.....	84

Project Overview



CONCEPT/DESCRIPTION

- 1 Students explain the process of making rock candy. Students describe the size and shape of sugar crystals.
- 2-3 Students define food chemistry. Students identify the building blocks of food and compare the molecular structure of lipids, proteins, and carbohydrates.
- 4 Students will analyze how the structure of sugar impacts the formation of butterscotch candy. Students analyze and interpret data.
- 5 Students separate the project description into tasks to be completed. Students develop questions to be answered about the knowledge and skills necessary to complete the project.
- 6 Students describe the difference between crystalline and noncrystalline candy.
- 7 Students will describe the relationship between heat, sugar structure, and tensile strength for candy. Students will describe the stages of candy texture. Students perform a cold water candy test. Students make observations of sugar crystal growth.
- 8 Students will identify additives in candy. Students will explain the function of additives in candy. Students describe how invertase is used for making cherry cordials.
- 9-10 Students examine the farm-to-table process of candy ingredients.
- 11 Students identify a candy recipe. Students analyze the characteristics of an existing candy product.



CONCEPT/DESCRIPTION

- 12 Students analyze trends in the confectionary industry.
- 13 Students describe the meanings of specific nutrient claims. Students identify nutrient claims commonly found on food packages. Students will read and interpret a food label.
- 14 Students will define target market and describe the characteristics of a target market. Students identify a target market for the new candy product. Students will create a new product strategy.
- 15 Students will describe the four Ps of marketing.
- 16 Students will calculate the price of a product.
- 17 Students calculate the nutrition label information for the serving size of the new candy product.
- 18 Students create an identity for a new product by developing a name and logo. Students develop a new product package.
- 19-20 Students develop a script. Students record a 30-second (maximum) commercial.
- 21 Students create a new candy product. Students follow a recipe to prepare a food item.
- 22 Students describe the elements of new product development. Students will give an oral presentation.



Key Question of the Day:

How are sugar crystals formed?

(Each day the key question should be prominently displayed and used to open the lesson.)



Estimated Time

One 50-minute class period



Learning Objectives

As a result of this lesson, students will be able to:

- Explain the process of making rock candy.
- Describe the size and shape of sugar crystals.



Required Materials

- Weekly Bell-Work journal – [Appendix 1](#) - One per student
- Daily Exit Ticket – [Appendix 2](#) – One for each student
- Sugar Article – [Appendix 3](#) Part 1 and 2 – One per student – Article adapted from: <http://www.exploratorium.edu/cooking/candy/sugar.html>
- Research Journal - [Appendix 4](#) – One per student
- Lab materials for each team:
 - › 4 cups of sugar
 - › 2 cups of water
 - › Small saucepan
 - › Hot plate or stove
 - › Wooden spoon
 - › Measuring cup
 - › Candy thermometer
 - › Mason jar (or something similar)
 - › Paper towels
 - › Cotton string
 - › A weight to hang on the string (e.g., galvanized washer)
 - › Waxed paper
 - › A pencil (to suspend the string in the jar)
 - › Timer
- Flip chart paper
- Markers



Bell-Work

(Each day the Bell-Work question should be prominently displayed and used to open the lesson)

- Provide students with the weekly Bell-Work sheet ([Appendix 1](#))
- “What is sugar?”

OPENING

(Designed to **prepare** students for learning. Students are prepared for learning by activating an **overview** of the **upcoming** learning experience, their **prior knowledge**, and the **necessary vocabulary**.)

- Read the Bell-Work question and solicit responses from the students.
- Explain that it’s okay if students don’t exactly know how to define sugar because they are about to learn more about sugar and its composition.
- Give each student a copy of [Appendix 3](#) Part 1 to read the first section of the article.
- Ask students to summarize the section in their own words.

MIDDLE

(Designed to provide a **structure** for learning that actively promotes the **comprehension and retention** of knowledge through the use of **engaging strategies** that acknowledge the brain’s limitations of **capacity and processing**.)

- Students will work in pairs for this lab, which you can either assign pairs or allow students to select on their own.
 - › They will only be working in this team for this lab.
- Follow food safety and labs safety precautions.
- Post the lab instructions somewhere in the room using a flip chart so that students have a reference as they work.

- Within their teams, they should create a hypothesis about how long they think it will take before they see the first crystals begin to form, and also what they think will happen to the samples that are covered versus uncovered.
 - › Since we don't know exactly how long it will take for students to see results, it is best for students to record the data for this lab in their research journals.
 - › Data for the lab should include their hypothesis and daily observations.
- Each team will heat their water in a saucepan over medium heat until it comes to a boil.
 - › They should completely dissolve the sugar in the boiling water, stirring continuously with the wooden spoon until the solution grows clear and it reaches a rolling boil.
- Remove the solution from the heat, and then carefully pour it into the jar. Cover the jar with a small piece of waxed paper.
- Tie the weight to one end of the string, and then tie the other end to the middle of the pencil.
 - › The string should be about $\frac{2}{3}$ as long as the jar is deep.
- Gently suspend the prepared string in the solution and let sit at room temperature, undisturbed, for several days. You can check each day until the experiment is finished. A good target timeline is about 7 days.
 - › You can adjust the timeline depending on the results. It could take less or more than 7 days. For this project, it is following a 7-day schedule, but feel free to adjust as you see fit.
 - › You can also have some groups try covering their jars with a paper towel and have some groups leave their jars uncovered to see if there is a difference between crystal formations of covered versus uncovered. If students do leave their jars uncovered, it is recommended that those samples are not consumed for food safety reasons.
- By the time the rock candy is ready, the crystals on the string should be clearly defined, with sharp right angles and smooth faces of various sizes.
 - › These are called monoclinic crystals. The shape is determined by the way the individual sugar molecules fit together, which is similar to the way the shape of a pile of oranges is determined by the shape of the individual orange and the way they stack together.
- After the students prepare their rock candy samples, have them research and respond to the following questions:
 - › What makes the sugar crystals grow?
 - › What happens when you heat sugar?
- After you pose the question for the class, set a timer for five minutes and see who can find the answer the fastest.
- When time is up, allow students to share their responses and have a brief discussion.
- Give students a copy of [Appendix 3](#) Part 2 to read the next section of the article about heating sugar.
- **Students should begin observations of their rock candy today as Day 1.**

CLOSING

*(Designed to promote the **retention of knowledge** through the use of engaging strategies designed to **rehearse and practice skills** for the purpose of **moving knowledge into long-term memory**.)*

- Provide each student with the weekly Exit Ticket handout [Appendix 2](#).
- Students will turn in their Exit Ticket for that day. They will respond to the following prompt: **“How long do you think it will take before crystals begin to grow for your team’s sample?”**
- Collect the Exit Ticket for the day as students leave the classroom.



Key Question of the Day:

What is food chemistry?



Estimated Time

One 50-minute class period



Learning Objectives

As a result of this lesson, students will be able to:

- Define food chemistry.
- Identify the building blocks of food.
- Compare the molecular structure of lipids, proteins, and carbohydrates.



Required Materials

- Weekly Bell-Work journal – [Appendix 1](#) - One for each student
- Daily Exit Ticket – [Appendix 2](#) – One for each student
- Jenga – try to include different colors throughout the tower
- Candy bar (use one that has a lot of different ingredients, such as a Snickers bar)
- Yarn
- Construction paper
- Scissors
- Glue
- Small balloons
- Pipe Cleaner
- Any other supplies that could be used to build a structure
- Protractor
- Computer
- Internet
- PowerPoint



Bell-Work

- Provide students with the weekly Bell-Work sheet ([Appendix 1](#))
- **“What does this tower have in common with this Snickers bar?”**
 ✓ **TEACHER TIP!** Create a tower using the Jenga prior to class so that when students enter the classroom, they will see the tower. Have the Snickers bar on the table next to the tower.

OPENING

5 minutes

- Read the Bell-Work question and solicit responses from the students.
- Possible responses may include:
 - › The both have multiple parts
 - › They are both stacked/have many layers
 - › The parts/ingredients are stacked in different directions
 - › Different colors
 - › Different textures
 - › The ingredients and blocks fit together in different directions
- The point to be made: **“The tower and the (insert candy name) are both made up of many parts and pieces. Think about each piece of the tower, or each ingredient of the (insert candy name), as a single chemical element. When those chemical elements are combined, they form compounds. Foods are made up of a variety of chemical compounds, such as salt (NaCl) or water (H₂O). By understanding how these compounds fit together to create delicious tasting foods like candy, we will be able to understand how those compounds interact with each other during cooking, and that’s food chemistry.”**

MIDDLE

40 minutes

- Review the following concepts with the class:
 - › Food chemistry is defined as “a study of the characteristics of the substances of which foods are made.” In other words, foods are essentially made of “building blocks” of chemical elements.
 - › The chemical elements are combined to form compounds, and almost all foods are composed of compounds, such as salt (NaCl) or water (H₂O).
 - › The main food constituents are water, lipids, proteins, and carbohydrates.

- The class will be divided into four groups: water, lipids, proteins, and carbohydrates.
- Depending on the number of students in the class, within each group, they will break into two smaller teams, the molecule team and the research team.
 - › For example, if there are four students in the water group, then half of the water group (two students) will use the Internet to research the structure of the water molecule and any food chemistry-related information they can find about it to share with the class, while the other half of the group (two students) uses the structure model they find to build the actual H₂O structure.
- The molecule teams will select the materials they wish to use to build their structure from whatever is provided by the teacher.
 - › The protractor should be used to ensure accurate angles within the bonds
- The research teams will create a brief presentation of the key concepts they find to share with the rest of the class.
 - › Students should find information specifically related to how lipids, proteins, and carbohydrates play a role in food, common sources of each, and should include key vocabulary terms
 - › The following list provides a guide of information the students should find. It will be best to allow the students to research first and provide hints leading them to these concepts as they go:
 - › *Water: acids and bases in water, boiling point, freezing point, hydrophilic, hydrophobic, water content of foods*
 - › *Lipids: hydrogenation, antioxidants, oxidative rancidity, free radicals*
 - › *Proteins: part of the DNA and RNA structure, enzymes, proteolytic deterioration, metabolic pathway; major roles in food: “nutrient function where it provides a source of amino acids for the assembly of proteins in our bodies and the*

enzymatic function, where it alters other components used in the food industry (as in food processing).”

› *Carbohydrates: disaccharide, monosaccharide, polysaccharide, caramelization, types of natural sweeteners*

- Once they finish each task (research and building the molecule), the molecule team will present their molecules to their partnering research team, and the research team will present their findings to the molecule team.
- **As students finish, they should make observations for Day 2 of their rock candy.**

CLOSING

5 minutes

- Students will turn in their Exit Ticket for that day. They will respond to the following prompt: **“Write two new facts you learned from your teammate’s presentations.”**
- Collect the Exit Ticket for the day as students leave the classroom.



Key Question of the Day:

(Continuation of Day 2)
What is food chemistry?



Estimated Time

One 50-minute class period



Learning Objectives

As a result of this lesson, students will be able to:

- Define food chemistry.
- Identify the building blocks of food.
- Compare the molecular structure of lipids, proteins, and carbohydrates.



Required Materials

- Jenga – try to include different colors throughout the tower
- Candy bar (use one that has a lot of different ingredients, such as a Snickers bar)
- Yarn
- Construction paper
- Scissors
- Glue
- Small balloons
- Pipe Cleaner
- Any other supplies that could be used to build a structure
- Protractor
- Computer
- Internet
- PowerPoint



Bell-Work

- Provide students with the weekly Bell-Work sheet ([Appendix 1](#))
- *“During the class presentations, I will...”*

OPENING

5 minutes

- Read the Bell-Work question and solicit responses from the students.
- Possible responses may include:
 - › Listen
 - › Pay attention
 - › Take notes
 - › Ask questions
 - › Stay focused
- Review presentation etiquette with students and remind them how to be a respectful audience.
- **As students finish, they should make observations for Day 3 of their rock candy.**

MIDDLE

40 minutes

- Begin by reviewing the definition of food chemistry.
- The teams will finish presenting to each other if necessary.
- Each team will then present their molecules and research findings to the class.
 - › During the presentations, students in the audience should take notes about each topic presented. This should be done using a sheet of paper divided into three sections. Students should label each section lipids, proteins, carbohydrates, and take notes about each molecule in the corresponding section.
- Following the presentations, have students from each team identify key terms to use to create a word wall for this project unit.

CLOSING*5 minutes*

- Students will turn in their Exit Ticket for that day. They will respond to the following prompt:
“Based on the class presentations, write two new facts you have learned about the chemistry of food.”
- Collect the Exit Ticket for the day as students leave the classroom.



Key Question of the Day:

What is the chemical structure of sucrose?



Estimated Time

One 50-minute class period



Learning Objectives

As a result of this lesson, students will be able to:

- Analyze how the structure of sugar impacts the formation of butterscotch candy.
- Analyze and interpret data.



Required Materials

- Computers
- Internet
- Research Journal – [Appendix 4](#) – One for each student
- Video: <http://www.youtube.com/watch?v=Q4CZ81EmAsw&feature=youtu.be> (Sugar Hiding in Plain Sight)
- Lab instructions and data questions adapted from *Gourmet Lab: The Scientific Principles Behind your Favorite Foods* by Sarah Reeves Young, page 279-311, 2011 – [Appendix 5](#) and 5.1 – One for each student
- Lab materials:
 - › 60 mL of brown sugar
 - › 30 mL butter
 - › 60 mL of sugar
 - › 60 mL of water
 - › 5 mL of vinegar
 - › 1 g of salt
 - › 1.5 mL vanilla extract
 - › Beaker, 400 mL
 - › Thermometer, 150°C and non-mercury
 - › 10 mL graduated cylinder
 - › 100 mL graduated cylinder
 - › Balance
 - › Aluminum foil
 - › Waxed paper
 - › Beaker tongs
 - › Bunsen burners and iron rings with wire gauze (or hot plate)
 - › Glass stirring rod
 - › Safety glasses
 - › Aprons
 - › Gloves



Bell-Work

- Provide students with the weekly Bell-Work sheet ([Appendix 1](#))
- “*Make your Day 4 observations for your milk samples.*”

OPENING

5 minutes

- ✓ **TEACHER TIP!** Materials such as beaker and Bunsen burner can be substituted for culinary equipment since the students will be able to eat the finished product. However, if you prefer that students do not consume the final product, these materials and units of measure are sufficient. If the students WILL consume the final product, use cooking equipment rather than lab equipment. If using cooking equipment, have students convert the dry ingredients from the metric units of measure to cooking units such as cup, teaspoons, etc.
- Read the Bell-Work question and solicit responses from the students.
- Possible answers may include:
 - › Sucrose
 - › Dextrose
 - › Maltose
 - › Fructose
 - › Brown sugar
 - › White sugar
 - › Corn syrup
- Explain that there are a number of different types of sugar, and some sugar comes from sugar cane, while other types, like corn syrup, come from corn.
- The point to be made: **“Sugar is a major ingredient used in the food industry. Not only is sugar present in some form in most of the foods we eat, but when it comes to confectionary products, sugar is often the main ingredient. The way sugar is processed during cooking also influences the end result of the product.”**
- Briefly review lab safety procedures.

MIDDLE

40 minutes

- Students should read the background of the lab ([Appendix 5.1](#))
 - › Review the key vocabulary and create a project word wall.
 - › Address any questions from the class.
- Students should work in teams of 2 or 3 (depending on the class size), and each team will be conducting the lab with a different variation of materials. There will be:
 - › One team using acid
 - › One team using different types of sugar
 - › One team creating crystallized sugar
 - › These may be duplicated depending on the number of teams in the class
- Assign students to their teams and explain which procedure they are going to test.
 - › Have students circle their procedure and cross out the others so that they follow the correct directions.
- In their teams, students should write a hypothesis about the types of characteristics they would expect to find in candies with a crystal sugar structure.
- Then, students will create their data tables. Each team should agree upon a data table and have it approved by the teacher. Data tables should include a section for each type of candy that will be made during the lab, and include a section for the sensory analysis (texture, taste, aroma).
- As students begin the lab using [Appendix 5](#), be sure they constantly stir the sugar while it is heating until it is dissolved. If it turns dark brown, the sugar is burning and the heat should be lowered.
 - ✓ **TEACHER TIP!** If the solution bubbles up, this is normal, and stirring should only happen at the top layer of the solution. When the vanilla is added to the solution, it may boil back up due to the temperature difference, so it may help if students wait about 60 seconds to add the vanilla. To prevent the sugar from drying onto the glassware, immediately place the materials in hot water (not cold water, as cold water will cause the glass to crack).
- Students may cut their butterscotch after about 5-7 minutes.
 - › If it cools completely and hardens, they may break it up into a “bark.”
- Each team will have a sample from the other teams and perform a sensory analysis of the different samples. During this time, students will fill in the data tables that they created.
- After each team has cleaned up from the lab, students can spend time responding to the data analysis and conclusion questions in their research journals ([Appendix 4](#)):
 - › What are two observations that you could use to identify whether acid was used in the production of a candy? Explain, citing the specific senses that allowed you to make that observation.
 - » *Answers will vary, but may include: candy was smooth to the touch, taste, appearance. When placed in mouth, it is slippery, which leads you to believe there is no crystallization, meaning the candy may have been produced with an acid that prevents the sugars from forming crystals.*
 - › What are two observations that you could use to identify whether different sugars were used in the production of a candy? Explain, citing the specific senses that allowed you to make that observation.
 - » *Answers will vary, but may include: candy was smooth to the touch, taste, and appearance. These are the same observations from Question 1. Those responses are correct because you cannot distinguish how crystallization was prevented.*
 - › Based on what you know about sugar, list two situations in which sugar would be the ideal food source. When would sugar not be an ideal food source?

