

Chemical Processes in Food Science

Media Type: Video
Duration: 29 minutes

Goal: For students to be able to discuss the role and different processes in fermentation, leavening, retrogradation, syneresis and gelatinization in the food industry.

Description: Cooking is all about chemistry and is nothing more than a series of chemical reactions. This presentation explains the “science” involved in cooking and food preparation. The fermentation process, caramelization, leavening, gelatinization, retrogradation and syneresis are explored, as well as discussing the role starch plays in the cooking process.

Objectives:

1. To explain fermentation, leavening, retrogradation, syneresis, gelatinization and gelation.
2. To discuss the role of fermentation, leavening, retrogradation, syneresis and gelatinization in the food industry.
3. To compare pickling methods.
4. To describe the vinegar making process and bread making process.
5. To demonstrate food production processes while making pickles, sauerkraut, bread, quick breads, meringue and sauerkraut.



College & Career Readiness Anchor Standards for Writing

Writing Standards	
Text Types & Purposes	Write informative/explanatory texts to examine and convey complex ideas and information clearly and accurately through the effective selection, organization, and analysis of content.
	<i>9-10.2</i> Write informative/explanatory texts to examine and convey complex ideas, concepts, and information clearly and accurately through the effective selection, organization, and analysis of content.
	<i>11-12.2</i> Write informative/explanatory texts to examine and convey complex ideas, concepts, and information clearly and accurately through the effective selection, organization, and analysis of content.
Research to Build & Present Knowledge	Conduct short as well as more sustained research projects based on focused questions, demonstrating understanding of the subject under investigation.
	Gather relevant information from multiple print and digital sources, assess the credibility and accuracy of each source, and integrate the information while avoiding plagiarism.
	<i>9-12.7</i> Conduct short as well as more sustained research projects to answer a question or solve a problem; narrow or broaden the inquiry when appropriate; synthesize multiple sources on the subject, demonstrating understanding of the subject under investigation.
	<i>9-10.8</i> Gather relevant information from multiple authoritative print and digital sources, using advanced searches effectively; assess the usefulness of each source in answering the research question; integrate information into the text selectively to maintain the flow of ideas, avoiding plagiarism and following a standard format for citation.

Chemical Processes in Food Science



College & Career Readiness Anchor Standards for Speaking and Listening

Speaking & Listening Standards	
Comprehension & Collaboration	Integrate and evaluate information presented in diverse media and formats, including visually, quantitatively, and orally.
	<i>9-10.2</i> Integrate multiple sources of information presented in diverse media or formats evaluating the credibility and accuracy of each source.
	<i>11-12.2</i> Integrate multiple sources of information presented in diverse formats and media in order to make informed decisions and solve problems, evaluating the credibility and accuracy of each source and noting any discrepancies among the data.
Presentation of Knowledge & Ideas	Present information, findings, and supporting evidence such that listeners can follow the line of reasoning and the organization, development, and style are appropriate to task, purpose, and audience.
	Make strategic use of digital media and visual displays of data to express information and enhance understanding of presentations.
	<i>9-10.4</i> Present information, findings, and supporting evidence clearly, concisely, and logically such that listeners can follow the line of reasoning and the organization, development, substance, and style are appropriate to purpose, audience, and task.
	<i>9-12.5</i> Make strategic use of digital media in presentations to enhance understanding of findings, reasoning, and evidence and to add interest.
	<i>11-12.4</i> Present information, findings, and supporting evidence, conveying a clear and distinct perspective, such that listeners can follow the line of reasoning, alternative or opposing perspectives are addressed, and the organization, development, substance, and style are appropriate to purpose, audience, and a range of formal and informal tasks.

Agriculture, Food & Natural Resources Career Cluster (AG)

Cluster	Standard
Food Products & Processing Systems Career Pathway (AG-FD)	Apply principles of nutrition, biology, microbiology, chemistry and human behavior to the development of food products.
	Explain the scope of the food industry and the historical and current developments of food products and processing.

Science, Technology, Engineering & Mathematics Career Cluster (ST)

Cluster	Standard
Engineering & Technology Career Pathway (ST-ET)	Apply engineering skills in a project that requires project management, process control and quality assurance.
	Use technology to acquire, manipulate, analyze and report data.
	Describe and follow safety, health and environmental standards related to science, technology, engineering and mathematics (STEM) workplaces.
	Display and communicate STEM information.
	Apply processes and concepts for the use of technological tools in STEM.
Use STEM concepts and processes to solve problems involving design and/or production.	

