

**Minnesota Department of Education**  
**Academic Standards Course Framework**  
**Food Science**

***Program: 090101***

***Program Name: Food and Food Industries***

***Course Code: 21, 22***

*Food Science* is a course that provides students with opportunities to participate in a variety of activities including laboratory work. This is a standards-based, interdisciplinary science course that integrates biology, chemistry, and microbiology in the context of foods and the global food industry. Students enrolled in this course formulate, design, and carry out food-base laboratory and field investigations as an essential course component. Students understand how biology, chemistry, and physics principles apply to the composition of foods, the nutrition of foods, food and food product development, food processing, food safety and sanitation, food packaging, and food storage. Students completing this course will be able to apply the principles of scientific inquiry to solve problems related to biology, physics, and chemistry in the context of highly advanced industry applications of foods.

**Recommended Prerequisites:** Fundamentals of Food Preparation, Nutrition and Wellness

**Application of Content and Multiple Hour Offerings**

Intensive laboratory applications are a component of this course and may be either school based or work based or a combination of the two. Work-based learning experiences should be in a closely related industry setting. Instructors shall have a standards-based training plan for students participating in work-based learning experiences. When a course is offered for multiple hours per semester, the amount of laboratory application or work-based learning needs to be increased proportionally.

**Career and Technical Student Organizations**

Career and Technical Student Organizations (CTSO) are considered a powerful instructional tool when integrated into Career and Technical Education programs. They enhance the knowledge and skills students learn in a course by allowing a student to participate in a unique program of career and leadership development. Students should be encouraged to participate in Family, Career and Community Leaders of America (FCCLA), the CTSO for this area.

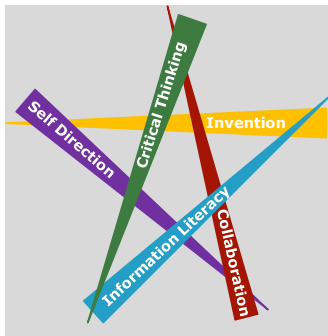
**FOOD SCIENCE**



**Student Leadership Opportunities**

- STAR Event Nutrition and Wellness
  - STAR Event Sports Nutrition
  - STAR Event National Programs in Action (Student Body)
  - STAR Event Illustrated Talk
- For additional information [visit FCCLA website.](#)

**21st Century Skills should be an integral part of all courses being taught. These soft skills are the foundation for all Career and Technical Education.**



- Critical Thinking and Reasoning:** *Thinking Deeply, Thinking Differently*
- Information Literacy:** *Untangling the Web*
- Collaboration:** *Working Together, Learning Together*
- Self-Direction:** *Own Your Learning*
- Invention:** *Creating Solutions*

**Document Key Words:**

Description	Acronym
Family and Consumer Sciences	FACS
Minnesota Food Science	MFS
Science, Technology, Engineering, and Math	STEM
Science, Technology, Engineering, Art, and Math	STEAM
Family, Career, and Community Leaders of America	FCCLA

## FOOD SCIENCE



### Possible Course Titles

Advanced Foods  
Experimentation with Food  
Food Science  
How Food Works



### STEM/STEAM Connections

Food Chemistry  
Food Engineering  
Food, Health and Nutrition  
Food Microbiology  
Food Processing and Packaging  
Food Product Development  
Food Safety and Defense  
Food Sensory  
Sustainability  
Policy and Regulations



### Career Pathways

**Career Field:** Agriculture, Food, and Natural Resources > **Career Cluster:** > Agriculture, Food, and Natural Resources > **Career Pathway:** Food Products and Processing Systems

**Career Field:** Health Science Technology > **Career Cluster:** Health Science > **Career Pathways:** Biotechnology Research and Development, Diagnostic Services, Support Services, Health Informatics, Therapeutic Services

**FOOD SCIENCE**
**Common Core: College and Career Readiness Anchor Standards in Food Science.**

**These Standards address Technical Skills Assessment (TSA) Rubrics that have been established by teachers attending TSA meetings focusing on our content areas.**

<b>Common Core Standards</b>	<b>Acronym</b>
English Language Arts	ELA
College and Career Readiness Anchor Standards Speaking and Listening	CCRA.SL
College and Career Readiness Anchor Standards Writing	CCRA.W
College and Career Readiness Anchor Standards Reading	CCRA.R
College and Career Readiness Anchor Standards Language	CCRA.L

