Course Title **Nutritional Food Science** Grade Levels 10-12 Credit Value 1.0

Description Nutritional Food Science is an interdisciplinary course that has a variety of applications to everyday life. The content in this course is directed toward providing students with knowledge of the various concepts and relationships between nutrition and science. Scientific methods are used to conduct laboratory experiments with food, applying both biology and chemistry principles. Students explore career possibilities in the field of food science. Leadership development will be provided through the Family, Career and Community Leaders of America (FCCLA) student organization.

Prerequisites Foods and Nutrition / Advanced Foods and Nutrition

Unit Title Introduction to Food Science

## Technical Content

1. Students will identify the chemical symbols most often used in food science.
2. Students will interpret basic science principles for food science such as composition of matter, atomic structure chemical formulas and equations, and chemical/physical changes in food.
3. Students will explore career pathways within nutritional science.

development.

5. Students will demonstrate employability and social skills relevant to the career cluster.
19. Students will apply math, science and communication skills within technical content.

## AAFCS Pre-PAC Competencies

AAFCSFoodScience Careers 1A. Define the study of food science.
AAFCSFoodScience Careers 1B. Understand the various careers in food science and list the educational requirements.
AAFCSFoodScience Careers 1C. Explain the roles, functions, and skills of individuals engaged in food science careers.
AAFCSFoodScience FoodTechnology 6D. Describe examples of emerging technologies that may impact careers in food science.
AAFCSFoodScience ProductDevelopment 5B. Discuss the basic chemistry concepts and the food science applications.

## National Standards

1.2.1 - Analyze potential career choices to determine the knowledge, skills, and attitudes associated with each career.
1.2.2 - Demonstrate job seeking and job keeping skills.
1.2.8 - Demonstrate work ethics and professionalism.
9.1.3 - Summarize education and training requirements and opportunities for career paths in food science, food technology, dietetics, and nutrition.
9.1.1 - Explain the roles and functions of individuals engaged in food science, food technology, dietetics, and nutrition careers.
9.1.2 - Analyze opportunities for employment and entrepreneurial endeavors.

## KY Academic Standards (Big Idea)

**Safety and Ethical/Social Issues - Technology**

Students understand safe and ethical/social issues related to technology. Students practice and engage in safe, responsible and ethical use of technology. Students develop positive attitudes toward technology use that supports lifelong learning, collaboration, personal pursuits and productivity.

**Research, Inquiry/Problem-Solving and Innovation - Technology**

Students understand the role of technology in research and experimentation. Students engage technology in developing solutions for solving problems in the real world. Students will use technology for original creation and innovation.

**Employability Skills - Vocational Studies**

Employability skills will focus on student's competencies with their work habits and academic/technical skills that will impact an individual's success in school and workplace. School-to-work transition skills will help students develop interpersonal skills and positive work habits.

**Information, Communication and Productivity - Technology**

Students demonstrate a sound understanding of the nature and operations of technology systems. Students use technology to learn, to communicate, increase productivity and become competent users of technology. Students manage and create effective oral, written and multimedia communication in a variety of forms and contexts.

**Career Awareness, Exploration, Planning - Vocational Studies**

Career awareness, exploration and planning gives students the opportunity to discover the various career areas that exist and introduce them to the realities involved with the workplace. Many factors need to be considered when selecting a career path and preparing for employment. Career awareness, exploration and planning will enable students to recognize the value of education, learn how to plan for careers and integrate academic subjects.

## English/Language Arts Standards

CC.11-12.L.1 Conventions of Standard English: Demonstrate command of the conventions of standard English grammar and usage when writing or speaking.
CC.11-12.L.2 Conventions of Standard English: Demonstrate command of the conventions of standard English capitalization, punctuation, and spelling when writing.
CC.11-12.L.4 Vocabulary Acquisition and Use: Determine or clarify the meaning of unknown and multiple-meaning words and phrases based on grades 11–12 reading and content, choosing flexibly from a range of strategies.
CC.11-12.L.6 Vocabulary Acquisition and Use: Acquire and use accurately 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 considering a word or phrase important to comprehension or expression.

