

# Food Science and Safety

<b>Primary Career Cluster:</b>	Agriculture, Food, & Natural Resources
<b>Consultant:</b>	<a href="mailto:CTE.Standards@tn.gov">CTE.Standards@tn.gov</a>
<b>Course Code(s):</b>	C18H26
<b>Prerequisite(s):</b>	<i>Principles of Food Production</i> (C18H29)
<b>Credit:</b>	1
<b>Grade Level:</b>	11
<b>Elective Focus - Graduation Requirements:</b>	This course satisfies one of three credits required for an elective focus when taken in conjunction with other Agriculture, Food, & Natural Resources courses. In addition, this course satisfies one lab science credit requirement for graduation.
<b>POS Concentrator</b>	This course satisfies one out of two required courses to meet the Perkins V concentrator definition, when taken in sequence in the approved program of study.
<b>Programs of Study and Sequence:</b>	This is the third course in the <i>Food Science</i> program of study.
<b>Aligned Student Organization(s):</b>	FFA: <a href="http://www.tnffa.org">http://www.tnffa.org</a>
<b>Coordinating Work-Based Learning:</b>	All Agriculture students are encouraged to participate in a Supervised Agricultural Experience (SAE) program. In addition, teachers who hold an active WBL certificate may offer placement for credit when the requirements of the state board's WBL Framework and the Department's WBL Policy Guide are met. For information, visit <a href="https://www.tn.gov/content/tn/education/career-and-technical-education/work-based-learning.html">https://www.tn.gov/content/tn/education/career-and-technical-education/work-based-learning.html</a> .
<b>Promoted Tennessee Student Industry Credentials:</b>	Credentials are aligned with postsecondary and employment opportunities and with the competencies and skills that students acquire through their selected program of study. For a listing of promoted student industry credentials, visit <a href="https://www.tn.gov/education/career-and-technical-education/student-industry-certification.html">https://www.tn.gov/education/career-and-technical-education/student-industry-certification.html</a>
<b>Teacher Endorsement(s):</b>	048, 150, 448, and 950
<b>Required Teacher Certifications/Training:</b>	None
<b>Teacher Resources:</b>	<a href="https://www.tn.gov/education/career-and-technical-education/career-clusters/cte-cluster-agriculture-food-natural-resources.html">https://www.tn.gov/education/career-and-technical-education/career-clusters/cte-cluster-agriculture-food-natural-resources.html</a> Best for All Central: <a href="https://bestforall.tnedu.gov/">https://bestforall.tnedu.gov/</a>

## Course at a Glance

CTE courses provide students with an opportunity to develop specific academic, technical, and 21st century skills necessary to be successful in career and in life. In pursuit of ensuring every student in Tennessee achieves this level of success, we begin with rigorous course standards which feed into intentionally designed programs of study.

Students engage in industry relevant content through general education integration and experiences such as career & technical student organizations (CTSO) and work-based learning (WBL). Through these experiences, students are immersed with industry standard content and technology, solve industry-based problems, meaningfully interact with industry professionals and use/produce industry specific, informational texts.

### Using a Career and Technical Student Organization (CTSO) in Your Classroom

CTSOs are a great resource to put classroom learning into real-life experiences for your students through classroom, regional, state, and national competitions, and leadership opportunities. Below are CTSO connections for this course, note this is not an exhaustive list.

- Participate in CTSO Fall Leadership Conference to engage with peers by demonstrating logical thought processes and developing industry specific skills that involve teamwork and project management.
- Participate in FFA career and leadership events (CDE/LDE) that align with this course including Agriscience Fair, Agricultural Issues, Meats Evaluation and Technology, and Milk Quality and Products

### Using Work-based Learning (WBL) in Your Classroom (Need to update)

Sustained and coordinated activities that relate to the course content are the key to successful work-based learning. Possible activities for this course include the following. This is not an exhaustive list.

- **Standards 1.1-1.4** | Visit a food production facility and have at least one of the manager's talking points include safety in the workplace.
- **Standards 2.1-2.3 and 5.1-5.3** | Have the students work with a food scientist on a real project.
- **Standards 3.1-3.2 and 6.1-7.3** | Have the students work on a real project that is evaluated by a food microbiologist.

## Course Description

*Food Science and Safety* is an applied-knowledge course designed for students interested in careers in food science. The course covers fundamental principles of food science, food safety and sanitation, foodborne pathogens, and food-related standards and regulations. Upon completion of this course, students will be versed in the technical knowledge and skills necessary for further education and careers in food science.

## Course Standards

### 1. Introduction to Food Science Industry and Careers

- 1.1 Economic Impact: Investigate the food processing industry and describe its scope and economic importance in the United States, including imports and exports. Describe how the study of food science and related sciences impacts the quality of life and enhances a Supervised Agricultural Experience (SAE) program.
- 1.2 Occupational Opportunities: Investigate the occupational trends and opportunities in food processing and support industries. Compare and contrast the knowledge, skills, and abilities necessary for employment, as well as the typical level of education required.
- 1.3 Food Science Industry Trends: Illustrate **significant trends with regard to supply and demand for processed food products across the world's population** and the degree to which these foods are processed. Identify and summarize common environmental and safety concerns regarding food production and the food supply.
- 1.4 Industry Safety: Review **common laboratory safety procedures** for tool and equipment operation in the food science laboratories, including but not limited to accident prevention and control procedures. Demonstrate the ability to follow safety and operational procedures in a lab setting and complete a safety test with 100 percent accuracy.
- 1.5 Food Processing Safety: Investigate the measures taken to ensure the safety of the foods produced by the food processing industry. Discuss the importance of formal and informal food processing safety training in the industrial environment. Including discussion of standardized training tools such as ServSafe for both food processors and food production retailers.