- » *Answers will vary, but may include: when a person is lacking energy and needs a quick pick-me-up. For example, when you are taking a test, eating a mint may give you a sudden burst of energy. Sugar is quickly metabolized by the body and delivers energy where it is needed. Any situation that requires strength and energy for an extended period of time are not ideal for using sugar as your source of energy. This could be playing a sport, running a marathon, acting in a play, etc.*
 - › What other items go through crystallization? Give two additional examples of materials that crystallize.
 - » *Answers will vary, but may include: Salts and minerals go through crystallization, so does ice.*
 - › What do you think would have happened if you had stretched and pulled the sugar while it was cooling? What properties would you expect to see in sugar that had undergone these physical manipulations?
 - » *The physical movement will alter the chains of sucrose while they are still hot. This is what happens when taffy is made. Properties of taffy include striations in the appearance, and softer more malleable texture and fewer crystals.*
- Debrief the lab student's thoughts from the sensory analysis, followed by a brief discussion of the responses to the questions and conclusions.
 - **As students finish, they should make observations for Day 4 of their rock candy.**

CLOSING

5 minutes

- Show the video: <http://www.youtube.com/watch?v=Q4CZ81EmAsw&feature=youtu.be>
- Students will turn in their Exit Ticket for that day. They will respond to the following prompt: **“Summarize what you learned about the sucrose molecule in one sentence.”**



Key Question of the Day:

Do you understand our project?



Estimated Time

One 50-minute class period



Learning Objectives

As a result of this lesson, students will be able to:

- Separate the project description into tasks to be completed.
- Develop questions to be answered about the knowledge and skills necessary to complete the project.



Required Materials

- Computers
- Internet
- Projector
- Project Management Log – [Appendix 6](#) – One for each student
- Project Description – [Appendix 7](#) – One for each student
- Highlighters
- Candy (can use one type or a variety) – One piece per student
- Video: <http://www.youtube.com/watch?v=XrbobH3SYKI> (The Science Behind Candy)



Bell-Work

- Provide students with the weekly Bell-Work sheet ([Appendix 1](#))
- **Give each student a piece of candy.**
- **“What is your favorite candy? Why?”**

OPENING

5 minutes

- Read the Bell-Work question and solicit responses from the students.
- Allow volunteers to share stories about their favorite candy.
- Explain that, **“Just listening to all of your comments today, we know that candy is a treat we all know and love. The local candy shop would like our help in creating a new candy product to sell for the four peak holidays, which will help increase their business revenue.”**

MIDDLE

40 minutes

- Pose the following question to the class, **“Why do people like candy?”**
 - › Show the video: <http://www.youtube.com/watch?v=XrbobH3SYKI>
- Take just a few minutes to debrief the video and ask the class if they agree or disagree with what was described about why people like candy.
 - › Emphasize that many of the factors listed in the video such as texture or flavor are key in creating a good product that the consumers will like.
- Distribute copies of the project description and give students time to read.
- Distribute highlighters. Have students highlight everything that is a task they will have to complete.
- As a class, list the tasks each team will have to complete.

- Create teams of two or three (depending on the size of the class) – you can do this purposefully or allow the students to choose. Give each team time to review the project description again and answer:
 - › What will your team need to accomplish?
 - › What terms or phrases do you not know?
 - › What do you have to present?
- Circulate and monitor team’s progress on this.
- Assign teams
- **As students finish, they should make observations for Day 5 of their rock candy.**

CLOSING

5 minutes

- Explain that before students can become expert candy makers and create their new products, they have to master their understanding of the chemistry behind making candy. So much of candy making depends upon the science behind the process of cooking, so in order to make a high quality product that will taste great and appeal to consumers, they have to understand the science behind cooking the candy, which is why we’ve spent the past few days exploring sugar and candy, will continue to do so throughout the project.
- Students will turn in their Exit Ticket for that day. They will respond to the following prompt:
“What questions do you still have about the project?”
- Collect the Exit Ticket for the day as students leave the classroom.



Key Question of the Day:

How is candy classified?



Estimated Time

One 50-minute class period



Learning Objectives

As a result of this lesson, students will be able to:

- Describe the difference between crystalline and noncrystalline candy.



Required Materials

- Computers
- Internet
- Post-It notes
- Flip chart
- Tape
- Sugar Article – [Appendix 3 Part 3](#) – Article adapted from: <http://www.exploratorium.edu/cooking/candy/sugar.html>
- Index card
- Highlighter



Bell-Work

- Provide students with the weekly Bell-Work sheet ([Appendix 1](#))
- ***“We have already discussed our favorite candies. Now, let’s take that thinking to the next level. Make a list of all of the different types of candy you can think of.”***

OPENING

5 minutes

- Read the Bell-Work question and solicit responses from the students.
- Possible responses may include:
 - › Gummies
 - › Chewing gum
 - › Chocolate
 - › Jawbreakers
 - › Lollipops
 - › Responses may also include specific brand names such as “Skittles”
- Explain to students, ***“There are many different types of candy as we have just discussed. From gummies to chocolates, the ingredients classify each candy into two groups. First, let’s find out what the two groups are.”***

MIDDLE

40 minutes

- Give students a copy of the article [Appendix 3 Part 3](#) and an index card.
- Students will have about ten minutes to read the article and highlight terms in the article they think are important vocabulary words.
 - › Depending on the number of students in the class and their reading levels, the time for this can be reduced or increased.
- On one side of the index card, students should write either a question about the article or a reaction to the article, and on the other side, they should make a list of the key vocabulary words they identified in the article with a summary of the definition for each term.
- Discuss the article with the class and emphasize the terms crystalline and noncrystalline.

- › Ask volunteers to share the notes from their index cards during the discussion and answer any questions. Add key terms to the word wall.
- Write the term “Crystalline” on one flip chart and “Noncrystalline” on another flip chart.
 - › Hang each flip chart paper somewhere in the room.
- Give each student a small stack of Post-It notes.
- Students will have about ten minutes to use the Internet to research the types of candies that fall under the crystalline and noncrystalline categories, which will become the reference of types of candy for the remainder of the project.
 - › Crystalline: chocolate, fudge, fondant, nougat, marshmallows, pralines
 - › Noncrystalline: hard candy, toffee, caramel, gummies, brittle
- Students should write each candy type on a Post-It note and place the note on the corresponding flip chart.
- Once students have completed this task, bring the class back together for a quick debrief.
 - › Review the types of candies that were identified as crystalline and noncrystalline.
- Students should spend the remainder of the class with their teams to determine what type of candy they would like to make, based on what they learned about crystalline versus noncrystalline candies.
 - › They will be doing some reverse engineering for this project, so they have to select a candy that already exists, and it has to be something they can easily replicate since they will eventually be cooking their candy. Teams will need time to do some research on the product they select to determine if it can be easily replicated.
- ✓ **TEACHER TIP!** Have each team get their selected candy approved by you so that you can ensure that there is a recipe out there to

make the candy and that the process isn't too complicated beyond the means of the resources you have available. A recipe for candy such as Skittles cannot be recreated. Keep in mind you will have to ensure you have all the ingredients and cooking supplies needed for each team, so it is very important that you consider this when approving the candies selected by each team.

- Each team should have their selected candy approved by teacher.
- **As students finish, they should make observations for Day 6 of their rock candy.**

CLOSING

5 minutes

- Students will turn in their Exit Ticket for that day. They will respond to the following prompt: ***“In your own words, summarize the difference between crystalline and noncrystalline candy.”***
- Collect the Exit Ticket for the day as students leave the classroom.
- Homework is for each team to bring in the candy (or just the package) that they selected for the project.



Key Questions of the Day:

What are the stages of candy texture?

How are the candy stages related to temperature?



Estimated Time

One 50-minute class period



Learning Objectives

As a result of this lesson, students will be able to:

- Describe the relationship between heat, sugar structure, and tensile strength for candy.
- Describe the stages of candy texture.
- Perform a cold water candy test.
- Make observations of sugar crystal growth.



Required Materials

- Candy Temperature Chart – [Appendix 8](#) – One per student
- Cold Water Candy Test Instructions – [Appendix 9.1](#) – One per team
- Cold Water Candy Test Article – [Appendix 9](#)
- Highlighter
- Flip chart
- Markers
- Lab materials (lab adapted from <http://www.exploratorium.edu/cooking/candy/index.html>):
 - 30 mL of glucose solution (Karo syrup)
 - 60 mL of white sucrose, C₁₂H₂₂O₁₁ (sugar)
 - 15 mL of dihydrogen monoxide, H₂O (water)
 - 1 g of sodium chloride, NaCl (table salt)
 - Beaker, 250 mL
 - Beaker, 500 mL (or other container that can be filled with water)
 - Cold water
 - Thermometer, 150°C and non-mercury
 - Graduated cylinder, 10 mL
 - Graduated cylinder, 100 mL
 - Balance
 - Beaker tongs
 - Bunsen burners and iron rings with wire gauze or hotplates
 - Glass stir rod
 - Spoons
 - Aprons
 - Gloves



Bell-Work

- Provide students with the weekly Bell-Work sheet ([Appendix 1](#))
- “How does cooking affect the end result of a product?”**

OPENING

5 minutes

- ✓ **TEACHER TIP!** The sugar solution made in this lab is NOT meant to be consumed. Therefore, the use of lab equipment and the units of measurement are appropriate for this experiment. Adjustments should only be made if your only resources include kitchen equipment (in which case students should convert from metric units of measurement to cooking units for the dry ingredients).

- Read the Bell-Work question and solicit responses from the students.
- Possible responses may include:
 - Cooking changes the texture
 - Can affect the flavor
 - Can affect the quantity (evaporation or breakdown of ingredients)
- Explain that, **“When it comes to candy, the temperature plays a significant role in the quality of the final product. For example, burning chocolate could make it go from a smooth liquid to a dry, lumpy semi-solid. So before we can make our own candy, let’s explore what happens to candy during the cooking process.”**

MIDDLE

40 minutes

- Students will work in their project teams for this lab
 - If the class is small and you don’t have enough students for five teams, students can either work independently and each student can test one, or you can have each team test more than one stage.
- ✓ **TEACHER TIP!** Make sure students understand that this is NOT what it takes to make candy. Although the steps are similar and the end product will resemble candy, this is NOT the same procedure. In candy-making, constant stirring would create crystallization, which is not desirable in a hard candy product. In this lab, the students want to create all the stages of crystallization and see it, so they are stirring the solution throughout.

- ✓ **TEACHER TIP!** The sugar solution is VERY HOT and will be “stringy” or “drippy” as the students work with it. Make sure they are very careful as they transfer spoonfuls from the boiling solution to the ice bath/cold water. If it lands on their skin, it will burn immediately and be hard to clean off due to the stickiness.
- ✓ **TEACHER TIP!** Have students work in groups to re-write or draw out the instructions, to ensure understanding
- ✓ **TEACHER TIP!** Test/check all equipment for accuracy, especially thermometers
- ✓ **TEACHER TIP!** Provide a spoon rest for spoons or stir rods
- ✓ **TEACHER TIP!** Have students spread foil or parchment paper on a cookie sheet to drop the samples. Instruct students to label the foil or parchment to identify which stage each sample represents. This will help students retain and understand the differences, also will make comparisons between groups easier
- ✓ **TEACHER TIP!** If you are using a kitchen lab rather than a science lab (grams to cups/tsp, etc.), consider reviewing conversions with students or providing the conversions for them, otherwise students may end up with incorrect measurements.
- Give each student a copy of [Appendix 8](#).
 - › Students should fill in the Fahrenheit temperature conversions below the Celsius temperatures.
 - » *Provide formula for conversions:*
 Temperature T in degrees Fahrenheit ($^{\circ}F$) is equal to the temperature T in degrees Celsius ($^{\circ}C$) times 1.8 plus 32:
 - $T(^{\circ}F) = T(^{\circ}C) \times 1.8 + 32$
- Each team will prepare the sugar solution to the temperature assigned by the teacher. The temperature will be one of the five candy texture stages:
 - › Soft ball – 235°F-240°F
 - › Firm ball – 245°F – 250°F
 - › Hard ball – 250°F – 265°F
 - › Soft crack – 270°F – 290°F
 - › Hard crack – 300°F – 310°F
- Each team should develop a hypothesis for what they expect to see happen at the stage they are trying to achieve.
- Remember these **Tips!** for running the lab:
 - › Students should wear eye protection
 - › Provide pot holders/heat gloves to students
 - › Instruct students to set up an ice bath rather than just a bowl/cup of cold water
 - › Instruct students to have multiple ice baths/ bowls/cups of cold water for when the temperature rises quickly between stages
 - › Include instructions for cleanup - especially disposal of the hardening/hardened sugar solution
 - › Use smaller beakers or saucepans for faster completion
 - › Use true candy thermometers rather than probe-style (based on teacher preference)
- Each team will use the following procedure to create the sugar solution:
 - › Measure 60 mL of glucose solution using the graduated cylinder and place it into the 250 mL beaker.
 - › Measure 120 mL of white sucrose using the graduated cylinder and place it in the 250 mL beaker. Mix with the glass stir rod.
 - › Use the balance to measure 2 g of sodium chloride and add to the mixture in the 250 mL beaker. Stir the contents together with the glass stir rod.
 - › Create an ice bath in a separate container (water with a few ice cubes).
 - › Set up a Bunsen burner and ring stand with wire mesh on the iron ring. Make sure your Bunsen burner gas intake tube is securely

connected to the gas nozzle and that the ring is set about 3 in. above the barrel of the burner. Light the Bunsen burner to create flame that is no more than 3 in. high. It should not be touching the wire mesh.

» *If you don't have access to gas and Bunsen burners, hotplates work great for this as well.*

- › Use the tongs to place the beaker on the ring stand. Slowly heat the mixture while stirring constantly. If you heat the mixture too quickly or do not stir it, you will burn your sucrose and ruin the candy.
 - ✓ **TEACHER TIP!** Direct students to start at a low temperature and work up to medium, then high, to avoid scorching the sugar solution
 - › When the solution reaches the desired temperature, turn off the heat.
 - › Take a spoonful of the solution and drop it into the container with the ice bath.
 - ✓ **TEACHER TIP!** Have students use multiple spoons to drop and retrieve sugar each time, especially as the stages start to change from one to the next faster at the end
 - › Wait a few seconds, and when the sample is cool, using your hands remove it from the ice bath.
 - › Roll the sample between your fingers for a few minutes and describe the texture.
- Post the following questions on a flip chart somewhere in the room. Students should respond to the questions independently on a sheet of paper.
 - Have students respond to the following questions:
 - › Was your hypothesis correct? Why or why not?
 - › What happened when you took the sample out of the water?
 - › Describe the texture of your candy sample. How did it feel?
 - › What can you conclude about the relationship between temperature and the texture of the candy? How do you think this affects the final product?
 - To debrief the lab, give each student a copy of the article ([Appendix 9](#)) about the cold water candy test.
 - Give students about 5-10 minutes to read through the article. Using a highlighter, students should highlight the main idea.
 - Take a few minutes to discuss the article and the results from the lab.
 - As students finish, they should make observations for Day 7 of their rock candy.
 - › Debrief the rock candy lab by having students compare their rock candy.
 - › If the rock candy isn't ready by this time, continue daily observations until there are significant results.

CLOSING

5 minutes

- Students will turn in their Exit Ticket for that day. They will respond to the following prompt: ***"List two new facts you learned from today's lab."***
- Collect the Exit Ticket for the day as students leave the classroom.



Key Questions of the Day:

What are common food additives in candy?
Why are they there?



Estimated Time

One 50-minute class period



Learning Objectives

As a result of this lesson, students will be able to:

- Identify additives in candy.
- Explain the function of additives in candy.
- Describe how invertase is used for making cherry cordials.



Required Materials

- Food Additives Article – [Appendix 10](#) - One per student
- Highlighter
- Post-It notes
- Flip chart
- Markers
- Cherry Cordial Enzyme Lab – Adapted from <http://www.brookfoodscience.com/labs.html> – [Appendix 11](#)
- Lab materials:
 - › Twelve maraschino cherries with stems (dried overnight)
 - › 1/8 cup of softened butter (2 Tbsp)
 - › 1/2 tablespoon of light corn syrup
 - › 1 tablespoon of reserved cherry juice
 - › 1/2 teaspoon of liquid invertase (small quantities are completely safe but allergic reactions are possible)
 - › 1 cup powdered sugar
 - › ½ pound of melted chocolate candy coating (4 blocks in a 1 lb. package of candy coating)
 - › Large mixing bowl
 - › Hand mixer
 - › Small microwave safe bowl or small sauce pan
 - › Waxed paper
 - › Twenty candy cups



Bell-Work

- Provide students with the weekly Bell-Work sheet ([Appendix 1](#))
- “What are all the extra ingredients on food labels?”

OPENING

5 minutes

- Read the Bell-Work question and solicit responses from the students.
- Possible responses may include:
 - › Chemicals
 - › Sugars
 - › Preservatives
- Explain that, “**We have all seen food labels where the list of ingredients is several lines long and we can hardly pronounce some of the words. Believe it or not, some of those ingredients are very important to the overall quality of the product.**”

MIDDLE

40 minutes

- Give each student a copy of [Appendix 10](#).
 - › This article has a lot of key terms. Be sure to identify a couple to add to the word wall.
- Give students about ten minutes to read through the article independently.
 - › As they read, they should use a highlighter to highlight key terms.
 - › Students should use the Post-It notes to write down the following:
 - » A question about the content.
 - » A new concept they learned.
 - » A concept they didn't understand.
 - ✓ **TEACHER TIP!** These questions should be posted somewhere in the room on a flip chart for students to reference
- When everyone has finished this task, students should get into their project teams and take a few minutes to share the items they listed on their Post-It notes. Then, come back as a class and quickly debrief the article.