## Technical Literacy Standards

Reading / 11-12 / #2 – Determine central ideas or conclusions of a text; summarize complex concepts, processes, or information presented in a text by paraphrasing them in simpler but still accurate terms.
Reading / 11-12 / #3 – Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks; analyze the specific results based on explanations in the text.
Reading / 11-12 / #4 – Determine the meaning of symbols, key terms, and other domain-specific words/phrases as they are used in specific scientific and technical context.
Reading / 11-12 / #5 – Analyze how the text structures information or ideas into categories or hierarchies.
Reading / 11-12 / #9 – Synthesize information from a range of sources into a coherent understanding of a process, resolving conflicting information when possible.
Reading / 11-12 / #10 – By the end of grade 12, read and comprehend science/technical texts in the grades 11-CCR text complexity band independently and proficiently.
Writing / 11-12 / #2 – Write informative / explanatory texts, including narration of historical events, scientific procedures / experiments, or technical processes.
Writing / 11-12 / #4 – Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose and audience.
Writing / 11-12 / #7 – 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.
Writing / 11-12 / #10 – Write routinely over extended time frames and shorter time frames for a range of discipline-specific tasks, purposes, and audiences.

## Mathematics Standards

CC.9-12.S.IC.6 Evaluate reports based on data.*

## 21st Century Skills and Knowledge

Critical Thinking and Problem Solving

Health Literacy

Life and Career Skills

Communication

Information Literacy

ICT (Information, Communications, and Technology) Literacy

Initiative and Self-Direction

Media Literacy

Productivity and Accountability

Leadership and Responsibility

## Learning Targets - Click here to view Sample Learner Activities

Define the study of food science.
Identify and critique related fields of study.
Outline important historical developments in food science.
Understand the various careers in food science and differentiate the educational requirements (ie: food scientist, food distributor, food technologist, research food scientist).
Identify chemical symbols most often used in food science.
Review fundamental concepts of chemistry (ie: chemical formulas, chemical and physical changes, composition of matter, acids / bases).

Course Title **Nutritional Food Science** Grade Levels 10-12 Credit Value 1.0

Description Nutritional Food Science is an interdisciplinary course that has a variety of applications to everyday life. The content in this course is directed toward providing students with knowledge of the various concepts and relationships between nutrition and science. Scientific methods are used to conduct laboratory experiments with food, applying both biology and chemistry principles. Students explore career possibilities in the field of food science. Leadership development will be provided through the Family, Career and Community Leaders of America (FCCLA) student organization.

Prerequisites Foods and Nutrition / Advanced Foods and Nutrition

Unit Title Food Protection and Technology

## Technical Content

6. Students will describe the functions / operations and maintenance of test laboratory and related equipment and supplies.
19. Students will apply math, science and communication skills within technical content.

## AAFCS Pre-PAC Competencies

AAFCSFoodScience FoodTechnology 6A. Describe the functions/operations and maintenance of test laboratory and related equipment and supplies.
AAFCSFoodScience FoodTechnology 6B. Conduct testing for safety of food products, utilizing up-to-date technology.
AAFCSFoodScience FoodTechnology 6C. Describe the benefits of various technological advances on the scientific study, processing, and preparation of food products.
AAFCSFoodScience FoodTechnology 6D. Describe examples of emerging technologies that may impact careers in food science.

## National Standards

9.2.4 - Use the Hazard Analysis Critical Control Point (HACCP) during all food handling processes to minimize the risks of food borne illness.
9.2.8 - Use Occupational Safety and Health Administration's (OSHA) Right to Know Law and Material Safety Data Sheets (MSDS) and explain their requirements in handling hazardous materials.
9.2.7 - Classify current types of cleaning materials and sanitizers and their proper use.
9.5.4 - Maintain test kitchen/ laboratory and related equipment and supplies.
9.5.5 - Implement procedures that affect quality product performance.
9.5.7 - Conduct testing for safety of food products, utilizing available technology.
9.6.2 - Implement food preparation, production, and testing systems.
9.6.3 - Apply standards for food quality.
9.6.6 - Analyze new products.
9.6.7 - Implement procedures that provide cost effective products.
9.6.9 - Utilize Food Code Points of time, temperature, date markings, cross contamination, hand washing, and personal hygiene as criteria for safe food preparation.

## KY Academic Standards (Big Idea)

**Information, Communication and Productivity - Technology**
Students demonstrate a sound understanding of the nature and operations of technology systems. Students use technology to learn, to communicate, increase productivity and become competent users of technology. Students manage and create effective oral, written and multimedia communication in a variety of forms and contexts.
**Safety and Ethical/Social Issues - Technology**
Students understand safe and ethical/social issues related to technology. Students practice and engage in safe, responsible and ethical use of technology. Students develop positive attitudes toward technology use that supports lifelong learning, collaboration, personal pursuits and productivity.
**Research, Inquiry/Problem-Solving and Innovation - Technology**
Students understand the role of technology in research and experimentation. Students engage technology in developing solutions for solving problems in the real world. Students will use technology for original creation and innovation.