*Note: Number behind Acronym indicates grade specific*

**Common Core: College and Career Readiness Anchor Standards in Food Science**
**Key Ideas and Details:** [CCSS.ELA-Literacy.CCRA.R.2](#)

Determine central ideas or themes of a text and analyze their development: summarize the key supporting details and ideas (*e.g. discussion of the history of food science and how food science is an integral part of our food production with the use of technology in the development of new food products.*)

**Key Ideas and Details:** [CCSS.ELA-Literacy.CCRA.R.3](#)

Analyze how and why individuals, events, or ideas develop and interact over the course of a text (*e.g. doing food science experiments, new product development.*)

**Craft and Structure:** [CCSS.ELA-Literacy.CCRA.R.4](#)

Interpret words and phrases as they are used in a text, including determining technical, connotative, and figurative meanings, and analyze how specific word choices shape meaning or tone (*e.g. labs that looks at food sensory, food additives, chemistry of food, packaging and labeling of food products.*)

**Comprehension and Collaboration:** [CCSS.ELA-Literacy.CCRA.SL.1](#)

Prepare for and participate effectively in a range of conversations and collaborations with diverse partners, building on others' ideas and expressing their own clearly and persuasively (*e.g. Lab and project planning.*)

**Comprehension and Collaboration:** [CCSS.ELA-Literacy.CCRA.SL.2](#)

Integrate and evaluate information presented in diverse media and formats, including visually, quantitatively, and orally (*e.g. search for recipes, food products, planning of food preparation and presentation of food and food research.*)

**Presentation of Knowledge and Ideas:** [CCSS.ELA-Literacy.CCRA.SL.4](#)

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 (*e.g. lab tasks, scientific inquiry with food preparation, collaboration in organization of lab procedures.*)

**Presentation of Knowledge and Ideas:** [CCSS.ELA-Literacy.CCRA.SL.6](#)

Adapt speech to a variety of contexts and communicative tasks, demonstrating command of formal English when indicated or appropriate (*e.g. context of food science in food experiments determining the outcome of chemical reactions, how food additives are used to enhance and preserve foods.*)

## FOOD SCIENCE

### Common Core: College and Career Readiness Anchor Standards in Food Science

**Production and Distribution of Writing:** [CCSS.ELA-Literacy.CCRA.W.4](#)

Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience (e.g. *lab tasks, procedures, safety and sanitation in order to prepare safe and healthy foods, scientific exploration of food products, taste testing.*)

**Production and Distribution of Writing:** [CCSS.ELA-Literacy.CCRA.W.5](#)

Develop and strengthen writing as needed by planning, revising, editing, rewriting, or trying a new approach (e.g. *revising or rewriting recipes to accommodate correct amounts of leavening agents to develop a superior product, use of bacteria cultures to produce food products; data collection, record keeping, and observation notes in experiments being conducted.*)

**Production and Distribution of Writing:** [CCSS.ELA-Literacy.CCRA.W.6](#)

Use technology, including the Internet, to produce and publish writing and to interact and collaborate with others (e.g. *use of technology to do research on a nutrition, food product development, food packaging, food science principles, etc.*)

**Range of Writing:** [CCSS.ELA-Literacy.CCRA.W.10](#)

Write routinely over extended time frames (time for research, reflection, and revision) and shorter time frames (a single sitting or a day or two) for a range of tasks, purposes, and audiences (e.g. *use of data from food experiments to create a new product, making revisions when necessary.*)

**Craft and Structure:** [CCSS.ELA-Literacy.CCRA.R.4](#)

Interpret words and phrases as they are used in a text, including determining technical, connotative, and figurative meanings, and analyze how specific word choices shape meaning or tone (e.g. *measurement which is key in any food experiment or development, recipe interpretation, cooking terms, nutritional choices.*)

**Integration of Knowledge and Ideas:** [CCSS.ELA-Literacy.CCRA.R.7](#)

Integrate and evaluate content presented in diverse media and formats, including visually and quantitatively, as well as in words (e.g. *use of websites such as Institute of Food Technology (IFT) or USDA, large food companies, such as ConAgra, General Mills.*)