- Have students review the ingredients list for their existing candy product and identify any of the common food additives from the list by placing a star next to next to each item. They will use this information as part of an activity later in the project.
- Transition by explaining that the lab is going to focus on one item from that list, invertase.
 - › As you explain the purpose of the lab review the definition of invertase and the reaction that will be demonstrated in the lab.
 - » *Chocolate covered cherries have a liquid center because of an enzyme called invertase. Invertase is an enzyme that is commonly used to make liquid centers and invert sugar (convert sucrose which is table sugar into glucose and fructose) in candy making. This process can take several days at room temperature to occur. Cake makers use invertase to soften fondant (a super saturated solution of frosting).*
 - » *To demonstrate how enzymes (a type of protein) act as a catalyst in a chemical reaction, we are going to make cherry cordials. A catalyst increases the rate of chemical reactions. In enzymatic reactions, the molecules at the beginning of the process, called substrates, are converted into different molecules, called products. In this lab, invertase will be used to soften fondant. Sucrose (table sugar) is the substrate, invertase is the enzyme and the products are glucose and fructose.*
- Students will work in their project teams for this lab.
- The teacher can determine how many cherry cordials each team should make. Be sure that there will be at least one for each student to taste of both the control (no invertase) and the variable (with invertase).
- Have one team complete this lab without using the invertase, so that a comparison can be made between the cherry cordials that have invertase and the ones that don't. This should help students actually see why the enzyme is needed.
- In a large bowl, students should combine the butter, corn syrup, reserved cherry juice and liquid invertase.
- Beat with a hand mixer until smooth.
- Add the powdered sugar gradually and mix until the fondant (a super saturated solution of sugar) is soft but not sticky.
- Form the fondant into quarter-sized portions and roll them in your clean hands to make them round.
- Flatten the ball between your palms and place a cherry in the center.
- Bring together the outer edges and pinch the fondant together at the top of the cherry, so the cherry is surrounded by the fondant.
- Roll with the palms of your hands until smooth.
- Dip the cherries in the bowl of melted chocolate by first dipping only the bottoms of the cherries.
- Place the cherries back on the waxed paper.
- By the time you are done with the last cherry, the first cherry should be firm and ready for the next dipping.
- Drag the first cherry through the chocolate and coat it completely. Use a teaspoon if necessary to coat the top of the cherry with chocolate.
- Place the chocolate-dipped cherry into an individual candy cup.

- Store at room temperature for 3 to 4 days and then enjoy your cherry cordials. *Storing in the refrigerator will slow down the enzymatic reaction and inhibit the syrup production.*

CLOSING

5 minutes

- Students will turn in their Exit Ticket for that day. They will respond to the following prompt:
“Create a hypothesis: what do you think will happen with the cherry cordials that do not contain invertase? What will happen to the ones that do?”
- Collect the Exit Ticket for the day as students leave the classroom.



Key Question of the Day:

How do the ingredients end up in the final candy product?



Estimated Time

One 50-minute class period



Learning Objectives

As a result of this lesson, students will be able to:

- Examine the farm-to-table process of candy ingredients.



Required Materials

- Computer
- Internet
- Access to PowerPoint (if these resources are not accessible, posters can be used instead)
- Rubric – [Appendix 12](#)



Bell-Work

- Provide students with the weekly Bell-Work sheet – [Appendix 1](#)
- **“Where does candy come from?”**

OPENING

5 minutes

- Read the Bell-Work question and solicit responses from the students.
- Possible responses may include:
 - › The store
 - › A factory
- Explain that, **“We know that we can go to the store to purchase candy when we are in the mood for a sweet treat. But that product has to be prepared before it ends up on the shelf. While the end product is likely made in a factory, each ingredient in the product was derived and processed from an original source somewhere. Think about the candy you selected as your existing product. Where did all of the ingredients in that final product come from?”**

MIDDLE

40 minutes

- Ask each team to have their candy/wrapper handy and think about the ingredients in that candy product.
- Ask each team to turn their package over to the nutrition label section and read through the list of ingredients.
- Students should write down every ingredient on the list that is an agricultural product.
 - › Examples may include chocolate, milk, eggs, peanuts (or other type of nut), coconut, sugar, rice crispies, raisins, etc.
 - › They should also consider what they learned on Day Eight and reference [Appendix 12](#) for additional help identifying agriculturally derived ingredients.
- After each team creates a list, ask each member of the team to select one ingredient from that list.
 - › Visit each team to approve their selections and if possible, try to avoid duplicates.

- Once students have their ingredients selected, pose the question, “How does that ingredient get from the farm into that candy bar?” Explain that their task is to investigate the road the ingredient travels to get into the candy from the farm to the grocery store shelf to their hands.
 - › To do this, each student will create a map tracing the life of the ingredient from its origin on the farm, all the way to the supermarket shelf where the consumer would purchase it.
- This map should include everything from agricultural production, harvest, processing, transportation/distribution, or any other steps specific to their particular ingredient.
- Students will use the Internet to research their ingredients.
- They will take the information they find and create a PowerPoint presentation to share with the rest of the class.
 - › By minimizing ingredient duplicates, the class would essentially be teaching each other the farm-to-table path of a variety of ingredients.
 - › The presentation can only be 10 slides, with 20 seconds per slide to discuss the information.
 - › Students should set their presentations to have slide transitions every 20 seconds.
 - › If using posters, students should have a two-minute limit for their presentations.

CLOSING

5 minutes

- Students will turn in their Exit Ticket for that day. They will respond to the following prompt:
“Based on your research, what is something unique about the ingredient you selected?”
- Collect the Exit Ticket for the day as students leave the classroom.



Key Question of the Day:

(Continuation of Day 9)

How do the ingredients end up in the final candy product?



Estimated Time

One 50-minute class period



Learning Objectives

As a result of this lesson, students will be able to:

- Examine the farm-to-table process of candy ingredients.



Required Materials

- Computer
- Internet
- Access to PowerPoint (if these resources are not accessible, posters can be used instead)
- Rubric – [Appendix 12](#)



Bell-Work

- Provide students with the weekly Bell-Work sheet ([Appendix 1](#))
- **“What questions do you have about your presentations?”**

OPENING

5 minutes

- Read the Bell-Work question and solicit responses from the students.
- Address any questions from the students.
 - › This would also be a great time to review how to use PowerPoint for any students who don't know how.

MIDDLE

40 minutes

- Give students a little bit more time to finish creating their presentations and doing their research.
- When ready, allow each student time to present.
- When the presentations are complete, debrief by discussing all of the ingredients and their farm to table paths:
 - › What did they have in common?
 - › What were major differences?
 - › Are any of those ingredients produced in your local area? If so, where? Would you be more likely to use the local ingredients versus store-bought?
 - › What role do government agencies play in this process for the different ingredients?

CLOSING

5 minutes

- Students will turn in their Exit Ticket for that day. They will respond to the following prompt: **“List two new facts about the ingredients you heard about today.”**
- Collect the Exit Ticket for the day as students leave the classroom



Key Question of the Day:

How are we going to make a new candy product?



Estimated Time

One 50-minute class period



Learning Objectives

As a result of this lesson, students will be able to:

- Identify a candy recipe.
- Analyze the characteristics of an existing candy product.



Required Materials

- Computers
- Internet
- Candy wrapper (from the candy the teams selected earlier in the project)
- Flip chart
- Tape



Bell-Work

- Provide students with the weekly Bell-Work sheet ([Appendix 1](#))
- ***“What are the characteristics of a good recipe?”***

OPENING

5 minutes

- Read the Bell-Work question and solicit responses from the students.
- Possible responses may include:
 - › Thorough instructions
 - › Full list of ingredients
 - › Detailed description of the steps
 - › Clearly stated measurements of the ingredients
- Explain that, ***“Today we will conduct research to identify a recipe to use to create your new candy product. When looking for a recipe, it’s important to consider all of the characteristics you described.”***

MIDDLE

40 minutes

- First, each team should take about five minutes to analyze the existing candy product they selected and answer the following questions:
 - › Predict how you think the existing candy product you selected was made.
 - › What is unique about the product?
 - › Why did you select this particular type of candy?
 - › Why do you think your candy selection was a good choice to work with?
- During the analysis of their candy product, students should review the nutrition label and ingredients list to thoroughly understand the product profile.
- Bring the class back together as a group and ask students to share some of their responses to the questions they answered in their teams.
 - › Use a flip chart to record the responses. Hang them around the room as a reference for the remainder of the project as a reminder for students.

- Next, students should use the computers and Internet to find a recipe that could be used to recreate the candy they selected.
 - › Note that the recipe has to be as close to the original product as possible, since students will later determine how to adjust it to create the new product.
- When each team finds a recipe they want to use, they should have it approved by the teacher.
 - › If the recipe is too complicated, lacking instruction, calls for too many ingredients or supplies that are not accessible, encourage students to continue their search for a more appropriate recipe.
- Teams should document the source where they found the recipe they plan to use, as well as the actual recipe in their research journals ([Appendix 4](#)).
 - ✓ **TEACHER TIP!** Check the serving size of the recipe before giving final approval. If the recipe makes a large batch, students can have the option to cut the recipe in half so they are making a smaller batch, which will use fewer ingredients.
- Cherry Cordials Day 3 - Be sure to take a few minutes to allow students to conduct a sensory analysis of the cherry cordials.
 - › In their research journals, they should note the flavor, texture of the filling, aroma, and mouth feel of each final product.

CLOSING

5 minutes

- Debrief the cherry cordial lab by discussing the results.
- Students will turn in their Exit Ticket for that day. They will respond to the following prompt:
“What happened to your cherry cordials?”
- Collect the Exit Ticket for the day as students leave the classroom.



Key Question of the Day:

What are the current trends in the confectionary industry?



Estimated Time

One 50-minute class period



Learning Objectives

As a result of this lesson, students will be able to:

- Analyze trends in the confectionary industry.



Required Materials

- Computers
- Internet
- Flip chart
- Markers
- Article – [Appendix 13](#)
- Resource - <http://www.candyindustry.com/articles/85425-confectionery-trends-in-the-united-states>



Bell-Work

- Provide students with the weekly Bell-Work sheet ([Appendix 1](#))
- “Have you noticed any new candy products in the stores lately? If you have, what are they?”*

OPENING

5 minutes

- Read the Bell-Work question and solicit responses from the students.
- Responses may vary depending on what is new and popular at the time this lesson is being taught.
 - ✓ **TEACHER TIP!** If possible, have a couple of these items ready to share with the class. This will add a lot of value to the discussion if the students can actually see the packages and discuss the new characteristics of the products.
- Explain that, *“As we start to think about how we will be modifying our recipes to create a new and exciting product, it’s important to know what is currently happening in the candy industry. Since we have already chosen the base recipe we plan to use, it’s time to start thinking about the modifications that will make the products new and marketable for the candy shop.”*

MIDDLE

40 minutes

- Each team will get a section of the article ([Appendix 13](#)) to read.
- After teams read their section, they will create a flip chart poster with the key points from that section to share with the rest of the class.
- They will hang their flip charts around the room as an artifact for the remainder of the project, as a reminder of industry trends.
- Following the team presentations, give each team time to discuss what they might change about their starting product based on what they learned about the industry trends.
- Students may use computers and the Internet to do additional research in order to help them decide how they will modify their existing product.

- The goal is not for them to make a final decision, but to start to identify a few options.
 - › The final decision will come after they learn about nutrient claims and target audience in the upcoming days.
- Students will record the information discussed about this in their research journals.

CLOSING

5 minutes

- Students will turn in their Exit Ticket for that day. They will respond to the following prompt:
“What other factors, aside from industry trends, may play a role in product development?”
- Collect the Exit Ticket for the day as students leave the classroom.



Key Question of the Day:

What do the nutrient claims on food labels mean?



Estimated Time

One 50-minute class period



Learning Objectives

As a result of this lesson, students will be able to:

- Describe the meanings of specific nutrient claims.
- Identify nutrient claims commonly found on food packages.
- Read and interpret a food label.



Required Materials

- Computers
- Internet
- Food labels or packages
- Article – [Appendix 14 - http://www.clemson.edu/extension/hgic/food/pdf/hgic4061.pdf](http://www.clemson.edu/extension/hgic/food/pdf/hgic4061.pdf)



Bell-Work

- Provide students with the weekly Bell-Work sheet ([Appendix 1](#))
- ***“What are some claims you commonly see on the packages of your favorite foods?”***

OPENING

5 minutes

- Read the Bell-Work question and solicit responses from the students.
- Possible responses may include:
 - › Fat free
 - › Zero trans fats
 - › Low fat
 - › Sugar free
 - › High protein
- Explain that, ***“There are a wide range of claims that companies use on their products to appeal to consumers. But do we even know what these claims really mean? How do you know you can believe the claims on the packages?”***
- Allow students to share their responses and have a brief discussion.
- Ask students if they can define any of the claims they shared. Then explain that, ***“We are going to explore these claims and what they actually mean, so that you can start to think about how this will relate to the new candy product you are creating.”***

MIDDLE

40 minutes

- Have a variety of food packages displayed at the front of the room.
- Give students a copy of the article [Appendix 14: http://www.clemson.edu/extension/hgic/food/pdf/hgic4061.pdf](http://www.clemson.edu/extension/hgic/food/pdf/hgic4061.pdf) along with a Post-It note.
- Students will read the article in their groups each student will have an assigned section of the article to read. After students finish reading their section, they should share a summary of what they read with their team.

- On the Post-It note, while reading the article, students should write one thing they understand that makes complete sense, one thing they are questioning, and one thing they completely do not understand.
- Then within the groups, students can review the questions and information on their Post-It notes.
- Once the class is finished reading and discussing the article, come back as a class. Ask the following reflection questions:
 - › What are your reactions to this article?
 - › What did you find most interesting?
 - › What are you now questioning?
 - › What surprised you the most?
 - › Did this article come from reliable resource? How do you know? (Briefly explain why the source is credible and the role of the Cooperative Extension Service)
- Transition by explaining that, ***“Based on what we just read, how will you know if the claims on the packages are actually true to the product inside of the package? The answer is on the food label in the list of ingredients.”***
- Ask each group to grab a package from the display (should be from the previous day and does not have to be the product from the engagement scenario). Explain how to determine if the nutrient claim is accurate:
 - › First look at the front of the package. What is the nutrient claim?
 - › Next, look at the ingredients list. Locate that ingredient in the list. For example, if it says made with whole grains, locate whole grains in the ingredients list. If it says high protein, locate the protein content on the nutrition label. All of the answers will be on the nutrition label or in the ingredients list.
 - › If the ingredient is towards the end of the ingredients list, then that means the food product contains very small amounts of that ingredient. If it is towards the beginning, like one of the first few ingredients, then it contains a higher quantity of the ingredient.
- Students should now look at the package, identify the nutrient claim, and then try to determine, based on the facts in the article, if the claim is true for that product.
- Solicit responses from the class. Take a poll, ask students to raise their hand if they believe their claim was accurate, and do the same if they believe it was misleading.
- For the rest of the class period, teams should discuss the nutrient claims and determine if they plan to use one, which one they will use and why.

CLOSING

5 minutes

- Students will turn in their Exit Ticket for that day. They will respond to the following prompt: ***“How do you feel about nutrient claims? Are they an accurate representation of the product?”***
- Collect the Exit Ticket for the day as students leave the classroom.



Key Question of the Day:

What is a target market?



Estimated Time

One 50-minute class period



Learning Objectives

As a result of this lesson, students will be able to:

- Define target market.
- Describe the characteristics of a target market.
- Identify a target market for the new candy product.
- Create a new product strategy.



Required Materials

- Computers
- Internet
- Magazine, newspaper or television advertisements
- Product packages or images of products (food, toiletries, household items, etc.)
- Flip chart
- Markers



Bell-Work

- Provide students with the weekly Bell-Work sheet ([Appendix 1](#))
- **“What is a target market?”**

OPENING

5 minutes

- Read the Bell-Work question and solicit responses from the students.
- Possible responses may include:
 - › A group of people that something is targeted for
- Explain to students that, **“A target market is an identifiable group of consumers with unmet needs or wants. For anything that you purchase whether it be a good such as sneakers or service like a haircut, there is always a target market, and as consumers, we are all part of a specific target market.”**

MIDDLE

40 minutes

- Allow each team 10 minutes to research target market and see if they can determine what characteristics make up target markets. They should be looking for demographics including (this is not a complete list):
 - › Age
 - › Gender
 - › Socioeconomic status
 - › Income
 - › Life stage (kids/no kids/married/single)
 - › Geographic location
 - › Lifestyle views (for example: health conscious)
 - › Relationship to the product or trend
- Once they have completed this task, bring the class back together and ask them to share their findings. Create a master list using a flip chart at the front of the room.
- Give each team a variety of items. The items should include some food-related items, in addition to household products, advertisements from magazines or newspapers.

- › You can also show television commercials that have a clear target audience by explaining how certain commercials are on certain channels, and take it further by discussing how certain commercials air at specific times of the day because of the typical audience watching television at those times.
- Each team will have 5 to 10 minutes to determine the target market for each item or advertisement.
- When this task is complete, bring the class back together and discuss their findings.
- Next, each team will create their new product strategy. Explain that a new product strategy is, ***“a detailed plan assembled by a group to achieve agreed-upon objectives. To carry out a plan or strategy, products may be developed within a corporation.”*** – From Food Science and Safety Second Edition by George J. Seperich
- Continue by explaining, ***“So, before we can move to the prototype phase of development, the first step is to create your new product strategy. What are you going to change about your existing product? What nutrient claims will be on the package? Who is your target market? Your task is to write a summary of your new product plan explaining why your team made the decisions that you made.”***
 - › Post these questions on a flip chart somewhere in the room for students to reference.
- For the remainder of the class, students will work in their teams to write their new product plan and determine who the target market will be for their new candy product. As each team identifies their target market, they should revisit the nutrient claims that they identified from the previous day and determine which ones fit best for the target market of the new candy product. Finally, each team should determine what ingredient they will add to the recipe to change the existing product and explain why they selected that ingredient. They also have to decide how much of the

ingredient will be added. For example, if they selected peanut butter cups and decide to add coconut, they have to decide how much coconut to add to the recipe.