## English/Language Arts Standards

CC.11-12.L.1 Conventions of Standard English: Demonstrate command of the conventions of standard English grammar and usage when writing or speaking.
CC.11-12.L.2 Conventions of Standard English: Demonstrate command of the conventions of standard English capitalization, punctuation, and spelling when writing.
CC.11-12.L.4 Vocabulary Acquisition and Use: Determine or clarify the meaning of unknown and multiple-meaning words and phrases based on grades 11–12 reading and content, choosing flexibly from a range of strategies.
CC.11-12.L.6 Vocabulary Acquisition and Use: Acquire and use accurately 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 considering a word or phrase important to comprehension or expression.

CC.11-12.R.I.7 Integration of Knowledge and Ideas: Integrate and evaluate multiple sources of information presented in different media or formats (e.g., visually, quantitatively) as well as in words in order to address a question or solve a problem.

## Technical Literacy Standards

Reading / 11-12 / #2 – Determine central ideas or conclusions of a text; summarize complex concepts, processes, or information presented in a text by paraphrasing them in simpler but still accurate terms.
Reading / 11-12 / #3 – Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks; analyze the specific results based on explanations in the text.
Reading / 11-12 / #4 – Determine the meaning of symbols, key terms, and other domain-specific words/phrases as they are used in specific scientific and technical context.
Reading / 11-12 / #7 - Integrate and evaluate multiple sources of information presented in diverse formats and media in order to address a question or solve a problem.
Reading / 11-12 / #9 – Synthesize information from a range of sources into a coherent understanding of a process, resolving conflicting information when possible.
Reading / 11-12 / #10 – By the end of grade 12, read and comprehend science/technical texts in the grades 11-CCR text complexity band independently and proficiently.
Writing / 11-12 / #1 – Write arguments based on discipline-specific content.
Writing / 11-12 / #6 – Use technology, including the Internet, to produce, publish, and update individual or shared writing products in response to ongoing feedback, including new arguments or information.
Writing / 11-12 / #9 – Draw evidence from informational texts to support analysis, reflection, and research.
Writing / 11-12 / #10 – Write routinely over extended time frames and shorter time frames for a range of discipline-specific tasks, purposes, and audiences.

## Mathematics Standards

CC.9-12.S.ID.7 Interpret the slope (rate of change) and the intercept (constant term) of a linear model in the context of the data.*
CC.9-12.S.ID.8 Compute (using technology) and interpret the correlation coefficient of a linear fit.*
CC.9-12.S.IC.6 Evaluate reports based on data.*

## 21st Century Skills and Knowledge

Health Literacy

Environmental Literacy

Critical Thinking and Problem Solving

Communication

Collaboration

Information Literacy

Media Literacy

ICT (Information, Communications, and Technology) Literacy

Initiative and Self-Direction

Productivity and Accountability

Leadership and Responsibility

## Learning Targets - Click here to view Sample Learner Activities

Recognize laboratory equipment and their purpose(s)
Recall appropriate laboratory safety procedures
Conduct testing for safety of food products
Describe the benefits of various technological advances on the scientific study, processing and preparation of food products (ie: biotechnology, ultra-high temperature (UHT)processing)
Research emerging technologies related to food science (ie: GMOs, nanoscale materials, new / innovative ingredients, packaging materials)

Course Title **Nutritional Food Science** Grade Levels 10-12 Credit Value 1.0

Description Nutritional Food Science is an interdisciplinary course that has a variety of applications to everyday life. The content in this course is directed toward providing students with knowledge of the various concepts and relationships between nutrition and science. Scientific methods are used to conduct laboratory experiments with food, applying both biology and chemistry principles. Students explore career possibilities in the field of food science. Leadership development will be provided through the Family, Career and Community Leaders of America (FCCLA) student organization.

Prerequisites Foods and Nutrition / Advanced Foods and Nutrition

Unit Title Nutritional Composition of Foods

## Technical Content

8. Students will identify the properties of acids and bases.
9. Students will test the pH of common foods and food ingredients.
10. Students will determine the function of water in the human body and in food preparation.
11. Students will identify the properties and composition of lipids, carbohydrates, proteins, vitamins, and minerals and how the body utilizes each.
12. Students will examine the effect of the breakdown and synthesis of food which are made possible by a large set of protein catalyst called enzymes.
16. Students will formulate a procedure for a food science experiment.
19. Students will apply math, science and communication skills within technical content.