Chemical Processes in Food Science



Lesson Plan

Class 1: Begin the class by handing out the *Chemical Processes in Food Science Worksheet*, *Vocabulary Handout* and *Student Handouts*. Distribute the *Types of Leavening Student Handout*. Show the *Chemical Processes in Food Science (Part 1)* and *(Part 2)*. Give the instructions of the *Fermentation Activity* and have the students complete.



Video
12 min.

Class 2: Show the *Chemical Processes in Food Science (Part 3)* and *(Part 4)*. Remind the students to use the *Worksheet* and *Vocabulary Handout* as a reference. Instruct the students to complete the *Leavening Activity* and the *Caramelization Activity*. Distribute the *Batter vs. Dough Activity* for students to complete as homework.



Video
6 min.

Class 3: Show the *Chemical Processes in Food Science (Part 5)*, *(Part 6)* and *(Part 7)*. Instruct the student to complete the *Retrogradation Activity*.



Video
7 min.

Class 4: Show the *Chemical Processes in Food Science (Part 8)* as a review. Hand out the *Chemical Processes in Food Science Crossword* for the students to complete. Administer the *Chemical Processes in Food Science Assessment*. Give instructions for one of the following: *Food Show Project*, *Starch Molecules Project* or *Culinary Careers Project*.



Video
4 min.

Class 5: Allow students to work on their projects.

Class 6: Students should complete the *Project*.



Lesson Links

**United States Department of Agriculture—
Agriculture Research Service**

- <http://www.ars.usda.gov>

Food-Info

- <http://www.food-info.net>



Career & Technical Student Organizations

FCCLA

- Culinary Arts
- Food Innovations

FFA

- Agricultural Communications
- Prepared Pubic Speaking
- Food Science and Technology



Career Connections

Using the *Career Connections Activity*, allow students to explore the various careers associated with this lesson. See the *Activity* for more details. *If student licenses have been purchased:* Students will select the interviews to watch based on your directions. *If only a teacher license is purchased:* Show students all the career interviews and instruct them to only complete the interview form for the required number of interviews.

- iCEV50100 Mindy Brashears, Ph.D. Professor & Food Scientist, Department of Animal & Food Sciences, Texas Tech University
- iCEV50064, Shalene McNeill, Ph.D., R.D., Executive Director, Human Nutrition Research, National Cattlemen's Beef Association.
- iCEV50538, Kerri Mikulik, Academic Advisor, Nutrition & Food Science, Texas A&M University

Additional Instructional Strategy

- *Fermentation Balloons Activity* - *Can be found in Fermentation Balloons Activity and Answer Key*

Recipes

- Bread & Butter Pickles
- Chocolate Pie
- Hot Rolls
- Polish Brined Dill Pickles
- Vinegar

Chemical Processes in Food Science



Lab Activities

Fermentation

Directions:

The students will research and find a recipe for vinegar, brine pickles or fresh-pack pickles. They will then create a drawing, chart or other visual presentation to show the steps of the recipe. Next to each step, the student should include the ways fermentation is occurring or how the step will facilitate the fermentation process.

Leavening

Directions:

The students will view the leavening process while baking rolls or a quick bread. While the student is viewing the leavening process they should take notes so they can create a presentation illustrating the process.

Batter vs. Dough

Directions:

Students will complete the Venn Diagram by comparing and contrasting the chemical characteristics of batter and dough.

Caramelization

Directions:

The students will caramelize either sugar or onions by placing the food product in a skillet on the stove. The students should use a stopwatch to time how long the total caramelization process takes, as well as record when the first browning occurs and the time from first browning to complete caramelization.

Retrogradation

Directions:

The students will view the retrogradation process by comparing loaves of bread in different storage environments and recording their findings on a poster with a picture of each storage type next to each set of findings.



Projects

Food Show

Directions:

The students will research one of the chemical processes discussed in the presentation and find a food which is an example of this process. The student will then prepare the food and give a two to three minute explanation of how they made the food and the chemical process they chose.

Starch Molecules

Directions:

The students will create a 3-D representation of the structure of amylose and amylopectin using different types of candy and toothpicks. The structures for the starches can be found on the presentation or by researching the structure using the Internet.

Culinary Careers

Directions:

The students will conduct research to find at least ten careers in the culinary industry. Next, the student will choose two careers and compose a job description for each.