**Range of Reading and Level of Text Complexity:** [CCSS.ELA-Literacy.CCRA.R.10](#)

Read and comprehend complex literary and informational texts independently and proficiently (e.g. *students' ability to read recipes follows directions, know the complexity of food preparation terms, and produce a finished food product. Understanding how certain chemical reactions change the taste and texture of a food item.*)

**Vocabulary Acquisition and Use:** [CCSS.ELA-Literacy.CCRA.L.4](#)

Determine or clarify the meaning of unknown and multiple-meaning words and phrases by using context clues, analyzing meaningful word parts, and consulting general and specialized reference materials, as appropriate (e.g. *using multiple media sources to access cooking terms and their correct method of implementation when creating a new food product or discovering why certain chemical reactions happen.*)

**Vocabulary Acquisition and Use:** [CCSS.ELA-Literacy.CCRA.L.5](#)

Demonstrate understanding of figurative language, word relationships, and nuances in word meanings (e.g. *Development of new food product.*)

**Vocabulary Acquisition and Use:** [CCSS.ELA-Literacy.CCRA.L.6](#)

Acquire and use accurately a range of general academic and domain-specific words and phrases sufficient for reading, writing, speaking, and listening at the college and career readiness level; demonstrate independence in gathering vocabulary knowledge when encountering an unknown term important to comprehension or expression (e.g. *career exploration of food industry and related jobs within our food systems. Comprehension of words that explain the principles behind food science and chemical reactions.*)

**FOOD SCIENCE**
**Topic: History of Food Science**

**Minnesota Framework:** 1.0 Analyze the development of food science principles and discoveries throughout history

**National Standard Correlation:** 9.1 Analyze career paths within food science, food technology, dietetics, and nutrition industries.

National Standard Correlation	Minnesota Framework/ Standard	Benchmarks/Competencies
9.1.1	MFS 1.1	Define food science and food technology.
9.1.1	MFS 1.2	Summarize how the food science industry has changed over time.
9.1.1	MFS 1.3	Evaluate how previous discoveries have influenced current food science advancements.

**Topic: Food Science Principles**

**Minnesota Framework:** 2.0 Demonstrate food science principles using mathematical reasoning and chemistry.

**National Standard Correlation:** 9.6 Demonstrate food science, dietetics, and nutrition management principles and practices.

**STEM/STEAM Standard:** 9.1.2.1 Engineering is a way of addressing human needs by applying science concepts and mathematical techniques to develop new products, tools, processes and systems. (i.e., candy making-crystallization, yogurt-probiotics, GMO's – genetically modified foods)

National Standard Correlation	Minnesota Framework/ Standard	Benchmarks/Competencies
9.6.3	MFS 2.1	Summarize measurement and mathematical skills used for recipe and product development.
9.6.3	MFS 2.2	Define the scientific method and apply to food science related experiment.
9.6.3	MFS 2.3	Model a chemical reaction within the production of a food item.

**Topic: Food Safety and Sanitation**

**Minnesota Framework:** 3.0 Apply risk management procedures to food safety, food testing, and sanitation.

**National Standard Correlation:** 9.2 Apply risk management procedures to food safety, food testing, and sanitation.

**STEM/STEAM Standard:** 9.4.4.2 Personal and community health can be affected by the environment, body functions and human behavior (i.e. *wellness is impacted by our food handling techniques when preparing food.*)

National Standard Correlation	Minnesota Framework/ Standard	Benchmarks/Competencies
9.2.1	MFS 3.1	Identify the factors that contribute to food borne illness.
9.2.2	MFS 3.2	Analyze food service safety and sanitation procedures.
9.2.4	MFS 3.3	Utilize Hazard Analysis Critical Control Point (HACCP) to minimize the risk of food borne illness before, during, and after food production.

## FOOD SCIENCE

### Topic: Food Chemistry

**Minnesota Frameworks:** 4.0 Evaluate chemical processes through food production.

**National Standard Correlation:** 9.6 Demonstrate food science, dietetics, and nutrition management principles and practices.

**STEM/STEAM Standard:** 9.1.3.1 Natural and designed systems are made up of components that act within a system and interact with other systems.