## AAFCS Pre-PAC Competencies

AAFCSFoodScience NutritionalComposition 3A. Discuss the functionality of carbohydrates in food preparation and preservation.
AAFCSFoodScience NutritionalComposition 3B. Discuss the functionality of lipids in food preparation and preservation.
AAFCSFoodScience NutritionalComposition 3C. Discuss the functionality of proteins in food preparation and preservation.
AAFCSFoodScience NutritionalComposition 3D. Discuss the functionality of vitamins, minerals, and phytochemicals, and the impacts by food preparation and preservation on their quality/integrity.
AAFCSFoodScience NutritionalComposition 3E. Discuss the functionality of water activity and pH in food preparation and preservation.
AAFCSFoodScience NutritionalComposition 3F. Apply basic concepts of human nutrition.
AAFCSFoodScience FoodProcessing 4A. Discuss the reasons for the use of food additives in processed food products.
AAFCSFoodScience FoodProcessing 4C. Evaluate procedures that affect product quality performance.
AAFCSFoodScience ProductDevelopment 5B. Discuss the basic chemistry concepts and the food science applications.
AAFCSFoodScience ProductDevelopment 5C. Prepare food products for presentation and assessment.
AAFCSNutritionFoodWellness ScienceTechnology 4A. Analyze influence of scientific and technical advances on the nutrient content, availability, and safety of foods.

## National Standards

9.3.3 - Apply principles of food production to maximize nutrient retention in prepared foods.
9.3.5 - Analyze recipe/formula proportions and modifications for food production.
9.5.6 - Conduct sensory evaluations of food products.
9.6.2 - Implement food preparation, production, and testing systems.
9.3.7 - Categorize foods into exchange groups and plan menus, applying the exchange system to meet various nutrient needs.
14.5.4 - Analyze the effects of food science and technology on meeting nutritional needs.

## KY Academic Standards (Big Idea)

**Information, Communication and Productivity - Technology**
Students demonstrate a sound understanding of the nature and operations of technology systems. Students use technology to learn, to communicate, increase productivity and become competent users of technology. Students manage and create effective oral, written and multimedia communication in a variety of forms and contexts.

**Safety and Ethical/Social Issues - Technology**
Students understand safe and ethical/social issues related to technology. Students practice and engage in safe, responsible and ethical use of technology. Students develop positive attitudes toward technology use that supports lifelong learning, collaboration, personal pursuits and productivity.

**Research, Inquiry/Problem-Solving and Innovation - Technology**
Students understand the role of technology in research and experimentation. Students engage technology in developing solutions for solving problems in the real world. Students will use technology for original creation and innovation.

**Personal Wellness (Health Education) - Practical Living**

Wellness is maximum well-being or total health. Personal wellness is a combination of physical, mental, emotional, spiritual and social well-being. It involves making behavioral choices and decisions each day that promote an individual's physical well-being, the prevention of illnesses and diseases and the ability to remain, physically, mentally, spiritually, socially and emotionally healthy.

**Nutrition (Health Education) - Practical Living**

Proper nutrition is critical to good health. To maintain a healthy weight, good dietary habits and physical activity are essential. Nutritious foods are necessary for growth, development and maintenance of healthy bodies.

## English/Language Arts Standards

CC.11-12.L.1 Conventions of Standard English: Demonstrate command of the conventions of standard English grammar and usage when writing or speaking.
CC.11-12.L.2 Conventions of Standard English: Demonstrate command of the conventions of standard English capitalization, punctuation, and spelling when writing.
CC.11-12.L.4 Vocabulary Acquisition and Use: Determine or clarify the meaning of unknown and multiple-meaning words and phrases based on grades 11–12 reading and content, choosing flexibly from a range of strategies.

