

PROGRAM CONCENTRATION: Family and Consumer Science
CAREER PATHWAY: Nutrition and Food Science
COURSE TITLE: Food Science

Food science integrates many branches of science and relies on the application of the rapid advances in technology to expand and improve the food supply. Students will evaluate the effects of processing, preparation, and storage on the quality, safety, wholesomeness, and nutritive value of foods. Building on information learned in Nutrition and Wellness and Chemistry, this course illustrates scientific principles in an applied context, exposing students to the wonders of the scientific world. Careers will be explored.

FCS-FS-1. Students will define food science and explore careers in food science.

- a. Define the study of food science and summarize how food products and processing methods have changed in modern history due to contributions of food scientists.
- b. Describe the history of the development of food and food systems emphasizing the transition from hunting and gathering to farming and then to market-based societies.
- c. Analyze how studying food science now can benefit one in the future.
- d. Identify scientific equipment found in the laboratory and how to properly and safely use it.
- e. Evaluate and list careers in food science and list the educational requirements.

ACADEMIC STANDARDS:

SCSh2. Students will use standard safety practices for all classroom laboratory and field investigations.

ELA10RL5. The student understands and acquires new vocabulary and uses it correctly in reading and writing.

ELA11W1. The student produces writing that establishes an appropriate organizational structure, sets a context and engages the reader, maintains a coherent focus throughout and signals a satisfying closure.

NFCS 9.1. Analyze career paths within food science, dietetics, and nutrition industries.

FCS-FS-2. Students will discuss how and why scientific evaluation of foods is conducted.

- a. Identify physical, physicochemical, and chemical techniques used for assessing food quality.
- b. Define sensory evaluation, identify the qualities that make-up the sensory characteristics of food, and explain how taste, aroma and mouth sensations combine to give food their flavor.
- c. Explain what sensory evaluation panels do and conduct a sensory panel using appropriate controls; quantify and analyze the data.

- d. Discuss factors affecting a person's food preference such as physical, psychological, cultural, and environmental influences.
- e. Describe the role of science in the development of new food products and the use of the scientific method.

ACADEMIC STANDARDS:

SCSh1. Students will evaluate the importance of curiosity, honesty, openness and skepticism in science.

SCSh2. Students will use standard safety practices for all classroom laboratory and field investigations.

SCSh3. Students will identify and investigate problems scientifically.

SCSh4. Students will use tools and instruments for observing, measuring and manipulating scientific equipment and materials.

SCSh5. Students will demonstrate the computation and estimation skills necessary for analyzing data and developing reasonable scientific explanation.

NFCS9.3.4. Assess the influence of socioeconomic and psychological factors on food and nutrition behavior.

NFCS9.5.6. Conduct sensory evaluations of food products.

FCS-FS-3. Students will discuss the basic chemistry concepts of food science.

- a. Describe the parts of an atom.
- b. Describe solutions, heterogeneous mixtures, and homogeneous mixtures and explain their similarities and differences.
- c. Define and differentiate between chemical and physical changes in food.
- d. Recognize chemical symbols, formulas, and equations for common elements found in food.
- e. Compare and contrast elements and compounds and explain the difference between ionic and covalent bonds and compounds.

ACADEMIC STANDARDS:

SC1. Students will analyze the nature of matter and its classification.

SC3. Students will use the modern atomic theory to explain the characteristics of atoms.

SC4. Students will use the organization of the periodic table to predict properties of elements.

SC7. Students will characterize the properties that describe solutions and the nature of acids and bases.

SPS1. The student will investigate our current understanding of the atom.

S8P1. Students will examine the scientific view of the nature of matter.

FCS-FS-4. Students will discuss how energy works in food preparation and preservation.

- a. Explain how heat is transferred in the cooking, baking, and thermal preservation processes and demonstrate the methods of boiling, roasting, and microwaving.
- b. Compare the effect of various temperatures on rates of chemical and physical reactions.

ACADEMIC STANDARDS:

SPS7. The student will relate transformations and flow of energy within a system.

S8P2. Students will be familiar with the forms and transformation of energy.

SC5 – Students will understand the rate at which a chemical reaction occurs can be affected by changing concentration, temperature, or pressure and the addition of a catalyst.

ELARL5. The student participates in student-to-teacher, student-to-student and group verbal interactions.

NFCS9.5.5. Implement procedures that affect quality product performance.