9.1.1.2 Scientific inquiry uses multiple interrelated processes to investigate and explain the natural world.

National Standard Correlation	Minnesota Framework/ Standard	Benchmarks/Competencies
9.6.2	MFS 4.1	Define food chemistry and how it is applied to the world food supply.
9.6.2	MFS 4.2	Predict various chemical reactions that may occur during food production.
9.6.2	MFS 4.3	Analyze the roles of elements, compounds, and mixtures during food production.
9.6.2	MFS 4.4	Compare and contrast the chemical composition of emulsions, foams, gels, and viscosity as used in food production.

### Topic: Food Additives

**Minnesota Frameworks:** 5.0 Assess the effects the food additives have on our daily lives.

**National Standard Correlation:** 9.3 Evaluate nutrition principles, food plans, preparation techniques and specialized dietary plans.

9.5 Demonstrate use of current technology in food product development and marketing.

**STEM/STEAM Standard:** 9.1.1.2 Scientific inquiry uses multiple interrelated processes to investigate and explain the natural world.

National Standard Correlation	Minnesota Framework/ Standard	Benchmarks/Competencies
9.3.2	MFS 5.1	Analyze the nutritional data of various food products to identify additives.
9.3.6	MFS 5.2	Critique the selection of foods to promote a healthy lifestyle.
9.3.6	MFS 5.3	Investigate the differences between artificial and natural food flavors.
9.3.6	MFS 5.4	Identify commonly used artificial flavors.
9.5.1	MFS 5.5	Distinguish the various factors that affect food preferences in food selection.

### Topic: Sensory Evaluation

**Minnesota Standard:** 6.0 Analyze the effectiveness of sensory evaluations in food productions.

**National Standard Correlation:** 9.5 Demonstrate use of current technology in food product development and marketing.

**STEM/STEAM Standard:** 9.1.3.3 Science and engineering operate in the context of society and both influence and are influenced by this context.

**FOOD SCIENCE**

National Standard Correlation	Minnesota Framework/ Standard	Benchmarks/Competencies
9.5.6	MFS 6.1	Describe the sensory analysis process in food development.
9.5.7	MFS 6.2	Analyze the importance of sensory testing for safety and marketability of food products.
9.5.6	MFS 6.3	Create a sensory test to be conducted in a laboratory setting.

**Topic: Packaging and Preservation**

**Minnesota Frameworks:** 7.0 Evaluate the importance of industry standards within food packaging and preservation.

**National Standard Correlation:** 9.5 Demonstrate use of current technology in food product development and marketing.

**STEM/STEAM Standard:** 9.1.1.2 Scientific inquiry uses multiple interrelated processes to investigate and explain the natural world.

National Standard Correlation	Minnesota Framework/ Standard	Benchmarks/Competencies
9.5.1	MFS 7.1	Identify the methods of food preservation.
9.5.1	MFS 7.2	Investigate a method and product to keep food items fresher longer.
9.5.1	MFS 7.3	Describe how irradiation works and how to handle foods that have been irradiated.
9.5.1	MFS 7.4	Explain how to safely freeze foods, the length of time to be frozen, and how to safely thaw foods.
9.5.1	MFS 7.6	Explain how foods can be preserved by vacuum packing and how it changes their shelf life.
9.5.1	MFS 7.7	Describe various drying processes, food nutrient values, and how you package and store dried foods.
9.5.1	MFS 7.8	Apply food preservation knowledge to store and package food safely.

**Topic: Food Science Careers Industry and Manufacturing**

**Minnesota Frameworks:** 8.0 Investigate career paths that correlate with food science, production and manufacturing.

**National Standard Correlation:** 9.1 Analyze career paths within food science, food technology, dietetics, and nutrition industries.

**STEM/STEAM Standard:** 9.1.2.1 Engineering is a way of addressing human needs by applying science concepts and mathematical techniques to develop new products, tools, processes and systems.

National Standard Correlation	Minnesota Framework/ Standard	Benchmarks/Competencies
9.1.1	MFS 8.1	Identify careers in the food science and technology industry.
9.1.1	MFS 8.2	Investigate the roles and functions of careers in the food science industry.
9.1.4	MFS 8.3	Analyze the impact that food science industries have on local, state, and national economies ( <i>i.e. General Mills, Hormel, Schwan's, Jenni-O, Land O' Lakes, Cargill, Con Agra.</i> )
9.1.5	MFS 8.4	Create a portfolio to assist with searching and applying for food science and technology related careers.