## Mathematics Standards

CC.9-12.S.IC.6 Evaluate reports based on data.*
CC.9-12.S.IC.5 Use data from a randomized experiment to compare two treatments; use simulations to decide if differences between parameters are significant.*
CC.9-12.S.ID.9 Distinguish between correlation and causation.*

## 21st Century Skills and Knowledge

Health Literacy
Critical Thinking and Problem Solving
Communication
Collaboration
Information Literacy
Media Literacy
ICT (Information, Communications, and Technology) Literacy
Initiative and Self-Direction
Productivity and Accountability
Leadership and Responsibility

## Learning Targets - Click here to view Sample Learner Activities

Explain the functionality of carbohydrates in food preparation and preservation.
Differentiate between simple and complex carbohydrates.
Summarize the processes of retrogradation and caramelization.
Explain the functionality of lipids in food preparation and preservation.
Discuss the properties of fat and as a heating medium for food.
Identify rancidity.
Explain the functionality of proteins in food preparation and preservation.
Classify the properties of proteins in foods (ie: enzymes and gluten).
Investigate methods for preventing enzymatic browning.
Explain the functionality of vitamins, minerals, and phytochemicals and the impacts by food preparation and preservation on their quality / integrity.
Identify the basic structures of a vitamin molecule.
Classify and the sources / functions of vitamins, minerals, and phytochemicals.
Evaluate the impact of sunlight, pH, precipitation and heat.
Discuss the functionality of water activity and pH in food preparation and preservation.
Evaluate pH levels.
Calculate molarity.
Differentiate among base, acid, free water and water activity.
Compare the relationship between water activity and shelf life.

Course Title **Nutritional Food Science** Grade Levels 10-12 Credit Value 1.0

Description Nutritional Food Science is an interdisciplinary course that has a variety of applications to everyday life. The content in this course is directed toward providing students with knowledge of the various concepts and relationships between nutrition and science. Scientific methods are used to conduct laboratory experiments with food, applying both biology and chemistry principles. Students explore career possibilities in the field of food science. Leadership development will be provided through the Family, Career and Community Leaders of America (FCCLA) student organization.

Prerequisites Foods and Nutrition / Advanced Foods and Nutrition

Unit Title Food Processing, Preservation and Packaging

## Technical Content

15. Students will justify the use of additives in specific food items.
16. Students will formulate a procedure for a food science experiment.
19. Students will research and apply the various methods for food processing, preservation and packaging.
20. Students will apply math, science and communication skills within technical content.

## AAFCS Pre-PAC Competencies

AAFCSFoodScience FoodProtection 2A. Analyze factors that contribute to food borne illnesses.
AAFCSFoodScience FoodProtection 2B. Analyze food safety and sanitation programs, including Hazard Analysis Critical Control Point (HACCP.
AAFCSFoodScience FoodProtection 2D. Identify government agencies and laws in the United States that regulate the safety of the food supply.
AAFCSFoodScience NutritionalComposition 3E. Discuss the functionality of water activity and pH in food preparation and preservation.
AAFCSFoodScience FoodProcessing 4A. Discuss the reasons for the use of food additives in processed food products.
AAFCSFoodScience FoodProcessing 4B. Discuss units of operation in food preparation and preservation, including thermal energy.
AAFCSFoodScience FoodProcessing 4D. Examine the principles of fermentation.
AAFCSFoodScience FoodProcessing 4E. Implement food preparation, production, and testing systems.
AAFCSFoodScience FoodProcessing 4F. Analyze packaging materials with regards to types, functions, and environmental factors.
AAFCSFoodScience ProductDevelopment 5B. Discuss the basic chemistry concepts and the food science applications.
AAFCSFoodScience ProductDevelopment 5C. Prepare food products for presentation and assessment.

## National Standards

9.3.3 - Apply principles of food production to maximize nutrient retention in prepared foods.
9.3.5 - Analyze recipe/formula proportions and modifications for food production.
9.5.4 - Maintain test kitchen/ laboratory and related equipment and supplies.
9.5.5 - Implement procedures that affect quality product performance.
9.5.6 - Conduct sensory evaluations of food products.
9.5.7 - Conduct testing for safety of food products, utilizing available technology.
9.6.4 - Create standardized recipes.
14.5.1 - Analyze how scientific and technical advances influence the nutrient content, availability, and safety of foods.
14.5.2 - Analyze how the scientific and technical advances in food processing, storage, product development, and distribution influence nutrition and wellness.
14.5.3 - Analyze the effects of technological advances on selection, preparation and home storage of food.
14.5.4 - Analyze the effects of food science and technology on meeting nutritional needs.

## KY Academic Standards (Big Idea)

**Consumer Decisions - Vocational Studies**

Individual and families need to make consumer decisions due to the numerous products/services on the market, multiple advertising techniques, and the need to make responsible financial management decisions. Accessing and assessing consumer information, comparing and evaluating products and services, provides basis for making effective consumer decisions. Consumer decisions influence the use of resources and the impact they have on the community and environment.