CLOSING

5 minutes

- Students will turn in their Exit Ticket for that day. They will respond to the following prompt: ***“Why is it important to understand the target market for your new product?”***
- Collect the Exit Ticket for the day as students leave the classroom.



Key Question of the Day:

What are the key marketing principles?



Estimated Time

One 50-minute class period



Learning Objectives

As a result of this lesson, students will be able to:

- Describe the four Ps of marketing



Required Materials

- Computers
- Internet
- Flip chart
- Post-It notes
- Markers
- Lab materials:
 - › 1/3 to 1/2 cup of cold water
 - › 1 package of flavored gelatin (variety of flavors and colors)
 - › 4 packets of unflavored gelatin
 - › Saucepan
 - › Rubber spatula
 - › Glass measuring cup
 - › Baster, funnel, or sterile disposable pipet (optional)
 - › Plastic or silicone mold tray (one tray per team)
 - » *This recipe will make enough solution to fill about one tray*



Bell-Work

- Provide students with the weekly Bell-Work sheet ([Appendix 1](#))
- ***“What makes a product sell?”***

OPENING

5 minutes

- Read the Bell-Work question and solicit responses from the students.
- Possible responses may include:
 - › The package – colors, logo, design
 - › The price – inexpensive, big value for small price
 - › Commercials
 - › Popularity of existing products from the same brand
 - › Convenience
- The point to be made is, ***“Companies are very strategic in how they market their products. It’s up to your team to create a marketing strategy that will encourage the ‘candy shop owners’ to select your product.”***

MIDDLE

40 minutes

- Have each of the following items written on their own sheet of flip chart paper and hang them around the room:
 - › Product – What is the product you are trying to sell?
 - › Price – What is the value of the product?
 - › Place – Where will the product be sold? What’s the competition?
 - › Promotion – What is your marketing strategy?
- Explain that these are the four P’s of marketing, which we have to consider when determining how to sell a product.
- Each team should have a few Post-It notes. Teams will rotate to each flip chart station for about a minute each to brainstorm these concepts as they relate to their new products.
 - › The only item that everyone will have similar is the place, since all of the candy is potentially going to be sold at the same candy shop.

- As teams have a response to each P, they should write it on the Post-It note and stick it on the corresponding flip chart. This exercise should take about 4 minutes.
- Bring the class back together and debrief by having a discussion about how the four Ps relate to the development of their new candy products.
- Transition by explaining that, ***“We are going to practice this with a little activity called the Great Gummy Challenge. The goal of the challenge is for each team to make a batch of gummies and create a 30-second commercial that covers the 4 Ps of marketing. While we haven’t gotten into the nitty-gritty of pricing, for this activity, use your best judgment. More on that to come later.”***
- Each team should select the flavor of gelatin and mold they wish to use.
- Each team will make a batch of gummy candies following this recipe:
 - › Place the cold water in a heat-proof glass measuring cup.
 - › Sprinkle the gelatin over the water while stirring with a rubber spatula.
 - » *The resulting mixture will be a super-thick mass, much like clay, but keep stirring.*
 - › When all of the gelatin is sprinkled on, try to get all the dry bits off the side of the measuring cup and off the spatula (as well as any moist bits) and press onto the surface of the gelatin mass.
 - › Cover the measuring cup with plastic wrap and let the mixture rest for 10 minutes. Fill a medium-sized saucepan half full with water, set over medium heat and bring the water to a simmer.
 - › Remove the plastic wrap from the measuring cup and place it in the water. Let the mass of gelatin melt, stirring occasionally and gently.
 - › When the mixture is clear, turn off the heat and let the mixture sit for 1 to 2 minutes.
 - › Very carefully pour the hot mixture from the measuring cup into the molds. An option to keep things from getting messy is to use a funnel, baster, or sterile disposable pipet to port the mixture into the molds. If pouring from a measuring cup with a spout, it should work just fine.
- › If the syrup gets too thick, you can reheat it a little. If the candies contract a fair bit as they cool, top them off with a second round of the gelatin mixture.
- › Place the mold in the freezer for 10 minutes, then in the refrigerator for another 5 to 10 minutes. Peel them out of the molds and serve.
- While the gummies are setting up in the freezer and refrigerator, the teams should be preparing their 30-second commercial.
 - › The commercial should be based on the color, flavor, and shape of the gummies.
- By the time the gummies are ready, teams should be finished planning their commercials.
- Each team will present their commercial.
- Following the commercial, everyone can sample the gummies.
- Have a brief discussion to debrief the lab and review the importance of the 4 Ps.
- Feel free to select a winner of the challenge or have the students vote on their favorite commercial.

CLOSING

5 minutes

- Students will turn in their Exit Ticket for that day. They will respond to the following prompt: ***“What makes gummy candies gummy?”***
- Collect the Exit Ticket for the day as students leave the classroom.



Key Question of the Day:

How is the price of the product calculated?



Estimated Time

One 50-minute class period



Learning Objectives

As a result of this lesson, students will be able to:

- Calculate the price of a product.



Required Materials

- Flip chart
- Markers
- Ingredients list for team recipes
- Pricing Scenarios – [Appendix 15](#)
- Gummy Article – [Appendix 16](#)



Bell-Work

- Provide students with the weekly Bell-Work sheet ([Appendix 1](#))
- *“Yesterday, your exit ticket question asked, ‘What makes gummy candies gummy?’ Let’s discuss this.”*

OPENING

5 minutes

- Read the Bell-Work question and solicit responses from the students.
- Give students a copy of [Appendix 16](#) to read (from lab manual)
- Then have a brief discussion about the article. Highlight that making gummy candy was another example of the chemistry behind candy.
- Transition by explaining, *“We just learned about the 4 Ps of marketing. Today we are going to focus on the P, or price, of food products. How do we determine the price of our new food products?”*

MIDDLE

40 minutes

- ✓ **TEACHER TIP!** You will have to keep track of the price of each ingredient when purchasing supplies. It will help to save a copy of the receipt. You will have to share this information with the students so that they can calculate the cost of their new candy products.
- Students will work in their project teams for this activity. Give each team a scenario from [Appendix 15](#).
- Allow them time to determine how to solve the scenario on their own before offering assistance.
- The process for calculating the price of the ingredients is:
 - › Determine how much milk and how much chocolate syrup to use to create the 12-ounce beverage
 - › Determine how many ounces are in a gallon
 - › Divide the cost of the milk by the number of ounces in a gallon (128 ounces)
 - » *Multiply this number by the number of ounces of milk identified by the team*

- › Divide the cost of the chocolate syrup by the number of ounces in the bottle
 - » *Multiply this number by the number of ounces of chocolate syrup identified by the team*
- › Add the cost of the milk and the cost of the chocolate syrup to total the cost of ingredients for a 12-ounce beverage
- If after about 5-10 minutes teams need help, give them hints about how to perform the calculations.
- Once each team has completed the challenge, come back together as a class and have each team report about their scenario and the cost.
- Explain that, ***“In addition to calculating the cost of each ingredient based on the serving size, we have to consider the other factors involved in. We are pricing our new candy products based mainly on the ingredients. What are some of those other factors that the ‘candy shop owners’ will have to consider when they price the new candy product?”***
 - › Brainstorm a list of factors together as a class. Make a list on a flip chart.
 - › Factors may include:
 - » *Electricity*
 - » *Rent/overhead costs*
 - » *Bulk/wholesale purchasing of the ingredients*
 - » *Equipment maintenance*
 - » *Hourly salary of employees*
 - » *Labor involved in making the product*
 - » *Any packaging materials*
- Give students the rest of the class period to work in teams to calculate the cost of their new candy product.
 - › Teams can divide the task by having each person calculate the price for a few ingredients from the recipe.
 - › They will follow the same procedures from the scenario examples to calculate the price of their products.
- › They will have to follow the procedure from the milk and chocolate syrup for every ingredient in their recipe, based on the serving size of the recipe.
- Students should keep track of their calculations in their research journals. They should show all work so that the teacher can check to see if the math was done correctly.

CLOSING

5 minutes

- Students will turn in their Exit Ticket for that day. They will respond to the following prompt: ***“What questions do you have about calculating the price of products? How do you feel about the price of your product? Is it fair?”***
- Collect the Exit Ticket for the day as students leave the classroom.



Key Question of the Day:

How do I create a nutrition label for a new product?



Estimated Time

One 50-minute class period



Learning Objectives

As a result of this lesson, students will be able to:

- Calculate the nutrition label information for the serving size of the new candy product.



Required Materials

- Computer
 - Projector
 - Sample Calculations – [Appendix 17](#)
 - Ingredients for the candy the students will be making (list will vary depending on the products students plan to create)
- ✓ **TEACHER TIP!** These ingredients should be purchased prior to this day. If there are perishables like butter, be sure the label can be removed so that students can see the nutrition information. Cooking will be coming soon, so this is a good time to have the ingredients handy. You can also decide if you would like to purchase all of the ingredients for the students, or if you would like students to help by bringing in some of the ingredients.



Bell-Work

- Provide students with the weekly Bell-Work sheet ([Appendix 1](#))
- “*What is the purpose of the nutrition label?*”

OPENING

5 minutes

- Read the Bell-Work question and solicit responses from the students.
- Possible responses may include:
 - › Tell if the food is healthy or unhealthy
 - › Serving size
 - › Daily nutritional intake
 - › Ingredients
- The point to be made is, “***These are all correct. Nutritional information tells the consumer how many servings are in the product, as well as the percentage of calories, fat, sodium, sugar, and other nutrients the product takes out of the average daily value. Today we are going to learn how to calculate the nutrition information for your new products.***”

MIDDLE

40 minutes

- Have the packages or nutrition labels of each ingredient on display for the class.
- Begin by reviewing how to properly read and interpret a nutrition label, by discussing where to identify the nutritional information such as calories, fat, sugar, carbohydrates, protein, etc.
- Each team should identify the nutrition information on the products they are using to create their new products.
- Once they have reviewed the nutrition information, explain that the number of calories is directly related to the servings of the product in the package. For example, if a two-pack of peanut butter cups says 200 calories for the entire pack, then eating both pieces means you consumed 200 calories. If it says 200 calories for one piece, then eating both pieces in the package would be 400 calories consumed.

- Explain that the numbers on the nutrition label account for each ingredient in the product.
- Each team will have to calculate the nutrition information for the product they are creating by using the recipe they selected to determine the calories, fat, sugar, carbohydrates, protein, fiber, sodium, and cholesterol for their new product.
- See [Appendix 17](#) for instructions on how to perform these calculations.
 - › Feel free to use this with students if they need assistance.
- Each team will have to calculate the nutrition information for their new product by using this procedure.
 - › Within their teams, students can divide up the ingredients so that each student is working on some of the calculations.
- Students should keep track of their calculations in their research journals. They should show all work so that the teacher can check to see if the math was done correctly.

CLOSING

5 minutes

- Students will turn in their Exit Ticket for that day. They will respond to the following prompt:
“What questions do you have about calculating nutrition information?”
- Collect the Exit Ticket for the day as students leave the classroom.



Key Question of the Day:

What are the components of a product package?



Estimated Time

Two 50-minute class periods



Learning Objectives

As a result of this lesson, students will be able to:

- Create an identity for a new product by developing a name and logo.
- Develop a new product package.



Required Materials

- Colored poster paper
- Markers (and other available art supplies for creating a package)
- Blank Nutrition Label – [Appendix 18](#)
- Empty packages (jars, plastic containers, boxes of different shapes and sizes)
- ✓ **TEACHER TIP!** Students can bring in empty packages or the teacher can be responsible for finding them. Each team will need an empty package and should select one that they feel goes best with the product they plan to make.



Bell-Work

- Provide students with the weekly Bell-Work sheet ([Appendix 1](#))
- *“What is a logo? Why do products have logos?”*

OPENING

5 minutes

- Read the Bell-Work question and solicit responses from the students.
- Possible responses may include:
 - › A symbol for a company
 - › Represents and identity
 - › Have logos for recognition of brands
- Explain that, ***“Great responses! A logo is the identifying symbol for a company. Logos attract attention, identify a company, and explain the product. When you look at a logo, you should immediately get a sense of what the product is. What is the logo on the original candy product you selected?”***
- Have a brief discussion about examples of logos.
- Transition by sharing that, ***“By now, we have been hard at work developing the different aspects of our new products. We have:

 - › Identified an existing product as a model for the new product
 - › Identified recipes with instructions for how to make the existing product
 - › Determined what we will be changing about the recipe create the new product by developing a new product strategy
 - › Calculated the nutrition information for the product
 - › Determined the price
 The next few days will be dedicated to the final details leading up to our final lab, which will be the creation of the prototype.”***

MIDDLE

40 minutes

- At this point, students should be ready to work toward finishing the package for the new confectionary product.

- Explain that teams should be focusing on:
 - › Create the package for the product – each team should select the container that makes the most sense for their prototype
 - › Creating a name for the product
 - › A logo to represent the product
 - › Finish up any calculations for the nutrition label and price
- Emphasize that creativity is very important. As the candy industry is very competitive, if teams want their product to be selected for the candy shop, they have to be creative and catch.
- The rest of the class period should be devoted to team time.
 - › Teams can divide tasks and determine the best way to be efficient and get the package complete.

CLOSING

5 minutes

- Students will turn in their Exit Ticket for that day. They will respond to the following prompt:
“What questions do you have about your packages?”
- Collect the Exit Ticket for the day as students leave the classroom.



Key Question of the Day:

What are the elements of a commercial?



Estimated Time

One 50-minute class period



Learning Objectives

As a result of this lesson, students will be able to:

- Develop a script.
- Record a 30-second (maximum) commercial.



Required Materials

- Video recording tool
 - › Students can use their cell phones, Flip cameras, iPads/iPods, or any other devices that are accessible for video recording
- Computer
- Projector



Bell-Work

- Provide students with the weekly Bell-Work sheet ([Appendix 1](#))
- **“What are the characteristics of a good commercial?”**

OPENING

5 minutes

- Read the Bell-Work question and solicit responses from the students.
- Possible responses may include:
 - › Grabs attention
 - › Entertaining
 - › Informative
 - › Shows an example of the product or service
 - › Includes testimonials from customers
 - › Includes data or statistics about the quality
- Explain that, **“Commercials grab attention and entice consumers to purchase their products or services by creating curiosity and interest. Commercials tend to pinpoint a specific need, propose a solution, and demonstrate knowledge about the product. What’s an example of a current commercial that follows this method?”**
 - › An example could be a food commercial that shows a person with a craving for pizza (the need), calls and orders a pizza for delivery (the solution), and information about the pizza and ingredients (the knowledge of the product).
- Transition by explaining that, **“As you finish up the design of your packages, the next step is to create your commercial. The first set is to prepare your script. Next, take some time to plan and rehearse. The last step should be filming. We are going to switch gears and focus on selling our products to the ‘candy shop owners.’ Your goal will be to convince them that your product is the one they should sell.”**

MIDDLE

40 minutes

- Students may still be working on their package designs, and that’s perfectly okay.



- There should be plenty of work for each team member to be engaged in a task, and working on the script or planning the commercial is something they can be doing while working on the package.
- Since the commercial is 30 seconds or less, it should be fairly short.
- Students have seen commercials on television, so they should be familiar with how to create a commercial.
- Some things to consider about the commercial (Project this criteria on a screen so that students can refer to it as they work):
 - › Should be creative
 - › If possible, can include music or any special effects from video editing apps
 - › To the point
 - › Address the proper target audience (this includes any music or special effects)
 - › Include a shot of the product package (since the actual candy has not been prepared yet)
 - › Include the name of the product, show the logo, and a description of the product
- Following the commercial, each team should be prepared to explain how they decided on the product they developed.
- For the rest of the class period, teams should continue to work on the package and/or commercial.

CLOSING

5 minutes

- Students will turn in their Exit Ticket for that day. They will respond to the following prompt:
“What questions do you have about your commercials?”
- Collect the Exit Ticket for the day as students leave the classroom.



Key Question of the Day:

(Continuation of Day 19)

What are the elements of a commercial?



Estimated Time

Two 50-minute class periods



Learning Objectives

As a result of this lesson, students will be able to:

- Develop a script.
- Record a 30-second (maximum) commercial.



Required Materials

- Video recording tool
 - › Students can use their cell phones, Flip cameras, iPads/iPods, or any other devices that are accessible for video recording



Bell-Work

- Provide students with the weekly Bell-Work sheet ([Appendix 1](#))
- **“Status update: How much progress have we made?”**

OPENING

5 minutes

- Read the Bell-Work question and solicit responses from the students.
- This is an opportunity to determine how much more time is needed for students to complete their packages and commercials before moving on to preparing the candy.
- If the class is small and everyone is done, you can skip this day. If the class needs more time to work on their packages and commercials, this is the time.
 - ✓ **TEACHER TIP!** Continue to allow time for the filming and editing of the commercials. If it seems like it is taking too long, feel free to assign pieces of this for homework, when possible.

MIDDLE

40 minutes

- Students will continue to work in teams to finish their packages and commercials.

CLOSING

5 minutes

- Students will turn in their Exit Ticket for that day. They will respond to the following prompt: **“Are you ready to make your new candy?”**
- Collect the Exit Ticket for the day as students leave the classroom.



Key Question of the Day:

How is candy made?



Estimated Time

Two 50-minute class periods



Learning Objectives

As a result of this lesson, students will be able to:

- Create a new candy product.
- Follow a recipe to prepare a food item.