FCS-FS-5. Students will discuss why water and pH are important factors in food preparation and preservation.

- a. Explain the properties of water.
- b. Describe and demonstrate the functions of water in food preparation and the influence of water content on the food preparation and storage process.
- c. List the common sources of water and the common contaminants.
- d. Identify the properties of acids and bases; discuss what happens when water ionizes and how ionization relates to the formation of acids and bases.
- e. Describe the pH scale and how it is related to the properties of food, safety, and freshness; demonstrate how to measure pH.

ACADEMIC STANDARDS:

SC7. Students will characterize the properties that describe solutions and the nature of acids and bases.

SPS6 – Students will investigate the properties of solutions.

NFCS 9.6. Demonstrate food science, dietetics, and nutrition management principles and practices.

FCS-FS-6. Students will discuss why carbohydrates are important in food preparation and preservation.

- a. Identify the functions of carbohydrates.
- b. Summarize how carbohydrates are produced through the process of photosynthesis.

- c. Define and identify the functions of simple and complex carbohydrates, define monosaccharides and disaccharides, and identify the role and function of sugars in food products.
- d. Define and identify starches and their role in food preparation.

ACADEMIC STANDARDS:

SB1 – Students will analyze the nature of the relationships between structures and functions in living cells.

SB3 – Students will derive the relationship between single-celled and multi-celled organisms and the increasing complexity of systems.

ELA10RL5. The student understands and acquires new vocabulary and uses it correctly in reading and writing.

ELARL5. The student participates in student-to-teacher, student-to-student and group verbal interactions.

ELA11SV2. The student formulates reasoned judgments about written and oral communication in various media genres. The student delivers focused, coherent and polished presentations that convey a clear and distinct perspective, demonstrate solid reasoning and combine traditional rhetorical strategies of narration, exposition, persuasion and description.

NFCS9.5. Demonstrate use of current technology in food product development and marketing.

FCS-FS-7. Students will discuss why lipids are an important ingredient in food preparation and preservation.

- a. Discuss the functions of fat in food preparation.
- b. Compare the properties of monosaturated fats, polyunsaturated fats, and saturated and unsaturated fatty acids and list the advantages and disadvantages of their use in food preparation.
- c. Examine the functions of lipids in food preparation and analyze the nutritional impact of lipids in the diet.
- d. Define glycerides and phospholipids and list the advantages and disadvantages of their use in food preparation.

ACADEMIC STANDARDS:

ELA10RL5. The student understands and acquires new vocabulary and uses it correctly in reading and writing.

NFCS 9.5.1. Utilize various factors that affect food preferences in the marketing of food.

FCS-FS-8. Students will discuss why proteins are important in food preparation and preservation.

- a. Describe ways in which protein is used in food preparation.
- b. Identify the essential and nonessential amino acids.
- c. Compare and contrast complete and incomplete proteins.
- d. Explain what happens during the denaturation of protein and how the process occurs.
- e. Explain coagulation and apply basic principles of the chemistry of protein to cooking eggs, milk, and meat products and in creating egg foams and meringues.

ACADEMIC STANDARDS:

SB1 – Students will analyze the nature of the relationships between structures and functions of living things.

SC2 – Students will relate how the Law of Conservation of Matter is used to determine chemical composition in compounds and chemical reactions.

ELA10RL5. The student participates in student-to-teacher, student-to-student and group verbal interactions.

ELA11LSV1. The student participates in student-to-teacher, student-to-student and group verbal interactions.

NFCS9.6.2. Implement food preparation, production, and testing systems.

FCS-FS-9: Students will discuss why vitamins, minerals, and phytochemicals are important food components impacted by food preparation and preservation.

- a. List the vitamins and minerals and the eight groups of phytochemicals present in food.
- b. Explain the impact of food preparation, food processing and preservation methods on the vitamin and mineral value in food.
- c. Explain the impact food preparation, food processing and preservation methods will have on phytochemicals.

ACADEMIC STANDARDS:

ELA10RL5. The student understands and acquires new vocabulary and uses it correctly in reading and writing.

ELA11LSV1. The student participates in student-to-teacher, student-to-student and group verbal interactions.

NFCS9.5. Demonstrate use of current technology in food product development and marketing.

FCS-FS-10: Students will discuss the reasons for the use of food additives and food analogs in food preparation and in processed products.