**Information, Communication and Productivity - Technology**

Students demonstrate a sound understanding of the nature and operations of technology systems. Students use technology to learn, to communicate, increase productivity and become competent users of technology. Students manage and create effective oral, written and multimedia communication in a variety of forms and contexts.

**Safety and Ethical/Social Issues - Technology**

Students understand safe and ethical/social issues related to technology. Students practice and engage in safe, responsible and ethical use of technology. Students develop positive attitudes toward technology use that supports lifelong learning, collaboration, personal pursuits and productivity.

**Research, Inquiry/Problem-Solving and Innovation - Technology**
Students understand the role of technology in research and experimentation. Students engage technology in developing solutions for solving problems in the real world. Students will use technology for original creation and innovation.
**Nutrition (Health Education) - Practical Living**
Proper nutrition is critical to good health. To maintain a healthy weight, good dietary habits and physical activity are essential. Nutritious foods are necessary for growth, development and maintenance of healthy bodies.

## English/Language Arts Standards

CC.11-12.L.1 Conventions of Standard English: Demonstrate command of the conventions of standard English grammar and usage when writing or speaking.
CC.11-12.L.2 Conventions of Standard English: Demonstrate command of the conventions of standard English capitalization, punctuation, and spelling when writing.
CC.11-12.R.I.1 Key Ideas and Details: Cite strong and thorough textual evidence to support analysis of what the text says explicitly as well as inferences drawn from the text, including determining where the text leaves matters uncertain.
CC.11-12.R.I.4 Craft and Structure: Determine the meaning of words and phrases as they are used in a text, including figurative, connotative, and technical meanings; analyze how an author uses and refines the meaning of a key term or terms over the course of a text (e.g., how Madison defines faction in Federalist No. 10).

## Technical Literacy Standards

Reading / 11-12 / #3 – Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks; analyze the specific results based on explanations in the text.
Reading / 11-12 / #4 – Determine the meaning of symbols, key terms, and other domain-specific words/phrases as they are used in specific scientific and technical context.
Reading / 11-12 / #5 – Analyze how the text structures information or ideas into categories or hierarchies.
Reading / 11-12 / #8 – Evaluate the hypothesis, data, analysis, and conclusions in a science or technical text.
Reading / 11-12 / #9 – Synthesize information from a range of sources into a coherent understanding of a process, resolving conflicting information when possible.
Reading / 11-12 / #10 – By the end of grade 12, read and comprehend science/technical texts in the grades 11-CCR text complexity band independently and proficiently.
Writing / 11-12 / #1 – Write arguments based on discipline-specific content.
Writing / 11-12 / #2 – Write informative / explanatory texts, including narration of historical events, scientific procedures / experiments, or technical processes.
Writing / 11-12 / #4 – Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose and audience.
Writing / 11-12 / #6 – Use technology, including the Internet, to produce, publish, and update individual or shared writing products in response to ongoing feedback, including new arguments or information.
Writing / 11-12 / #7 – 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.
Writing / 11-12 / #9 – Draw evidence from informational texts to support analysis, reflection, and research.
Writing / 11-12 / #10 – Write routinely over extended time frames and shorter time frames for a range of discipline-specific tasks, purposes, and audiences.

## Mathematics Standards

CC.9-12.F.IF.6 Calculate and interpret the average rate of change of a function (presented symbolically or as a table) over a specified interval. Estimate the rate of change from a graph.*
CC.9-12.S.IC.6 Evaluate reports based on data.*
CC.9-12.S.ID.9 Distinguish between correlation and causation.*

## 21st Century Skills and Knowledge

Health Literacy
Critical Thinking and Problem Solving
Collaboration
Communication
Information Literacy
Media Literacy
ICT (Information, Communications, and Technology) Literacy
Initiative and Self-Direction
Productivity and Accountability
Leadership and Responsibility

## Learning Targets - Click here to view Sample Learner Activities

Recognize food additives and their purpose in processed food products.
Determine common antioxidants, emulsifiers, humectants, tenderizers, food analogs, bulking agent (polydextrose).
Differentiate advantages and disadvantages of polyols, xylitol, food analogs, monosodium glutamate including the use of warning labels.
Judge different units of operation in food preparation and preservation including microwave, conduction, convection and radiation.
Examine the principles of fermentation (bacteria, mold, acetic acid).
Test milk cultures and milk fermentation.
Calculate mass percentages of a solution.
Define, explain and test culling, centrifuging, osmosis, evaporation, sedimentation, solutes, colloids, emulsion, gelatinization, opacity, syneresis, translucency, and viscosity.
Analyze packaging materials with regards to types, functions, and environmental factors (laminates, aluminum foil, canning methods).