Required Materials

- Candy ingredients (which should have been purchased several days ago)
- Cooking equipment
 - › Stove or hot plates (microwaves work too)
 - › Thermometers (regular or candy thermometers)
 - › Glass bowls
 - › Wooden spoons
 - › Measuring cups
 - › Measuring spoons
 - › Refrigerators
 - › Freezers
 - › Paper towels
 - › Waxed paper
 - › Food storage containers
 - › Baking sheets
 - › Anything else required by specific recipes
 - › Food handling gloves



Bell-Work

- Provide students with the weekly Bell-Work sheet ([Appendix 1](#))
- ***“Today is the day! Are you ready to make your new candy prototype? What questions do you have?”***

OPENING

5 minutes

- Read the Bell-Work question and solicit responses from the students.
- Answer any questions the students might have about making their recipes.
- Explain that teams will have to be efficient with time due to the fact that we only have a 50-minute class period to work.
- Review food safety and lab safety.

MIDDLE

40 minutes

- Teams will use the class period to make their new candy product prototype.
 - › They should only prepare one serving of the product.
- Offer assistance to any teams who need it.
- If anyone finishes early, they can put any finishing touches on the overall project (package, commercial, etc.).
- Note that it is possible to continue preparation of the candy the next day if it can be stored in a refrigerator overnight.
- There should be enough candy for the teams to sample what they created, as well as for the “candy shop owners” to taste during the judging.

CLOSING

5 minutes

- Students will turn in their Exit Ticket for that day. They will respond to the following prompt: ***“What questions do you have about your commercials?”***
- Collect the Exit Ticket for the day as students leave the classroom.



Key Question of the Day:

Why is my product the best?



Estimated Time

Two 50-minute class periods



Learning Objectives

As a result of this lesson, students will be able to:

- Describe the elements of new product development.
- Give an oral presentation.



Required Materials

- Computer
- Projector
- Cooked candy product
- Packages and commercials
- Candy shop owner
- ✓ **TEACHER TIP!** If there is a local candy store in your community, invite the owner to be a guest judge. If this isn't possible, you can invite administrators, teachers, or other key community business leaders to serve as the "candy shop owners."
- Rubric – [Appendix 19](#)
- Project Reflection – [Appendix 20](#)
- Collaboration Rubric – [Appendix 21](#) – One for the teacher
- Project Presentation Audience Feedback – [Appendix 22](#) – One per student



Bell-Work

- Provide students with the weekly Bell-Work sheet ([Appendix 1](#))
- *“Any last minute questions? Today is the day you will pitch your prototype.”*

OPENING

5 minutes

- Read the Bell-Work question and solicit responses from the students.
- Answer any questions the students might have about their projects.
- Review etiquette for the audience and presenters.

MIDDLE

40 minutes

- After each team shares their commercial, they will also explain why they decided to create the product they chose.
- Students should use [Appendix 22](#) to select one team to evaluate.
- The teacher should use [Appendix 21](#) as a guide for evaluating team collaboration.
- At that time, the “candy shop owners” will conduct a sensory evaluation of the prototype.
- The “candy shop owners” have the option to ask the team any questions about how their prototype was developed.
 - › Sort of like cooking shows like Cupcake Wars, where the judges taste the cupcakes and the chefs describe the cupcake, the ingredients, and why they selected the ingredients.
- If any of the recipes made a large serving size, feel free to take some time for the students to sample each other's creations.
- For small classes, presentations would likely take one day, but for larger classes, it might carry over to two days.
- When presentations are complete, give each student a copy of the [Appendix 20](#) to complete.



- Have a brief discussion to debrief their experience learning about product development through candy.

CLOSING

5 minutes

- Students will turn in their Exit Ticket for that day. They will respond to the following prompt:
“What did you learn from the presentations today?”
- Collect the Exit Ticket for the day as students leave the classroom.

Daily Bell-Work Journal

MONDAY

DATE _____

TUESDAY

DATE _____

WEDNESDAY

DATE _____

THURSDAY

DATE _____

FRIDAY

DATE _____

Daily Exit Tickets



DAY EXIT TICKET Name: (First, Last) _____
Date: _____ Period: _____
Topic: _____



Continue your answer on the back if necessary

DAY EXIT TICKET Name: (First, Last) _____
Date: _____ Period: _____
Topic: _____



Continue your answer on the back if necessary

DAY EXIT TICKET Name: (First, Last) _____
Date: _____ Period: _____
Topic: _____



Continue your answer on the back if necessary

DAY EXIT TICKET Name: (First, Last) _____
Date: _____ Period: _____
Topic: _____



Continue your answer on the back if necessary

DAY EXIT TICKET Name: (First, Last) _____
Date: _____ Period: _____
Topic: _____



Continue your answer on the back if necessary

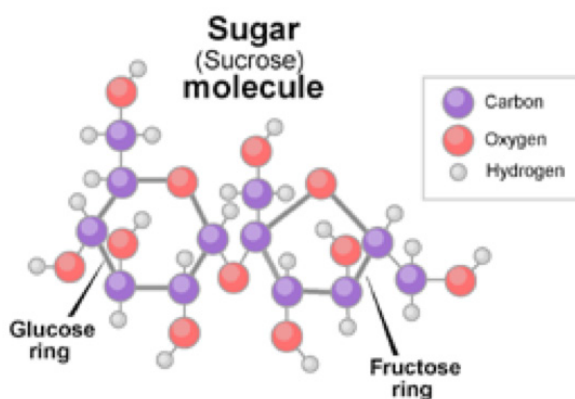


What is Sugar?

The white stuff we know as sugar is sucrose, a molecule composed of 12 atoms of carbon, 22 atoms of hydrogen, and 11 atoms of oxygen (C₁₂H₂₂O₁₁). Like all compounds made from these three elements, sugar is a carbohydrate. It's found naturally in most plants, but especially in sugarcane and sugar beets—hence their names.

Sucrose is actually two simpler sugars stuck together: fructose and glucose. In recipes, a little bit of acid (for example, some lemon juice or cream of tartar) will cause sucrose to break down into these two components.

If you look closely at dry sugar, you'll notice it comes in little cubelike shapes. These are sugar crystals, orderly arrangements of sucrose molecules.



What happens when you heat a sugar solution?

When you add sugar to water, the sugar crystals dissolve and the sugar goes into solution. But you can't dissolve an infinite amount of sugar into a fixed volume of water. When as much sugar has been dissolved into a solution as possible, the solution is said to be saturated.

The saturation point is different at different temperatures. The higher the temperature, the more sugar that can be held in solution.

When you cook up a batch of candy, you cook sugar, water, and various other ingredients to extremely high temperatures. At these high temperatures, the sugar remains in solution, even though much of the water has boiled away. But when the candy is through cooking and begins to cool, there is more sugar in solution than is normally possible. The solution is said to be supersaturated with sugar.

Supersaturation is an unstable state. The sugar molecules will begin to crystallize back into a solid at the least provocation. Stirring or jostling of any kind can cause the sugar to begin crystallizing.

Why are crystals undesirable in some candy recipes – and how do you stop them from forming?

The fact that sugar solidifies into crystals is extremely important in candy making. There are basically two categories of candies – crystalline (candies which contain crystals in their finished form, such as fudge and fondant), and noncrystalline, or amorphous (candies which do not contain crystals, such as lollipops, taffy, and caramels). Recipe ingredients and procedures for noncrystalline candies are specifically designed to prevent the formation of sugar crystals, because they give the resulting candy a grainy texture.

One way to prevent the crystallization of sucrose in candy is to make sure that there are other types of sugar—usually, fructose and glucose—to get in the way. Large crystals of sucrose have a harder time forming when molecules of fructose and glucose are around. Crystals form something like Legos locking together, except that instead of Lego pieces, there are molecules. If some of the molecules are a different size and shape, they won't fit together, and a crystal doesn't form.

A simple way to get other types of sugar into the mix is to "invert" the sucrose (the basic white sugar you know well) by adding an acid to the recipe. Acids such as lemon juice or cream of tartar cause

sucrose to break up (or invert) into its two simpler components, fructose and glucose. Another way is to add a nonsucrose sugar, such as corn syrup, which is mainly glucose. Some lollipop recipes use as much as 50% corn syrup; this is to prevent sugar crystals from ruining the texture.

Fats in candy serve a similar purpose. Fatty ingredients such as butter help interfere with crystallization—again, by getting in the way of the sucrose molecules that are trying to lock together into crystals. Toffee owes its smooth texture and easy breakability to an absence of sugar crystals, thanks to a large amount of butter in the mix.

Research Notes

Name _____ Project _____ Date _____

Question

Search Terms

Enter all search terms you intend to use here. Circle any that result in a good reference:

Reference (Not all sections apply to all sources)

Author(s): _____

Title: _____

Website: _____

Publisher: _____

City/State: _____

Year: _____ Pages: _____

Notes

Crystal Carbohydrates

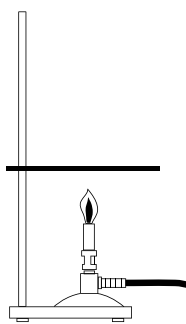
Materials Needed per Group

- 60 ml of brown sucrose, $C_{12}H_{22}O_{11}$ (brown sugar) or 60 ml of glucose solution (Karo syrup)
- 30 ml of solid fatty acid (butter)
- 60 ml of white sucrose, $C_{12}H_{22}O_{11}$ (white sugar)
- 60 ml of dihydrogen monoxide, H_2O (water)
- 5 ml of acetic acid solution (vinegar)
- 1 g of sodium chloride, $NaCl$ (table salt)
- 1.5 ml of Vanilla planifolia liquid (vanilla avoring)
- Beaker, 400 ml
- Thermometer, $150^{\circ}C$ and nonmercury
- 10 ml graduated cylinder
- 100 ml graduated cylinder
- Balance
- Aluminum foil
- Waxed paper
- Beaker tongs
- Bunsen burners and iron rings with wire gauze
- Glass stir rod
- Indirectly vented chemical-splash goggles
- Aprons
- Gloves



Procedure for Groups Using Acid

1. Read through the entire procedure before beginning.
2. Put on your safety goggles, apron, and gloves, and gather all your materials at your lab station. If you notice any of the materials are dirty or discolored, notify your teacher.
3. Measure 60 ml of brown sucrose using the graduated cylinder and place in the 400 ml beaker.
4. Measure 60 ml of white sucrose using the graduated cylinder, place in the 400 ml beaker, and mix with a glass stir rod.
5. Add 60 ml of H₂O and 5 ml of the acetic acid solution to the mixture of sucrose in the 400 ml beaker. Stir thoroughly with the glass stir rod.
6. Use the balance to measure 1 g of sodium chloride and add to the mixture in the 400 ml beaker.
7. Finally, add the 30 ml of solid fatty acid to the mixture in the beaker. Stir the contents together with the glass stir rod.
8. Set up a Bunsen burner and ring stand with wire mesh on the iron ring. Make sure your Bunsen burner gas intake tube is securely connected to the gas nozzle and that the ring is set about 3 in. above the barrel of the burner (see Figure 14.2). Light the Bunsen burner to create flame that is no more than 3 in. high. (It should not be touching the wire mesh.)
9. Using the tongs, place the beaker on the ring stand. Slowly heat the mixture while stirring constantly. If you heat the mixture too quickly or do not stir it, you will burn your sucrose and ruin your candy.
10. Slowly increase the size of the flame. Stir the mixture until all the sugar is dissolved and the beaker contains a clear mixture. Bring the mixture to a boil. Once the mixture is boiling, you do not need to stir.
11. While waiting for the sucrose to boil, have one partner fold a piece of aluminum foil into a 13 cm × 19 cm mold. Double layer the aluminum foil to prevent leaks.
12. Grease the mold with a solid fatty acid. Be generous because if you miss a spot, the sucrose will stick.
13. Continue to heat the sucrose mixture until it reaches 130°C. Use the thermometer to measure the temperature, not to stir. Stirring could cause the tool to break, leaving you with a ruined batch of sucrose.
14. Remove the beaker from heat using the tongs. Add 1.5 ml of Vanilla planifolia liquid, but do not stir.
15. Using the tongs, pour the solution into the well-greased mold. Let the mixture cool before cutting it into squares. **Safety note:** Use caution in this step because the hot solution will seriously burn your skin if spilled.
16. Squares of sucrose can be individually wrapped using waxed paper.
17. Place your beaker, thermometer, and glass stir rod underneath a stream of hot water for one minute. Allow the items to sit in hot water while completing other observations in the lab.
18. Compare a piece of your candy with groups that had a different procedure. Make visual, touch, and taste observations to compare and contrast the sugar structures. Record these observations in your sugar structure table.
19. Clean your area while you are waiting for the butterscotch to cool.

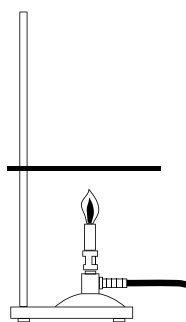


Bunsen burner and ring stand



Procedure for Groups Using Different Types of Sugar

1. Read through the entire procedure before beginning.
2. Put on your safety goggles, apron, and gloves, and gather all your materials at your lab station. If you notice any of the materials are dirty or discolored, notify your teacher.
3. Measure 60 ml of glucose solution using the graduated cylinder and place it in the 400 ml beaker.
4. Measure 60 ml of white sucrose using the graduated cylinder and place it in the 400 ml beaker and mix with a glass stir rod.
5. Add 60 ml of H₂O to the mixture of sucrose in the 400 ml beaker. Stir thoroughly with the glass stir rod.
6. Use the balance to measure 1 g of sodium chloride and add to the mixture in the 400 ml beaker.
7. Finally, add the 30 ml of solid fatty acid to the mixture in the beaker. Stir the contents together with the glass stir rod.
8. Set up a Bunsen burner and ring stand with wire mesh on the iron ring. Make sure your Bunsen burner gas intake tube is securely connected to the gas nozzle, and that the ring is set about 3 in. above the barrel of the burner (see Figure 14.3). Light the Bunsen burner to create flame that is no more than 3 in. high. (It should not be touching the wire mesh.)
9. Using the tongs, place the beaker on the ring stand. Slowly heat the mixture while stirring constantly. If you heat the mixture too quickly or do not stir it, you will burn your sucrose and ruin your candy.
10. Slowly increase the size of the flame. Stir the mixture until all the sugar is dissolved and the beaker contains a clear mixture. Bring the mixture to a boil. Once the mixture is boiling, you do not need to stir.
11. While waiting for the sucrose to boil, have one partner fold a piece of aluminum foil into a 13 cm × 19 cm mold. Double layer the aluminum foil to prevent leaks.
12. Grease the mold with a solid fatty acid. Be generous because if you miss a spot, the sucrose will stick.
13. Continue to heat the sucrose mixture until it reaches 130°C. Use the thermometer to measure the temperature, not to stir. Stirring could cause the tool to break, leaving you with a ruined batch of sucrose.
14. Remove the beaker from heat using tongs. Add 1.5 ml of Vanilla planifolia liquid, but do not stir.
15. Using the tongs, pour the solution into the well-greased mold. Let the mixture cool before cutting it into squares. Safety note: Use caution in this step because the hot solution will seriously burn your skin if spilled.
16. Squares of sucrose can be individually wrapped using waxed paper.
17. Place your beaker, thermometer, and glass stir rod underneath a stream of hot water for one minute. Allow items to sit in hot water while completing other observations in the lab.
18. Compare a piece of your candy with groups that had a different procedure. Make visual, touch, and taste observations to compare and contrast the sugar structures. Record these observations in your sugar structure table.
19. Clean your lab area while you are waiting for your butterscotch to cool.

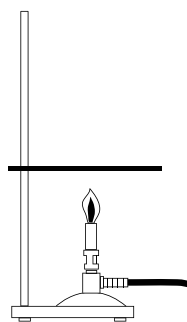


**Bunsen burner
and ring stand**



Procedure for Groups Using Crystallized Sugar

1. Read through the entire procedure before beginning.
2. Put on your safety goggles, apron, and gloves, and gather all your materials at your lab station. If you notice any of the materials are dirty or discolored, notify your teacher.
3. Measure 60 ml of brown sucrose using the graduated cylinder and place it in the 400 ml beaker.
4. Measure 60 ml of white sucrose using the graduated cylinder and place in the 400 ml beaker and mix with a glass stir rod.
5. Add 60 ml of H₂O to the mixture of sucrose in the 400 ml beaker. Stir thoroughly with the glass stir rod.
6. Use the balance to measure 1 g of sodium chloride and add to the mixture in the 400 ml beaker.
7. Stir the contents together with the glass stir rod.
8. Set up a Bunsen burner and ring stand with wire mesh on the iron ring. Make sure your Bunsen burner gas intake tube is securely connected to the gas nozzle, and that the ring is set about 3 in. above the barrel of the burner (see Figure 14.4). Light the Bunsen burner to create flame that is no more than 3 in. high. (It should not be touching the wire mesh.)
9. Using the tongs, place the beaker on the ring stand. Slowly heat the mixture while stirring constantly. If you heat the mixture too quickly or do not stir it, you will burn your sucrose and ruin your candy.
10. Slowly increase the size of the flame. Stir the mixture until all the sugar is dissolved and the beaker contains a clear mixture. Bring the mixture to a boil. Once the mixture is boiling, you do not need to stir.
11. While waiting for the sucrose to boil, have one partner fold a piece of aluminum foil into a 13 cm × 19 cm mold. Double layer the aluminum foil to prevent leaks.
12. Grease the mold with a solid fatty acid. Be generous because if you miss a spot, the sucrose will stick.
13. Continue to heat the sucrose mixture until it reaches 130°C. Use the thermometer to measure the temperature, not to stir. Stirring could cause the tool to break, leaving you with a ruined batch of sucrose.
14. Remove the beaker from heat using tongs. Add 1.5 ml of Vanilla planifolia liquid, but do not stir.
15. Using the tongs, pour the solution into the well-greased mold. Let the mixture cool before cutting it into squares.
16. Squares of sucrose can be individually wrapped using waxed paper.
17. Place your beaker, thermometer, and glass stir rod underneath a stream of hot water for one minute. Allow items to sit in hot water while completing other observations in the lab.
18. Compare a piece of your candy with groups that had a different procedure. Make visual, touch, and taste observations to compare and contrast the sugar structures. Record these observations in your sugar structure table.
19. Clean your lab area while you are waiting for your butterscotch to cool.