- a. Define food additive, discuss the various purposes of food additives, and identify advantages and disadvantages of their use.
- b. Identify regulations of food additives and the agencies involved.
- c. Explain the difference between natural and artificial additives.
- d. Define food analog and list the main functions of food analogs.
- e. Conduct a sensory evaluation of foods with and without food additives, compile data, and examine the results.

ACADEMIC STANDARDS:

SCSh1. Students will evaluate the importance of curiosity, honesty, openness and skepticism in science.

SCSh6. Students will communicate scientific investigations and information clearly.

MC4P5. Students will represent mathematics in multiple ways.

ELA11SV2. The student formulates reasoned judgments about written and oral communication in various media genres. The student delivers focused, coherent and polished presentations that convey a clear and distinct perspective, demonstrate solid reasoning and combine traditional rhetorical strategies of narration, exposition, persuasion and description.

NFCS 9.5.6. Conduct sensory evaluations of food products.

FCS-FS-11. Students will discuss the principles of fermentation.

- a. List the reasons that food is fermented and identify food products that result from fermentation.
- b. Differentiate among yeast, bacterial, and mold fermentation.
- c. List the factors that impact the growth of single celled organisms.
- d. Describe the process of pickling, making vinegar, and making yeast breads.

ACADEMIC STANDARDS:

SC5. Students will understand that the rate at which a chemical reaction occurs can be affected by changing concentration, temperature, or pressure and the addition of a catalyst.

SB3. Student will derive the relationship between single-celled and multi-celled organisms and the increasing complexity of systems.

ELA11LSV1. The student participates in student-to-teacher, student-to-student and group verbal interactions.

NFCS9.5. Demonstrate use of current technology in food product development and marketing.

FCS-FS-12. Students will discuss the principles of food safety and identify intervention procedures to maintain safe food.

- a. Name and describe the properties of the microorganisms that cause food spoilage.
- b. List specific organisms that can cause food-borne illness.
- c. Define toxin, pathogen, and parasite and differentiate between food intoxication and food infection.
- d. Discuss sanitation and food handling and processing practices that may prevent food-borne illness and differentiate between cleaning and sanitizing.
- e. Identify government agencies in the United States that regulate the safety of the food supply.

ACADEMIC STANDARDS:

SCSh3. Students will identify and investigate problems scientifically.

SCSh4. Students will use tools and instruments for observing, measuring and manipulating scientific equipment and materials.

SB3. Student will derive the relationship between single-celled and multi-celled organisms and the increasing complexity of systems.

NFCS9.5.7. Conduct testing for safety of food products, utilizing available technology.

FCS-FS-13: Students will compare and contrast different food preservation methods and the resultant quality of preserved food.

- a. Identify pretreatment necessary for food preservation (blanching, sulfiting, sulfuring).
- b. List the properties of containers used for commercial food packaging and explore the impact of storing conditions on salting, rancidity, and molding.
- c. Examine the factors needed for the selection of successful thermal processing techniques (canning, freezing, and pasteurization).
- d. Examine the processes of curing, dehydration, freeze-drying, and extended shelf life of fresh products (refrigeration, modified atmosphere packaging and irradiation).
- e. Compare and contrast processes used for home and commercial preservation and evaluate resulting quality of the products preserved using different methods.

ACADEMIC STANDARDS:

ELA10RL3. The student deepens understanding of literary works by relating them to contemporary context or historical background, as well as to works from other time periods.

ELA10C1. The student demonstrates understanding and control of the English language, realizing that usage involves the appropriate application of conventions and grammar in both written and spoken formats.

NFCS9.5.5. Implement procedures that affect quality product performance.

FCS-FS-14: Students will examine emerging technology in the field of food science.

- a. Describe the benefits of various technological advances on the scientific study, processing, and preparation of food products.
- b. Describe examples of emerging technologies that may impact careers in food science and nutrition.
- c. Explore new types of food products and examine emerging food packaging technology.

ACADEMIC STANDARDS:

SCSh1. Students will evaluate the importance of curiosity, honesty, openness and skepticism in science.

SCSh7. Students will analyze how scientific knowledge is developed.

SCSh8. Student will understand important features of the process of scientific inquiry.

ELA11SV2. The student formulates reasoned judgments about written and oral communication in various media genres. The student delivers focused, coherent and polished presentations that convey a clear and distinct perspective, demonstrate solid reasoning and combine traditional rhetorical strategies of narration, exposition, persuasion and description.