Course Title **Nutritional Food Science** Grade Levels 10-12 Credit Value 1.0

Description Nutritional Food Science is an interdisciplinary course that has a variety of applications to everyday life. The content in this course is directed toward providing students with knowledge of the various concepts and relationships between nutrition and science. Scientific methods are used to conduct laboratory experiments with food, applying both biology and chemistry principles. Students explore career possibilities in the field of food science. Leadership development will be provided through the Family, Career and Community Leaders of America (FCCLA) student organization.

Prerequisites Foods and Nutrition / Advanced Foods and Nutrition

Unit Title Product Development and Testing

## Technical Content

16. Students will formulate a procedure for a food science experiment.
17. Students will conduct scientific sensory evaluation of food.
18. Students will examine why chemical bonds of leavening agents contain energy that is released when broken and new compounds are formed.
20. Students will apply math, science and communication skills within technical content.

## AAFCS Pre-PAC Competencies

AAFCSFoodScience FoodProcessing 4C. Evaluate procedures that affect product quality performance.
AAFCSFoodScience FoodProcessing 4E. Implement food preparation, production, and testing systems.
AAFCSFoodScience ProductDevelopment 5A. Describe the role of science and food science management in the development of new food products.
AAFCSFoodScience ProductDevelopment 5B. Discuss the basic chemistry concepts and the food science applications.
AAFCSFoodScience ProductDevelopment 5C. Prepare food products for presentation and assessment.
AAFCSFoodScience ProductDevelopment 5D. Explain the purpose of sensory evaluation panels and how to conduct a sensory panel using appropriate controls.
AAFCSFoodScience ProductDevelopment 5E. Discuss factors affecting a person's food preference such as physical, psychological, cultural, and environmental influences.
AAFCSNutritionFoodWellness ScienceTechnology 4B. Relate scientific and technical advances in food processing, storage, product development, and distribution for nutrition and wellness.

## National Standards

14.5.1 - Analyze how scientific and technical advances influence the nutrient content, availability, and safety of foods.
14.5.2 - Analyze how the scientific and technical advances in food processing, storage, product development, and distribution influence nutrition and wellness.
14.5.3 - Analyze the effects of technological advances on selection, preparation and home storage of food.
9.2.4 - Use the Hazard Analysis Critical Control Point (HACCP) during all food handling processes to minimize the risks of food borne illness.
9.3.3 - Apply principles of food production to maximize nutrient retention in prepared foods.
9.3.5 - Analyze recipe/formula proportions and modifications for food production.
9.3.6 - Critique the selection of foods to promote a healthy lifestyle.
9.3.7 - Categorize foods into exchange groups and plan menus, applying the exchange system to meet various nutrient needs.
9.4.1 - Analyze nutritional needs of individuals.
9.4.4 - Construct a modified diet based on nutritional needs and health conditions.
9.5.1 - Analyze various factors that affect food preferences in the marketing of food.
9.5.2 - Analyze data in statistical analysis in making development and marketing decisions.
9.5.3 - Prepare food for presentation and assessment.
9.5.4 - Maintain test kitchen/ laboratory and related equipment and supplies.
9.5.5 - Implement procedures that affect quality product performance.
9.5.6 - Conduct sensory evaluations of food products.
9.5.7 - Conduct testing for safety of food products, utilizing available technology.
9.6.1 - Build menus to customer/ client preferences.
9.6.2 - Implement food preparation, production, and testing systems.
9.6.3 - Apply standards for food quality.
9.6.4 - Create standardized recipes.
9.6.6 - Analyze new products.
9.6.7 - Implement procedures that provide cost effective products.
9.6.9 - Utilize Food Code Points of time, temperature, date markings, cross contamination, hand washing, and personal hygiene as criteria for safe food preparation.

## KY Academic Standards (Big Idea)

**Consumer Decisions - Vocational Studies**

Individual and families need to make consumer decisions due to the numerous products/services on the market, multiple advertising techniques, and the need to make responsible financial management decisions. Accessing and assessing consumer information, comparing and evaluating products and services, provides basis for making effective consumer decisions. Consumer decisions influence the use of resources and the impact they have on the community and environment.