### 2. Food Chemistry

- 2.1 Physical properties: Differentiate between each food group and compare and contrast their nutritive values. Explain how the **chemical and physical properties of foods influence nutritional value and quality**. Examine the basic principles of proper nutrition, including the identification and evaluation of the six essential nutrients needed for good health.

- 2.2 Basic chemical process: Investigate and apply the **concepts of basic chemical processes and interactions between constituent components of foods**. Through experimentation and observation, identify chemical properties of food that are affected by production, processing, and storage.
- 2.3 Food additives: Identify **common food additives (preservatives, antioxidants, stabilizers, colors, and flavors) and describe their general purposes**. Summarize safety issues associated with food additives, assessing the extent to which the reasoning and evidence provided support their continued use or potential elimination.

### 3. Food Microbiology

- 3.1 Microorganisms: Examine the **role of microorganisms in food products** and evaluate their implications for human consumption.
- 3.2 Fermentation: Research **common microorganisms that cause fermentation, discuss the benefits or dangers of fermentation in food products and processing**. Illustrate fermentation techniques and the foods they are used to create, describing the basic chemical principles of fermentation and the factors that affect the fermentation process.

### 4. Food Preservation

- 4.1 **Basic food preservation**: Describe the **oldest methods of food preservation still in use** today (salting, smoking, drying, fermentation, cooling, and heating). Discuss the degree to which each of these techniques control spoilage and explore limitations to their use.
- 4.2 High technology food preservation: Explore the range of **food preservation techniques developed in the 20<sup>th</sup> and 21<sup>st</sup> centuries** to preserve foods (for example, modified atmosphere storage, irradiation, and chemical preservation). Discuss the advantages and disadvantages of each of these techniques and consumer attitudes toward them.
- 4.3 Food spoilage: Differentiate among the various **microorganisms that cause food spoilage and determine their life cycles**. Compare and contrast the application of food preservation methods to prevent the growth of microbes in food. Outline the processes for heating, refrigerating, and freezing for food preservation.

### 5. Food Safety and Sanitation

- 5.1 Foodborne illness: Identify the types and general **characteristics of microorganisms associated with foodborne illnesses**. Summarize safe food habits and practices by researching proper procedures for safe handling, storage, preparation, and cooking. Compose a checklist of general safety guidelines for different food groups, such as fruits and vegetables, red meat, fish, eggs, or dairy products.

5.2 Sanitation: Describe **procedures and inspection standards for sanitation in the food processing industry**. Demonstrate the ability to follow procedures for appropriate chemical selection, cleaning techniques, and insect and rodent control methods. Identify concepts and principles that provide the scientific foundation for current food sanitation standards.

5.3 Food industry inspection standards: Research principles and applications of the **Hazard Analysis and Critical Control Point (HACCP) system** and describe how they apply to **food safety**. **Interpret food industry inspection standards** to assess conditions related to food safety and sanitation. Create a model HACCP plan including a summary of procedures to control biological, chemical, and physical hazards in food production.

## 6. Food Safety Laws and Regulations

6.1 **Food inspection standards**: Analyze **state and federal laws and regulations governing food inspection standards** and explain their importance to public health. Define the roles of state and government agencies responsible for the establishment and enforcement of food safety regulations. Interpret the regulations governing the “Local Foods for Local Schools” program in Tennessee.

## 7. Food Science Trends and Issues

7.1 Blockchain: Analyze **blockchain processes being used in the food processing industry** from printed and digital credible sources. Describe how blockchain technology revolutionizes the food supply chain with respect to food safety issues.

7.2 Current trends: Research **major development trends in the food processing industry** by analyzing documents authored by for-profit companies and lobbying organizations, defining the question(s) each seeks to address. Compare and contrast the use of advanced technologies in food production, such as but not limited to biotechnology, irradiation, and genetically modified organisms (GMOs), citing specific textual evidence. Summarize technological principles, process effects, and consumer concerns, referencing the extent to which reasoning and evidence presented for each supports specific claims.

7.3 Solving food science issues: Formulate a hypothesis regarding a current food related issue. **Design and conduct an original experiment to prove or disprove the hypothesis**. Collect the appropriate data to evaluate claims, synthesizing and communicating results within the broader context of food science.

## Standards Alignment Notes

References to other standards include:

- SAE: [Supervised Agricultural Experience](#): All Agriculture students are encouraged to participate in a Supervised Agricultural Experience program to practice and demonstrate the knowledge and skills learned in their agriculture courses.
- AFNR: [National Agriculture, Food, & Natural Resources \(AFNR\) Career Cluster Content Standards](#): Students who are engaging in activities outlined above should be able to demonstrate fluency in Standards CR, FPP, and PS at the conclusion of the course.
- P21: Partnership for 21st Century Skills [Framework for 21st Century Learning](#)
  - Note: While not all standards are specifically aligned, teachers will find the framework helpful for setting expectations for student behavior in their classroom and practicing specific career readiness skills.