NFCS9.5. Demonstrate use of current technology in food product development and marketing.

Reading Standard Comment

After the elementary years, students engage in reading for learning. This process sweeps across all disciplinary domains, extending even to the area of personal learning. Students encounter a variety of informational as well as fictional texts, and they experience text in all genres and modes of discourse. In the study of various disciplines of learning (language arts, mathematics, science, social studies), students must learn through reading the communities of discourse of each of those disciplines. Each subject has its own specific vocabulary, and for students to excel in all subjects, they must learn the specific vocabulary of those subject areas in context.

Beginning with the middle grades years, students begin to self-select reading materials based on personal interests established through classroom learning. Students become curious about science, mathematics, history, and literature as they form contexts for those subjects related to their personal and classroom experiences. As students explore academic areas through reading, they develop favorite subjects and become confident in their verbal discourse about those subjects.

Reading across curriculum content develops both academic and personal interests in students. As students read, they develop both content and contextual vocabulary. They also build good habits for reading, researching, and learning. The Reading Across the Curriculum standard focuses on the academic and personal skills students acquire as they read in all areas of learning.

MRC. Students will enhance reading in all curriculum areas by:

- a. Reading in all curriculum areas
 - Read a minimum of 25 grade-level appropriate books per year from a variety of subject disciplines and participate in discussions related to curricular learning in all areas.
 - Read both informational and fictional texts in a variety of genres and modes of discourse.
 - Read technical texts related to various subject areas.
- b. Discussing books
 - Discuss messages and themes from books in all subject areas.
 - Respond to a variety of texts in multiple modes of discourse.
 - Relate messages and themes from one subject area to messages and themes in another area.
 - Evaluate the merit of texts in every subject discipline.
 - Examine author's purpose in writing.
 - Recognize the features of disciplinary texts.
- c. Building vocabulary knowledge
 - Demonstrate an understanding of contextual vocabulary in various subjects.
 - Use content vocabulary in writing and speaking.
 - Explore understanding of new words found in subject area texts.

- d. Establishing context
- Explore life experiences related to subject area content.
 - Discuss in both writing and speaking how certain words are subject area related.
 - Determine strategies for finding content and contextual meaning for unknown words.

CTAE Foundation Skills

The Foundation Skills for Career, Technical and Agricultural Education (CTAE) are critical competencies that students pursuing any career pathway should exhibit to be successful. As core standards for all career pathways in all program concentrations, these skills link career, technical and agricultural education to the state's academic performance standards.

The CTAE Foundation Skills are aligned to the foundation of the U. S. Department of Education's 16 Career Clusters. Endorsed by the National Career Technical Education Foundation (NCTEF) and the National Association of State Directors of Career Technical Education Consortium (NASDCTEc), the foundation skills were developed from an analysis of all pathways in the sixteen occupational areas. These standards were identified and validated by a national advisory group of employers, secondary and postsecondary educators, labor associations, and other stakeholders. The Knowledge and Skills provide learners a broad foundation for managing lifelong learning and career transitions in a rapidly changing economy.

CTAE-FS-1 Technical Skills: Learners achieve technical content skills necessary to pursue the full range of careers for all pathways in the program concentration.

CTAE-FS-2 Academic Foundations: Learners achieve state academic standards at or above grade level.

CTAE-FS-3 Communications: Learners use various communication skills in expressing and interpreting information.

CTAE-FS-4 Problem Solving and Critical Thinking: Learners define and solve problems, and use problem-solving and improvement methods and tools.

CTAE-FS-5 Information Technology Applications: Learners use multiple information technology devices to access, organize, process, transmit, and communicate information.

CTAE-FS-6 Systems: Learners understand a variety of organizational structures and functions.

CTAE-FS-7 Safety, Health and Environment: Learners employ safety, health and environmental management systems in corporations and comprehend their importance to organizational performance and regulatory compliance.

CTAE-FS-8 Leadership and Teamwork: Learners apply leadership and teamwork skills in collaborating with others to accomplish organizational goals and objectives.

CTAE-FS-9 Ethics and Legal Responsibilities: Learners commit to work ethics, behavior, and legal responsibilities in the workplace.

CTAE-FS-10 Career Development: Learners plan and manage academic-career plans and employment relations.

CTAE-FS-11 Entrepreneurship: Learners demonstrate understanding of concepts, processes, and behaviors associated with successful entrepreneurial performance.