**Bunsen burner
and ring stand**

Data Analysis

For each of the following questions, be sure to explain using detail and complete sentences. If the question requires you to complete calculations, show all of your work.

1. What were two observations that you could use to identify whether acid was used in the production of a candy? Explain, citing the specific senses that allowed you to make that observation.

2. What were two observations that you could use to identify whether different sugars were used in the production of a candy? Explain, citing the specific senses that allowed you to make that observation.

Conclusions and Connections

1. Draw a picture of what you think the sucrose molecules look like in candies formed through each of the listed procedures. Label your diagrams.

CANDY FORMED WITH ACID	CANDY FORMED WITH DIFFERENT SUGARS	CANDY FORMED WITH ONLY SUCROSE

Crystal Carbohydrates Background

CREATING A DATA TABLE TO ANALYZE HOW SUGAR STRUCTURE IMPACTS THE FORMATION OF BUTTERSCOTCH CANDY

Background

From the title of this experiment alone, I know that I have your attention. That's right; in this lab we are working with sugar. The average U.S. student consumes about 40 lbs. of sugar each year! And this desire for sugar is nothing new. Cravings for sweets date back to the 16th century when a teaspoon of sugar sold for almost \$5. Can you imagine what a piece of candy would have cost?

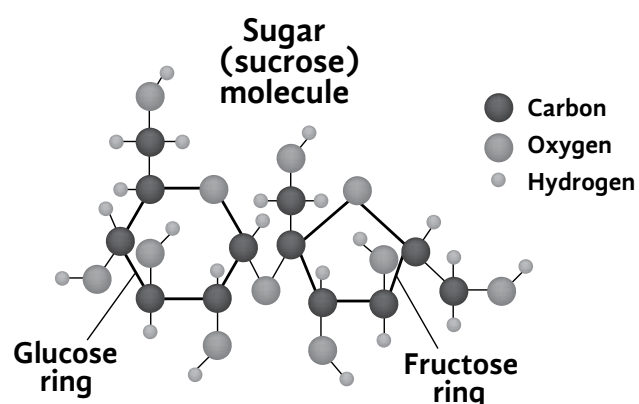
But why is sugar so good? Sugar, which goes by the scientific name sucrose, is an ideal energy source for the human body. Figure 14.1 shows the molecular structure of sucrose, which is made up of carbon, oxygen, and hydrogen atoms.

The sucrose molecule packs a lot of calories (human energy units) into a small amount of substance. It is also easy for the human body to digest, providing instant energy.

With all these good qualities, why do people warn you to stay away from eating too many sweets? Although sucrose provides energy, the body quickly synthesizes that energy. This causes you to experience a sugar "high" before you "crash" and your body is left feeling tired. Second, sucrose is often considered to be an empty calorie source because it doesn't come along with the vitamins and minerals that our body requires. Finally, once the body has absorbed enough sugar, the remaining sucrose is converted into fat stores, which can lead to health problems. So what is the lesson here? Sugar can be consumed in moderation. It isn't healthy to eat all 40 lbs. in one day; however, you certainly do not have to completely remove it from your diet. In what form do you consume sugar? It is found in almost all foods from fruits to cereals, but in its most highly concentrated form, sugar is obtained through candy. Candy aligns the chains of sugar in a way that is pleasing to the mouth and body. These

molecules will interact like Legos that lock together to form crystals, similar to what is seen in rock candy. However, not all sweets want crystallization of sugar. You can prevent crystallization from occurring using a couple of methods, such as adding acid. Acid breaks down the chain into its two subparts—glucose and fructose—making it difficult for the sugar molecules to stay together. You can also add other sugars into the mix, like glucose, to prevent the crystals from forming. Finally, you can use fats like butter to prevent the sucrose molecules from locking into place.

In this experiment, several lab groups will create the sucrose candy of butterscotch using the acid method of preventing crystallization. Several other lab groups will prepare their candy with a mix of different kinds of sugars. One other group will volunteer to make its candy without the acid to see the difference in how sugar reacts when it starts to make chains. We will then compare sugar structures of all three methods to observe the differences in structure.



Essential Question:

How are new candy products created?

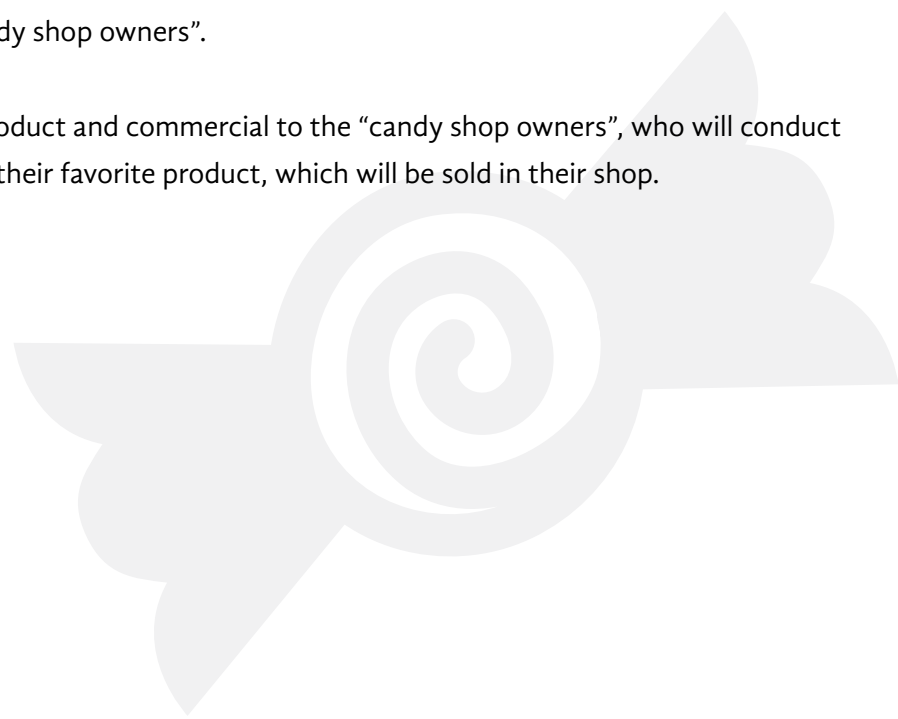
Engagement Scenario:

The candy industry is booming. According to the National Confectioners Association, “U.S. confectionary sales accounted for \$29.4 billion, where 25% of confectionary spending happens around four major holidays – Halloween, Easter, Christmas, and Valentine’s Day.” A local candy company read this data in a recent publication and is eager to increase business at their local shop. To increase revenue, the owners of the candy shop have asked you to develop a new product, which they would like to unveil in time for the major candy holidays. While chocolate represents approximately 60% of all confectionary sales in the U.S., the owners are willing to sell any type of confectionary (e.g., gummy, chocolate, hard candy, caramel, etc.) that will increase sales.

Your team will identify an existing candy product and determine how to change the product so that it can be sold as a new product. To do this, your team will develop a new product strategy and a prototype of the new candy product, which will be evaluated by the “candy shop owners”. To accomplish this task, your team will research how candy is made including the chemistry of candy, candy ingredients from the farm to the table, as well as the marketing aspect of product development. Your team will also conduct a number of experiments to learn about the science behind candy. Once you have identified the type of candy product you plan to create, your team will cook the candy product.

Your team will create a package including the name, nutrition information, ingredients list, health claims (if any), price, and logo. The product should be geared towards a specific target market. You will also create a sales pitch to sell your product to the “candy shop owners”.

Your team will then present your candy product and commercial to the “candy shop owners”, who will conduct a sensory analysis of the candy and select their favorite product, which will be sold in their shop.



Candy Temperature Chart

NAME OF STRUCTURE	TEMPERATURE (BASED ON SEA LEVEL)	DESCRIPTION	COMMON USES
Thread	108°C-118°C	The syrup drips from a spoon, forms thin threads in water.	Syrup
Soft ball	118°C-120°C	The syrup easily forms a ball while in cold water, but attens once removed.	Fudge
Firm ball	123°C-125°C	The syrup will form a stable ball, but loses its round shape once pressed.	Caramel candies
Hard ball	125°C-133°C	The syrup holds a ball shape, but remains sticky.	Marshmallows
Soft crack	135°C-155°C	The syrup will form rm but pliable threads.	Taffy
Hard crack	160°C-168°C	The syrup will crack if you try to mold it.	Lollipops
Caramel	169°C and above	The syrup will turn golden at this stage.	Pralines

Cold Water Candy

As a sugar syrup is cooked, water boils away, the sugar concentration increases, and the temperature rises. The highest temperature that the sugar syrup reaches tells you what the syrup will be like when it cools. In fact, that's how each of the temperature stages discussed below is named.

For example, at 235° F, the syrup is at the “soft-ball” stage. That means that when you drop a bit of it into cold water to cool it down, it will form a soft ball.

Most candy recipes will tell you to boil your sugar mixture until it reaches one of the stages below. For the best results and most accuracy, we recommend that you use both a candy thermometer and the cold water test. It's also a good idea to test your thermometer's accuracy by placing it in plain boiling water. At sea level, it should read 212° F. If it reads above or below this number, make the necessary adjustments when cooking your candy syrup.

Note: The temperatures specified here are for sea level. At higher altitudes, subtract 1° F from every listed temperature for each 500 feet above sea level.

Thread Stage

230° F–235° F

sugar concentration: 80%

At this relatively low temperature, there is still a lot of water left in the syrup. When you drop a little of this syrup into cold water to cool, it forms a liquid thread that will not ball up.

Cooking sugar syrup to this stage gives you not candy, but syrup—something you might make to pour over ice cream.

Soft-Ball Stage

235° F–240° F

sugar concentration: 85%

At this temperature, sugar syrup dropped into cold water will form a soft, flexible ball. If you remove the ball from water, it will flatten like a pancake after a few moments in your hand.

Fudge, pralines, and fondant are made by cooking ingredients to the soft-ball stage.

Firm-Ball Stage

245° F–250° F

sugar concentration: 87%

Drop a little of this syrup in cold water and it will form a firm ball, one that won't flatten when you take it out of the water, but remains malleable and will flatten when squeezed.

Caramels are cooked to the firm-ball stage.

Hard-Ball Stage

250° F–265° F

sugar concentration: 92%

At this stage, the syrup will form thick, “ropy” threads as it drips from the spoon. The sugar concentration is rather high now, which means there's less and less moisture in the sugar syrup. A little of this syrup dropped into cold water will form a hard ball. If you take the ball out of the water, it won't flatten. The ball will be hard, but you can still change its shape by squashing it.

Nougat, marshmallows, gummies, divinity, and rock candy are cooked to the hard-ball stage.

Soft-Crack Stage

270° F–290° F

sugar concentration: 95%

As the syrup reached soft-crack stage, the bubbles on top will become smaller, thicker, and closer together. At this stage, the moisture content is low. When you drop a bit of this syrup into cold water, it will solidify into threads that, when removed from the water, are flexible, not brittle. They will bend slightly before breaking.

Saltwater taffy and butterscotch are cooked to the soft-crack stage.

Hard-Crack Stage

300° F–310° F

Sugar concentration: 99%

The hard-crack stage is the highest temperature you are likely to see specified in a candy recipe. At these temperatures, there is almost no water left in the syrup. Drop a little of the molten syrup in cold water and it will form hard, brittle threads that break when bent. CAUTION: To avoid burns, allow the syrup to cool in the cold water for a few moments before touching it!

Toffee, nut brittles, and lollipops are all cooked to the hard-crack stage.

Cold Water Candy Test

1. Measure 60 mL of glucose solution using the graduated cylinder and place it into the 250 mL beaker.
2. Measure 120 mL of white sucrose using the graduated cylinder and place it in the 250 mL beaker. Mix with the glass stir rod.
3. Use the balance to measure 2 g of sodium chloride and add to the mixture in the 250 mL beaker. Stir the contents together with the glass stir rod.
4. Create an ice bath in a separate container (water with a few ice cubes).
5. Set up a Bunsen burner and ring stand with wire mesh on the iron ring. Make sure your Bunsen burner gas intake tube is securely connected to the gas nozzle and that the ring is set about 3 in. above the barrel of the burner. Light the Bunsen burner to create flame that is no more than 3 in. high. It should not be touching the wire mesh.
 - a. If you don't have access to gas and Bunsen burners, hotplates work great for this as well.
6. Use the tongs to place the beaker on the ring stand. Slowly heat the mixture while stirring constantly. If you heat the mixture too quickly or do not stir it, you will burn your sucrose and ruin the candy.
7. When the solution reaches the desired temperature, turn off the heat.
8. Take a spoonful of the solution and drop it into the container with the ice bath.
***Be very careful when removing the solution from the beaker, as it will be very hot and is difficult to remove if it hits your skin!*
9. Wait a few seconds, and when the sample is cool, using your hands remove it from the ice bath.
10. Roll the sample between your fingers for a few minutes and describe the texture.



Common Food Additives in Candy

Aurora Saulo Hodgson

Department of Tropical Plant and Soil Sciences
College of Tropical Agriculture and Human Resources
University of Hawai'i at Manoa
Food Safety and Technology, Apr. 2002, FST-9

Trick or treat? Here, goblins, have some butylated hydroxyanisole, some invertase, some glycerol monostearate . . . Although some candy ingredients may have scary names, there is nothing ghoulish about them. Many of these ingredients play a significant role in making candy taste and look so good. This is a brief guide to some commonly used candy additives.

Food additives such as emulsifiers blend the ingredients of mixtures and keep them from separating, giving the mixtures a consistent texture. Stabilizers and thickeners give mixtures a smooth, uniform texture. Anti-caking agents help nonliquid substances, such as salt, to flow freely. Preservatives inhibit candy spoilage by preventing the growth of mold, yeast, and bacteria. Antioxidants prevent fats and oils in candy from becoming rancid (oxidized by exposure to air) and developing an “off” flavor or unpleasant taste. Leavening agents release acids in candy mixtures during processing, adding texture and volume. Acidulants are multipurpose acids that add tartness to candy, maintain acidity during processing, and also act as preservatives.

Natural flavors and colors, such as peppermint and caramel, are derived from natural sources. Synthetic colors are man-made and designated on food labels as Food, Drug, and Cosmetic (FD&C) water-soluble colors or water-insoluble “aluminum lakes”; for example, FD&C Yellow No. 6. Synthetic flavors, such as ethyl vanillin (artificial vanilla), are also laboratory-made.

Chemical names are used for most additives on ingredient labels because these names are the most explicit. For example, hundreds of sweeteners differ

from table sugar in both taste and function. The familiar word “sugar” cannot be used in place of the chemical name “mannitol” on a label because mannitol is not sugar—it is a sugar alcohol (polyol) that is about 70 percent as sweet as sucrose derived from sugarcane. However, food manufacturers may opt to provide a parenthetical “translation” for such ingredients, such as “mannitol (a sweetener).”

Manufacturers are required by law to indicate if an additive is derived from milk in products labeled non-dairy or if it is a sulfiting agent, such as the preservative sodium sulfite. This is so that people with sensitivities to milk or sulfites may avoid these products if necessary. For example, caseinate is a milk derivative and must be labeled as such in parentheses in “nondairy” foods to alert consumers to potential allergens.

Some chemical names of additives, such as sodium chloride (salt) and sodium bicarbonate (baking soda), have become familiar to many consumers. But many chemical names remain unfamiliar to consumers. Following is a list of common candy additives and what they are used for.

Albumin: any of several proteins that are coagulated by heat and found in egg white, milk, and soy products. The proteins are used to bind ingredients in candies such as mint patties.

Butylated hydroxyanisole (BHA): an antioxidant that prevents fats and oils from becoming rancid (oxidizing) in candies such as peanut-butter cups.

Citric acid: the predominant acid in citrus fruits (oranges, lemons, limes), it gives candies such as lemondrops their tart flavor.

Dextrose: a corn sweetener made from dehydrated cornstarch. Also known as corn sugar, it is the dry form of glucose.

Gelatin: a protein that functions as a gelling agent in gummy candies. It is obtained from collagen derived from beef bones and calf or pork skin.

Glycerol monostearate: an emulsifier used in candies such as licorice.

Gum arabic or gum acacia: a gum used to stabilize emulsions in candy coatings. It is derived from the *Anogeissus latifolia* tree, where it acts as a protective sealant when the bark is damaged.

Gum base: one of the primary ingredients (15–30 percent) in chewing-gum that provides its characteristic texture and insolubility. Gum base is made by blending and heating several vegetable or synthetic substances, such as chicle (latex of the sapodilla tree), petroleum wax, lanolin, or rubber, with a softener such as paraffin and antioxidants.

Hydrogenated vegetable oils: unsaturated oil that has been turned from a liquid to a semisolid (partially hydrogenated) or solid by the addition of hydrogen. Hydrogenated oil has a more desirable texture and consistency than liquid oil, and a higher melting point.

Invertase: an enzyme that causes sucrose (table sugar) to break down into glucose and fructose. It prevents crystallization of sugar, which would cause grittiness in candy.

Lecithin: an emulsifier obtained primarily from soybeans. It is used in chocolates to create a smoother texture and reduce the cocoa-butter content.

Magnesium stearate: the magnesium salt of stearic acid, a fat that may function as a lubricant, binder, emulsifier, or anti-caking agent. It is used in sugarless gum and mints and as a release agent in creating pressed candies.

Malic acid: the predominant acid in apples, it adds tartness to candies for flavoring.

Maltodextrin: generally derived from cornstarch, it is used as a bodying or bulking agent, texturizer, carrier, and sugar-crystallization inhibitor.

Modified food starch: derived from cornstarch, tapioca, or potato, this ingredient is used as a thickener, binder, and stabilizer in candy.

Pectin: a gum obtained from citrus peel and apple pomace. It is used to make gelled candies, such as gumdrops.

Potassium sorbate: a preservative that is the potassium salt of sorbic acid, also a preservative. Sodium aluminum phosphate: a leavening agent that slowly releases carbon dioxide during candy processing, adding volume and texture to hard candies or baked fillings, such as cookies and peanut-butter cups.

Sorbitol: a sugar that is 60 percent as sweet as sugar and 50 percent as caloric. It is a polyol (sugar alcohol) that maintains moistness in candy and provides taste and body in sugarless candy and chewing gum. Glycerin and mannitol are also polyols used in sugarless products.



Enzyme Lab

Introduction

Chocolate covered cherries have a liquid center because of an enzyme called invertase. Invertase is an enzyme that is commonly used to make liquid centers and invert sugar (convert sucrose which is table sugar into glucose and fructose) in candy making. This process can take several days at room temperature to occur. Cake makers use invertase to soften fondant (a super saturated solution of frosting).

Purpose

To demonstrate how enzymes (a type of protein) act as a catalyst in a chemical reaction. A catalyst increases the rate of chemical reactions. In enzymatic reactions, the molecules at the beginning of the process, called substrates, are converted into different molecules, called products. In this lab invertase will be used to soften fondant. Sucrose (table sugar) is the substrate, invertase is the enzyme and the products are glucose and fructose.

Materials

- 12 maraschino cherries with stems (dried overnight) **Note:** There approximately 26 in a 10 ounce jar
- 1/8 cup of softened butter (2 Tbsp.)
- 1/2 tablespoon of light corn syrup
- 1 tablespoon of reserved cherry juice
- 1/2 teaspoon of liquid invertase (small quantities are completely safe but allergic reactions are possible)
- 1 cup powdered sugar
- 1/2 pound of melted chocolate candy coating (4 blocks in a 1 lb. package of candy coating) Ask instructor about melting procedure
- Large mixing bowl
- Hand mixer
- Small microwave safe bowl or small sauce pan
- Waxed paper
- 20 candy cups

Procedures

1. In a large bowl combine the butter, corn syrup, reserved cherry juice and liquid invertase.
2. Beat with a hand mixer until smooth.
3. Add the powdered sugar gradually and mix until the fondant (a super saturated solution of sugar) is soft but not sticky.
4. Form into quarter-sized balls of the fondant and roll it in your clean hands to make it round.
5. Flatten the ball between your palms and place a cherry in the center.
6. Bring together the outer edges and pinch the fondant together at the top of the cherry.
7. Roll with the palms of your hands until smooth.
8. Repeat the procedure with the approximately 12 of the cherries.
9. Dip the cherries in the bowl of melted chocolate by first dipping only the bottoms of the cherries.
10. Dip the bottom of the cherries only and then place back on the waxed paper.
11. By the time you are done with the last cherry, the first cherry should be firm and ready for the next dipping.
12. Drag the first cherry through the chocolate and coat it completely. Used a teaspoon if necessary to coat the cherry with chocolate.
13. Place it on an individual candy cup.
14. Store at room temperature for 3 to 4 days and then enjoy your cherry cordials. *Storing in the refrigerator will slow down the enzymatic reaction and inhibit the syrup production.*

<http://www.brookfoodscience.com/labs.html>

Farm to Table Map Rubric

Student _____ Ingredient _____

Total Points for Project _____ /40

PRESENTATION INCLUDED EACH STEP OF THE PROCESS:	
• Production of the ingredient (0-5 points)	
• How the ingredient is processed once it is harvested (0-5 points)	
• How the ingredient is packaged and prepared for transport (0-5 points)	
• Mode of transportation of the ingredient (0-5 points)	
• Description of happens when the ingredient arrives at the final destination where it will be sold (0-5 points)	
Presentation was within the two-minute timeframe (0-5 points)	
Content on the visual was neatly organized (0-5 points)	
Visual design was creative and included images, drawings, etc. (0-5 points)	



Chocolate and Candy Remain Recession Resistant

Contact: Susan Whiteside
(202) 534-1440
susan.whiteside@CandyUSA.com

Washington, DC (June 24, 2009) - Experimenting with flavors, flexibility and variety, confectionery makers are thinking outside the bar to provide consumers with chocolate and candy innovation that will drive consumer purchasing over the next five years, according to the National Confectioners Association's (NCA) Confectionery Industry Trend Report 2009. Even in economic uncertainty, the industry continues to post gains.

"Insight from the confectionery industry's leading influentials provides an appetizing future for consumers and the industry alike," says NCA President Larry Graham. "Chocolate and confections are treats that consumers can count on to be affordable luxuries. Our industry provides people with new choices, new experiences and old favorites that provide moments of happiness to be enjoyed any time."

With in-depth insight from 40 industry experts, including top manufacturers, market researchers, award-winning chocolatiers, nutritionists and confectionery makers, NCA's Industry Trend Report captures the confectionery trends and influences that will foster growth of the industry through 2014. Top line category trends include:

- Chocolate explosion
- Health benefits
- Flavor fusions
- International influences

So, what's next?

Experts believe that the next "big" trend in confections will be healthier confectionery options, specifically a growing demand for health benefits

and 'better for you' ingredients, according to almost nine out of ten (88 percent) experts. Already, we are seeing consumers embrace portion-control sized treats and the potential heart health benefits of higher cacao content in chocolate. As consumers continue to lead healthy lifestyles, health benefits will heavily influence manufacturers to focus largely on developing 'better for you' confections, especially new types of enhanced chocolate treats.

More than sweet and good to eat, manufacturers will take steps toward social responsibility. Sixty-five (65) percent of experts say eco-friendly manufacturing efforts, like recyclable packaging, will influence product development and consumer purchasing.

"For 125 years, the National Confectioners Association and its members have brought innovation and reinvention, always meeting the demand to fit consumers' lifestyles," Graham adds.

Choc-full-of-it

America's favorite flavor, chocolate, will emerge as one of the largest growth drivers for the industry in new, delicious and exciting ways. Experts predict consumers can expect to find chocolate and cocoa popping up more frequently as a key ingredient in main courses alongside salmon, chicken and steak, according to 73 percent of experts surveyed. Not just for dinner, 38 percent of insiders say to be on the lookout for cocoa and chocolate in appetizers.

"Chocolate is a classic indulgence," commented Susan Smith, senior vice president of NCA's Chocolate Council. "From its potential health benefits to its organic roots and inclusion as an ingredient in many types of sweet and savory foods, we have only begun to experience the versatility of chocolate."

Embracing versatility may mean more of an emphasis on global influences and flavor pairings, according to the survey. Forty-three percent of experts say consumers are going to become more open to chocolate and flavor infusions that include spices, salts, herbs and floral flavors. For example, exotic fruit pairings such as mango will become more



prominent and we'll start to see ethnic flavors emerge in popularity with herbs being incorporated into chocolate dishes. Consumers can also expect to see sweet and savory combinations like chocolate and bacon, as well as chocolate and cheese duos appear in stores and on the menu.

In the chocolate and cocoa category, the potential health benefits of the antioxidants found in chocolate will continue to be evidenced as new and positive health-related findings are discovered. Nearly half of those surveyed say consumers can expect to see more research into the potential health benefits of milk chocolate and dark chocolate, including exploration of naturally occurring cocoa compounds and positive effects on mood and blood pressure levels.

Additionally, one-third of experts say consumers will become more knowledgeable about the global origin of the chocolate they enjoy. Embracing origins helps consumers to breakdown cacao percentage and connect the provenance of the cocoa bean to the final product. All chocolate begins with cocoa beans, the fruit of the cacao tree. The tree, *Theobroma cacao*, produces pods that hold cacao beans. These trees grow only in tropical regions around the world within a close proximity to the equator. Therefore, many exotic locales can lay claim to a connection with chocolate including regions like Africa, the Dominican Republic, Malaysia, Indonesia and South America.

Better for You, Inside and Out

Consumers are finding new ways to incorporate traditional candy as part of a healthy, active lifestyle. Since 2005, the confectionery industry has responded to market demands by introducing hundreds of portion-controlled, calorie-controlled, reduced-fat, sugar-free and fortified products. And there's no sign of a slow down, according to experts. Forty-three percent say health-related influences will be the leading influence on new product development in the confectionery industry overall. Within the health category, drivers include:

- 35 percent of industry leaders cite portion control as the leading influencer. The popularity of snack-sized products and 100-calorie packs, which give consumer the full flavor of their favorites, in smaller, reduced calorie options, is expected to continue.
- 25 percent point to fortified products - confections with added vitamins, minerals or protein.
- 45 percent note an emerging trend towards healthier chocolate options.

More than offering potential heart health benefits, chocolate and cocoa may benefit your body and mind overall. The experience of chocolate is extending beyond an edible edition and into personal care products. The benefits of cocoa butter, which is an essential ingredient of all chocolate, will also continue to materialize. Currently doctors and scientists recognize cocoa butter as a skin protectant recommended for the treatment of dry skin conditions. To that end, 23 percent of experts agree that skin care products will be the next big market expansion when it comes to non-edible cocoa product including skin care, soap and shampoos, lotions and anti-aging products.

The majority of respondents also say that oral health care will drive the chewing gum category. One-fourth of experts say sugar-free options will become increasingly common, along with dental professionals' backing and the American Dental Association approvals.

Out-of-the-Box Innovation

In 2008 alone, more than 6,000 new confectionery and snack products debuted to meet consumer demand. Candy, chocolate and gum continued to lead the snack category in sales and ranked third in food sales overall in 2008. And the confectionery industry posted a 3.7 percent gain for the 52-week period ending April 19, 2009. As classic candies remain tried and true favorites overall, a maturing American palate is trending toward twists, turns and more innovative product creations.

Experts say limited editions - which allow confectionery makers the freedom to experiment with flavors in a variety of ways - will continue to prevail. Limited-time product extension will be big, experts think, such as introducing dark chocolate versions of classic milk chocolate candies. Experimental limited editions will also include more entertainment promotional ties and new twists on old favorites, such as unconventional flavor combinations.

When it comes to kids' candies, experts say it's all about intense new flavors and interactive experiences. Respondents comment that this dynamic category is unique and different from all other products in the market, catering to the more attention-grabbing, fun and entertaining products that kids like.

Global Influences

International spices and ethnic flavors will also have a large influence on new U.S. products and flavor development overall, 58 percent of experts say. While Asian and Latin flavors will serve as the biggest influences on U.S. confectionary product launches, insiders point to Europe as the birthplace for international confectionery trends now and in the coming years. Although Europe is most frequently perceived as the origin of confectionery trends, Japan appears to be an emerging influencer in the candy industry.

And when it comes to America's global influence, one in three industry experts say U.S. trends will have the greatest impact on the dark chocolate market. Twenty percent say the U.S. market for confections will influence product pricing and economic issues overseas.

For more information on emerging trends, chocolate and candy statistics and much more, please visit www.candyusa.com.

About the National Confectioners Association

(NCA): Founded in 1884 in Chicago by representatives of 69 confectionery manufacturing firms, the National Confectioners Association is one of the oldest, most respected trade associations in the world. Today NCA has more than 600 members and is the major association representing the entire confectionery industry, offering education and leadership in manufacturing, technical research, public relations, retailing practices, government relations and statistical analyses. NCA fosters industry growth by advancing and promoting the interests of the confectionery industry, its customers and its consumers.

About NCA's Confectionery Industry Trend

Report 2009: These in-depth interview findings are from a diverse mix of 40 elite confectionary experts from among the most knowledgeable within the confections industry (e.g., chocolate and confectionary experts/specialists, representatives of culinary institutes, chefs, experts within NCA's staff, specialty retailers, manufacturers, bloggers, and editors/publishers of food and candy magazines). The telephone interviews were conducted from November 5 to December 5, 2008, and averaged 45 minutes in length. Because these in-depth interviews were qualitative in nature and do not represent a randomly selected sample of those working within the confectionary industry, a sampling margin of error cannot be reported.

Nutrient Claims on Food Labels

Clemson Cooperative Extension
Home & Garden Information Center
<http://www.clemson.edu/extension/hgic>
HGIC 4061, 1-888-656-9988

Are you familiar with the label language on food products in the grocery store?

- The label on a can of pears says there is "no added sugar."
- The words on a milk carton boast that it is "high in calcium."
- Certain breakfast cereals claim to be "high in fiber."
- "Lite" salad dressing and cookies with "fewer calories" also catch your eye.

These are all nutrient content claims. The optional information in a nutrient claim tells you that a food contains desirable levels of certain nutrients or alerts you to avoid a food that contains a certain nutrient that is detrimental to your health.

What is a Nutrient Claim?

This is a claim concerning a product's nutritive value. It describes the content of a food, including the amount of nutrients, calories, cholesterol or fiber, but not in exact amounts. Usually on the front of the food label, the nutrient claim provides a quick comparison between similar products.

Have you ever wondered if you can believe the nutrient claims on food labels? Yes, you can. Under the Nutrition Labeling and Education Act (NLEA) of 1990, the government set strict rules and definitions that a product must meet to make a nutrient claim or a health claim. If a product meets these strict criteria, the manufacturer can display certain approved claims about the food.

Approved Terms: By knowing the definitions of terms used on food labels, you will be able to choose foods wisely. The NLEA permits the use of label claims that

describe the level of a nutrient in a food (e.g. nutrient content claims). Nutrient content claims describe the level of a nutrient or dietary substance in the product, using terms such as free, high, and low, or they compare the level of a nutrient in a food to that of another food, using terms such as more, reduced, and lite. Refer to the table, "Definitions of Nutrient Content Claims," on the next page to learn what these claims mean.

The Food and Drug Administration (FDA) requires that a nutrient content claim on a food package be based on how much of the food most people usually eat or drink. This is called the reference amount. Serving size and reference amount are usually the same.

Always check the label, because sometimes serving size and reference amount are different. For example, a serving size of low calorie soda is 12 fl. oz., but the low calorie claim on the label is based on a reference amount of 8 fl. oz. Therefore, the manufacturer must include this statement: "40 calories or less per 240 milliliters (8 fl. oz.)."

Daily Values: Most nutrient claims apply to nutrients that have an established Daily Value (DV), which is the basis for nutrient claims such as a food is "low" in sodium or a "good source" of fiber. Use the % DV to compare a food with a nutrient claim to a similar food without a claim.

A food which provides 10% or more of the Daily Value for a nutrient per serving is a good source, while one providing 20% is considered "high in" the nutrient. Choose several servings of foods that are "high in" or "good sources" of hard-to-get nutrients like calcium. Recommended amounts are the minimums you should consume daily.

Any food containing less than 5% of a Daily Value provides only a small amount of that nutrient. Aim for 100% or less of the Daily Value for nutrients that should be limited, such as total fat, saturated fat, cholesterol and sodium. For more information on % DVs, refer to [HGIC 4057, Determining Nutritional Value of Foods](#).

DEFINITIONS OF NUTRIENT CONTENT CLAIMS

NUTRIENT CONTENT CLAIM	WHAT THE CLAIM MEANS PER SERVING
High (rich in, excellent source)	20% or more of the Daily Value
Good	10% to 19% of the Daily Value
More	Contains at least 10% more of the Daily Value for vitamins, minerals, protein, dietary fiber, or potassium.*
Light	Has at least 1/3 fewer calories or 50% less fat.* If more than half the calories are from fat, fat content must be reduced by 50% or more.
Less or fewer	Has 25% less of a nutrient or of calories
CALORIE CLAIMS	
Calorie free	Less than 5 calories
Low calorie	40 calories or less
Reduced calories	At least 25% fewer calories*
SUGAR CLAIMS	
Sugar free	Less than 0.5 gram sugars
Reduced sugar	At least 25% less sugar
FIBER CLAIMS (If food is not low in total fat, the label must state total fat in conjunction with the fiber claims)	
High fiber	5 grams or more
Good source of fiber	2.5 grams to 4.9 grams
More or added fiber	At least 2.5 grams more*
SODIUM CLAIMS	
Sodium free or salt free	Less than 5 milligrams sodium
Very low sodium	35 milligrams of sodium or less
Low sodium	140 milligrams of sodium or less
Reduced sodium	At least 25% less sodium*
Light in sodium	At least 50% less sodium
Salt free	Less than 5 milligrams sodium
FAT CLAIMS	
Fat free	Less than 0.5 gram fat
Low fat	3 grams or less total fat
Reduced fat	At least 25% less fat than the regular version
SATURATED FAT CLAIMS	
Saturated fat free	Less than 0.5 gram saturated fat and less than 0.5 gram trans fatty acids
Low in saturated fat	1 gram or less saturated fat & no more than 15% calories from saturated fat
Reduced saturated fat	At least 25% less saturated fat* and reduced by more than 1 gram fat
<i>Note: Trans fat has no FDA-defined nutrient content claims.</i>	
CHOLESTEROL CLAIMS	
Cholesterol free	Less than 2 milligrams cholesterol and 2 grams or less saturated fat
Low cholesterol	20 milligrams or less cholesterol and 2 grams or less saturated fat
Reduced cholesterol	At least 25% less cholesterol and 2 grams or less saturated fat*
LEAN CLAIMS	
Lean	Contains less than 10 grams total fat, 4.5 grams or less saturated fat, and less than 95 milligrams cholesterol
Extra lean	Contains less than 5 grams total fat, less than 2 grams saturated fat, and less than 95 milligrams cholesterol

*compared to the reference, or regular, food this would replace

All of these terms give a general idea of a food's nutrient content. For the exact amount of nutrients and calories in one serving, read the Nutrition Facts, which is usually on the side or back of the package. Light: The term "light" can also be used to describe texture and color, if the label explains the intent (e.g. "light brown sugar" and "light and fluffy").

Healthy: A "healthy" food is low in fat and saturated fat and contains limited amounts of cholesterol (60 mg or less per serving) and sodium (480 mg or less per serving). If it is a single-item food, it also must follow the "10-percent" rule. This means that it provides at least 10% of the DV per serving of at least one of these: vitamins A or C, iron, calcium, protein and fiber.

Certain fresh, canned and frozen fruits and vegetables and certain cereal-grain products are exceptions to this rule. They can be labeled "healthy" even if they don't have at least 10% DV per serving of the above nutrients.

Meal-type products (e.g. frozen entrees and multi-course frozen dinners) must provide 10% DV of two or three of these: vitamins A or C, iron, calcium, protein or fiber, as well as meet the other criteria. Sodium content cannot exceed 360 mg per serving for individual foods and 480 mg per serving for meal-type products.

If a food is labeled "healthy" or makes a health claim, it can't contain any nutrient that increases risk for disease. It must contain no more than 20% of the DV per serving of: total fat, saturated fat, cholesterol, or sodium. Therefore, low-fat and fat-free milks qualify to make the calcium and osteoporosis claim, yet whole milk contains too much saturated fat to make that claim.

Other Definitions

Percent Fat Free: A product with this claim must be low-fat or fat-free, and the claim must show the amount of fat present in 100 grams of the food. If a food contains 2.5 grams of fat per 50 grams, for example, the claim must be "95% fat free."

Implied: These claims are prohibited if they wrongfully imply that there is, or is not, a meaningful level of a nutrient in a food. For example, "made with oat bran" is not allowed unless the product contains enough oat bran to meet the definition for "good source" of fiber. However, a claim that a product contains "no tropical oils" is allowed, but only on foods that are "low" in saturated fat. Why? Consumers have come to equate tropical oils with high saturated fat.

Meals & Main Dishes: A meal or main dish that claims to be "free" of a nutrient (e.g. cholesterol or sodium) must meet the same requirements as those for individual foods. The following claims can be used under special circumstances:

- **Low calorie** means the meal or main dish contains 120 calories or less per 100 g.
- **Low sodium** meals and main dishes have 140 mg or less sodium per 100 g.
- **Low cholesterol** means the food contains 20 mg cholesterol or less per 100 g and no more than 2 g saturated fat.
- **Light meals** and main dishes are low-fat or low-calorie.

Standardized Foods: Any nutrient content claim (e.g. "reduced fat," "low calorie") can be used in conjunction with a standardized term, as long as the new product:

- has been specifically formulated to meet FDA's criteria for that claim
- is not nutritionally inferior to the traditional standardized food
- complies with certain compositional requirements set by FDA

A new product that makes a claim must have performance characteristics similar to the referenced traditional standardized food. If it does not and the product's use is limited, then the label must inform consumers of the differences (e.g. "not recommended for baking").

Health Claims

Health claims, which must be authorized by FDA, describe a relationship between a nutrient or food and a disease or health-related condition. If a claim names a specific disease risk, there is substantial scientific evidence that, in the context of a healthy diet, the food product may help protect against the disease. A few examples are: fruits and vegetables and a reduced risk of cancer; calcium and a lower risk of osteoporosis; fat and a greater risk of cancer; sodium and a greater risk of high blood pressure.

Health claims must be written so that consumers can understand the nutrient's importance in the daily diet and the relationship between the nutrient and the disease. An example is: "While many factors affect heart disease, diets low in saturated fat and cholesterol may reduce the risk of this disease." Health claims made in magazine and television advertisements are not regulated by FDA.

Claims on Functional Foods

If food products meet strict government rules and definitions, then their labels can display certain nutrient or health claims. On the other hand, the labels of functional foods and other products claiming to be dietary supplements are largely unregulated. This allows them to make misleading, unsubstantiated (but legal) claims.

A nutrient or health claim and a claim on functional food may look similar, but you must learn the difference. A health claim is well-researched, reliable and approved by FDA (e.g. "may reduce the risk of heart disease").

Although deceptively similar, a structure/function claim is not supported by scientific evidence, is far less regulated, and must be worded so that it does not mention a specific disease (e.g. "promotes a healthy heart," "builds strong bones," improves memory," "slows aging," or "provides a variety of health benefits").

The following type of FDA disclaimer must be included on the label: "This statement has not been

evaluated by the Food and Drug Administration. This product is not intended to diagnose, treat, mitigate, cure or prevent any disease."

For more information on food labeling request: [HGIC 4056, Reading the New Food Labels](#); [HGIC 4057, Determining Nutritional Value of Foods](#); [HGIC 4058, Food Labels: Fat & Cholesterol](#); [HGIC 4059, Food Labels: Carbohydrates](#); [HGIC 4060, Serving Sizes for Special Diets](#); and [HGIC 4062, Nutrient Density](#).

SOURCES

1. Duyff, Roberta Larson. American Dietetic Association Complete Food and Nutrition Guide, 3rd Edition. 2006.
- 2.Sizer, Frances and Eleanor Whitney. Nutrition Concepts and Controversies, Ninth Edition. 2003.
3. Brown, Lynne J. Penn State College of Agricultural Sciences. Nutrition Facts: Nutrient Content Claims. 1998. <http://pubs.cas.psu.edu/FreePubs/pdfs/uk029.pdf>
4. U.S. Department of Health and Human Services. U.S. Food and Drug Administration (FDA). Label Claims. Updated May 26, 2006. www.cfsan.fda.gov/~dms/lab-ssa.html
5. U.S. Department of Health and Human Services. U.S. Food and Drug Administration (FDA). The Food Label. May 1999. www.cfsan.fda.gov/~dms/fdnewlab.html

This information has been reviewed and adapted for use in South Carolina by J. G. Hunter, HGIC Information Specialist, and K. L. Cason, Professor, State EFNEP Coordinator, Clemson University. (New 11/06.)

This information is supplied with the understanding that no discrimination is intended and no endorsement by the Clemson University Cooperative Extension Service is implied. All recommendations are for South Carolina conditions and may not apply to other areas. Use pesticides only according to the directions on the label. All recommendations for pesticide use are for South Carolina only and were legal at the time of publication, but the status of registration and use patterns are subject to change by action of state and federal regulatory agencies. Follow all directions, precautions and restrictions that are listed.



Pricing Scenarios

Organic Chocolate Milk

Your team is challenged with the task of creating new organic chocolate milk beverage. The product must be a 12 ounce serving size, and should be made with organic milk, which costs \$6.00 per gallon and organic chocolate syrup, which costs \$4.19 per 14 ounce bottle. How much will the 12-ounce organic chocolate milk cost?

Your team must determine how much of the organic milk and how much of the organic chocolate syrup to use to create the new beverage. Then, calculate the cost of the amount of the ingredients used to make the 12-ounce organic beverage. Be prepared to report the cost for the ingredients.

Inexpensive Chocolate Milk

Your team is challenged with the task of creating new inexpensive chocolate milk beverage. The product must be a 12 ounce serving size, and should be made with generic brand milk, which costs \$2.50 per gallon and generic brand chocolate syrup, which costs \$1.75 per 10 ounce bottle. How much will the 12-ounce chocolate milk cost?

Your team must determine how much of the generic brand milk and how much of the generic brand chocolate syrup to use to create the new beverage. Then, calculate the cost of the amount of the ingredients used to make the 12-ounce beverage. Be prepared to report the cost for the ingredients.

Gourmet Chocolate Milk

Your team is challenged with the task of creating new gourmet chocolate milk beverage. The product must be a 12 ounce serving size, and should be made with whole milk, which costs \$3.75 per gallon and gourmet milk chocolate syrup, which costs \$8.00 per 5 ounce bottle. How much will the 12-ounce chocolate milk cost?

Your team must determine how much of the whole milk and how much gourmet milk chocolate syrup to use to create the new beverage. Then, calculate the cost of the amount of the ingredients used to make the 12-ounce beverage. Be prepared to report the cost for the ingredients.

Diet Chocolate Milk

Your team is challenged with the task of creating new diet chocolate milk beverage. The product must be a 12 ounce serving size, and should be made with fat free milk, which costs \$3.00 per gallon and sugar free chocolate syrup, which costs \$3.00 per 10 ounce bottle. How much will the 12-ounce chocolate milk cost?

Your team must determine how much of the fat free milk and how much sugar free chocolate syrup to use to create the new beverage. Then, calculate the cost of the amount of the ingredients used to make the 12-ounce beverage. Be prepared to report the cost for the ingredients.

Soy Chocolate Milk

Your team is challenged with the task of creating new soy chocolate milk beverage. The product must be a 12 ounce serving size, and should be made with soy milk, which costs \$4.25 per gallon and regular chocolate syrup, which costs \$2.50 per 20 ounce bottle. How much will the 12-ounce chocolate milk cost?

Your team must determine how much of the soy milk and how much regular chocolate syrup to use to create the new beverage. Then, calculate the cost of the amount of the ingredients used to make the 12-ounce beverage. Be prepared to report the cost for the ingredients.

Gummy Candy Background Information

Adapted from Gourmet Lab: The Scientific Principles Behind your Favorite Foods by Sarah Reeves Young (2011)

When you walk into a candy store you see lollipops, chocolate bars, peppermints, and demineralized bone. Wait, what? That is correct; between the taffy and licorice you can find a variety of candies that contain gelatin. Gelatin, a product most often associated with JELL-O, is made from animal products that contain collagen. Gelatin can be obtained from pigskin, cow bones, and connective tissues, and can be used in the creation of everything from strawberry jelly to your favorite gummy creatures.

So how does animal skin end up in your favorite gummy worm? Gelatin is obtained from the breakdown of collagen proteins. The proteins exist

in large helical structures kind of like jump ropes that have been braided together. When the gelatin is heated, these ropes break down, allowing water to seep in between them. As they cool, they reform the braid, trapping the water between the proteins. This is what allows the gummy worms to be squishy and chewy. These proteins, when combined with water, have a melting temperature that is below normal body temperature (less than 35°C). This allows gelatin candies such as gummy worms to go from solid to liquid when placed in your mouth. Other thickening chemicals that come from plants such as starch or pectin do not have the melt-in-your-mouth properties of gelatin.

Calculating Nutrition Information

Download: Appendix 17 Calculating Nutrition Information and open in Microsoft PowerPoint

Example: How to calculate nutrition information

Step 1: Identify the ingredients in your recipe and the serving size of your recipe

- You are making peanut butter cups with shredded coconut
- The recipe makes 30 peanut butter cups
 - 2 cups of milk chocolate chips
 - 2 tablespoons of shortening
 - ½ cup butter
 - ½ cup crunchy peanut butter
 - 1 cup confectioner’s sugar
 - 1 cup of shredded coconut

Step 2: Calculate the nutrition per serving of chocolate chips

- For 2 cups of chocolate chips, this bag of chocolate contains:

- A serving is 1 cup
 - 210 Calories
 - 8g fat
 - 30 mg cholesterol
 - 27 g carbohydrates
 - 1 g fiber
 - 25 g sugar
 - 9 g protein

Nutrition Facts	
Serving Size 1 cup (249g)	
Servings Per Container 8	
Amount Per Serving	
Calories 210	Calories from Fat 80
% Daily Value*	
Total Fat 8g	13%
Saturated Fat 5g	28%
Trans Fat 0g	
Cholesterol 30mg	10%
Sodium 200mg	9%
Total Carbohydrate 27g	9%
Dietary Fiber 1g	5%
Sugars 25g	
Protein 9g	
Vitamin A 6%	Vitamin C 0%
Calcium 30%	Iron 6%
Vitamin D 30%	

*Percent Daily Values are based on a diet of 2,000 calories.

Step 3: Calculate the nutrition per serving of chocolate chips

- To determine the calories for the chocolate chips in the new peanut butter cup recipe, multiply the number of calories for one serving of chocolate by the amount needed in the recipe:

210 Calories (per cup) x 2 (2 cups needed for the recipe) = 420 calories for 2 cups of chocolate chips

Step 4: Repeat this procedure each of the following nutrients for each ingredient:

- Calories
- Fat
- Cholesterol
- Carbohydrates
- Fiber
- Sugar
- Protein

Step 5: Determine the final nutrition information

- To do this, add the total of each nutrient for each ingredient. For example:
 - Total Calories for 2 cups of chocolate chips = **420**
 - Total Calories for 2 tablespoons shortening = **60**
 - Total Calories for ½ cup butter = **80**
 - Total Calories for ½ cup crunchy peanut butter = **200**
 - Total Calories for 1 cup confectioner’s sugar = **60**
 - Total Calories for 1 cup of shredded coconut = **170**
 - **420+60+80+200+60+170 = 990** total Calories

Nutrition Facts Panel

Nutrition Facts	
Serving Size	
Servings Per Container	
<hr/>	
Amount Per Serving	
<hr/>	
Calories	
<hr/>	
<hr/>	
Total Fat	
<hr/>	
Cholesterol	
<hr/>	
Sodium	
<hr/>	
Total Carbohydrate	
<hr/>	
Dietary Fiber	
<hr/>	
Sugars	
<hr/>	
Protein	
<hr/>	



Candy Prototype Rubric

Team _____ Date _____ Class Period _____

Total Points for Project _____ /100

PACKAGE (40 POINTS)	
• Product name is prominently displayed on the package (0-5 points)	
• A logo is displayed on the package (0-5 points)	
• The logo clearly identifies the product (0-5 points)	
• Includes a nutrient claim (0-5 points)	
• The target market is clearly identifiable by the package (0-5 points)	
• Nutrition label is complete and on the package (0-5 points)	
• Price is clearly listed on the package (0-5 points)	
• Package design is creative, neatly organized, and appropriate for the product (0-5 points)	
Package Total	
COMMERCIAL (40 POINTS)	
• 30-seconds or less (0-5 points)	
• The purpose is clear and concise (0-5 points)	
• Explains the product by including the name, logo, and a description (0-5 points)	
• Clearly addresses the target market (0-5 points)	
• Includes a shot of the product package (0-5 points)	
• Script is organized and had a nice flow (0-5 points)	
• Commercial is creative and engaging (0-5 points)	
• Includes music and special effects/editing (0-5 points)	
Commercial Total	
FINAL PRESENTATION (20 POINTS)	
• Candy prototype was prepared properly (e.g., no burnt sugar or chocolate, followed recipe, etc.) (0-10 points)	
• Team was able to explain: <ul style="list-style-type: none"> › Why they decided to create their product › Why they selected the target market › How they came to the decision about which food claim to use and what ingredient to add/change (new product strategy) (0-10 points) 	
Final Presentation Total	

Self-Reflection on Project Work

Think about what you did in this project and how well the project went. Write your comments in the right column.

Student Name:	
Project Name:	
Driving Question:	
List the major steps of the project:	
ABOUT YOURSELF:	
What is the most important thing you learned in this project:	
What do you wish you had spent more time on or done differently:	
What part of the project did you do your best work on:	
ABOUT THE PROJECT:	
What was the most enjoyable part of this project:	
What was the least enjoyable part of this project:	
How could your teacher(s) change this project to make it better next time:	



Collaboration Rubric

	BELOW STANDARD	APPROACHING STANDARD	AT STANDARD	ABOVE STANDARD
RESPONSIBILITY FOR ONESELF	<ul style="list-style-type: none"> is not prepared and ready to work with the team does not do project tasks does not complete tasks on time does not use feedback from others to improve his/her work 	<ul style="list-style-type: none"> is sometimes prepared and ready to work with the team does some project tasks, but needs to be reminded competes some tasks on time sometimes uses feedback from others 	<ul style="list-style-type: none"> is prepared and ready to work with the team; is available for meetings and uses the team's communication system does what he or she is supposed to do without having to be reminded completes tasks on time uses feedback from others to improve his or her work 	<p><i>In addition to At Standard criteria:</i></p> <ul style="list-style-type: none"> does more than what he or she has to do asks for additional feedback to improve his or her work, beyond what everyone has been given
HELPING THE TEAM	<ul style="list-style-type: none"> does not help the team solve problems; may cause problems does not share ideas with other team members does not give useful feedback to others does not offer to help others 	<ul style="list-style-type: none"> cooperates with the team but does not actively help it makes some effort to share ideas with the team sometimes gives useful feedback to others sometimes offers to help others 	<ul style="list-style-type: none"> helps the team solve problems, manage conflicts, and stay focused and organized shares ideas that help the team improve its work gives useful feedback (specific and supportive) to others so they can improve their work offers to help others do their work if they need it 	<p><i>In addition to At Standard criteria:</i></p> <ul style="list-style-type: none"> steps in to help the team when another member is absent encourages others to share ideas, helps to make them clear, and connects them to the team's work notices if a team member does not understand something and takes action to help
RESPECT FOR OTHERS	<ul style="list-style-type: none"> does not pay attention to what teammates are talking about does not show respect for teammates (may interrupt, ignore ideas, hurt feelings) 	<ul style="list-style-type: none"> usually listens to teammates, but not always is polite and kind to teammates most of the time, but not always 	<ul style="list-style-type: none"> listens carefully to teammates is polite and kind to teammates 	<p><i>In addition to At Standard criteria:</i></p> <ul style="list-style-type: none"> encourages the team to be respectful to each other recognizes everyone's strengths and encourages the team to use them

Project Presentation Audience Feedback

Student Team _____

Project Name _____ Date _____

Thank you for attending our project presentations and taking the time to write thoughtful answers to the following questions:

1. What did you learn from this presentation, or what did it make you think about?

2. What did you like about this presentation?

3. Do you have any questions about the topic or about how the project was done?

4. Any other comments about this presentation?