**Financial Literacy - Vocational Studies**

Financial literacy provides knowledge so that students are responsible for their personal economic well-being. As consumers, individuals need economic knowledge as a base for making financial decisions impacting short and long term goals throughout one's lifetime. Financial literacy will empower students by providing them with the knowledge, skills and awareness needed to establish a foundation for a future of financial responsibility and economic independence.

**Communication/Technology - Vocational Studies**

Special communication and technology skills are needed for success in schooling and in the workplace. Students will be able to express information and ideas using a variety of technologies in various ways.

**Information, Communication and Productivity - Technology**

Students demonstrate a sound understanding of the nature and operations of technology systems. Students use technology to learn, to communicate, increase productivity and become competent users of technology. Students manage and create effective oral, written and multimedia communication in a variety of forms and contexts.

**Safety and Ethical/Social Issues - Technology**

Students understand safe and ethical/social issues related to technology. Students practice and engage in safe, responsible and ethical use of technology. Students develop positive attitudes toward technology use that supports lifelong learning, collaboration, personal pursuits and productivity.

**Nutrition (Health Education) - Practical Living**

Proper nutrition is critical to good health. To maintain a healthy weight, good dietary habits and physical activity are essential. Nutritious foods are necessary for growth, development and maintenance of healthy bodies.

## English/Language Arts Standards

CC.11-12.L.1 Conventions of Standard English: Demonstrate command of the conventions of standard English grammar and usage when writing or speaking.

CC.11-12.L.2 Conventions of Standard English: Demonstrate command of the conventions of standard English capitalization, punctuation, and spelling when writing.

CC.11-12.L.3 Knowledge of Language: Apply knowledge of language to understand how language functions in different contexts, to make effective choices for meaning or style, and to comprehend more fully when reading or listening.

CC.11-12.R.I.7 Integration of Knowledge and Ideas: Integrate and evaluate multiple sources of information presented in different media or formats (e.g., visually, quantitatively) as well as in words in order to address a question or solve a problem.

## Technical Literacy Standards

Reading / 11-12 / #1 - Cite specific textual evidence to support analysis of science and technical texts, attending to important distinctions the author makes and to any gaps or inconsistencies in the account.

Reading / 11-12 / #2 – Determine central ideas or conclusions of a text; summarize complex concepts, processes, or information presented in a text by paraphrasing them in simpler but still accurate terms.

Reading / 11-12 / #3 – Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks; analyze the specific results based on explanations in the text.

Reading / 11-12 / #8 – Evaluate the hypothesis, data, analysis, and conclusions in a science or technical text.

Reading / 11-12 / #9 – Synthesize information from a range of sources into a coherent understanding of a process, resolving conflicting information when possible.

Reading / 11-12 / #10 – By the end of grade 12, read and comprehend science/technical texts in the grades 11-CCR text complexity band independently and proficiently.

Writing / 11-12 / #1 – Write arguments based on discipline-specific content.

Writing / 11-12 / #2 – Write informative / explanatory texts, including narration of historical events, scientific procedures / experiments, or technical processes.

Writing / 11-12 / #9 – Draw evidence from informational texts to support analysis, reflection, and research.

Writing / 11-12 / #10 – Write routinely over extended time frames and shorter time frames for a range of discipline-specific tasks, purposes, and audiences.

## Mathematics Standards

CC.9-12.S.IC.6 Evaluate reports based on data.*

CC.9-12.S.ID.9 Distinguish between correlation and causation.*

CC.9-12.S.MD.7 (+) Analyze decisions and strategies using probability concepts (e.g., product testing, medical testing, pulling a hockey goalie at the end of a game).*

## 21st Century Skills and Knowledge

Financial, Economic, Business and Entrepreneurial Literacy
Health Literacy
Environmental Literacy
Creativity and Innovation
Critical Thinking and Problem Solving
Communication
Collaboration
Information Literacy
Media Literacy
ICT (Information, Communications, and Technology) Literacy
Initiative and Self-Direction
Productivity and Accountability
Leadership and Responsibility

## Learning Targets - Click here to view Sample Learner Activities

Identify steps in new food product development.
Test sources of acidity.
Evaluate substitutes for baking powder (i.e. cream of tartar and baking soda).
Conduct a sensory lab protocol to determine factors that effect basic taste and flavor intensity.
Explain the purpose of sensory evaluation panels and how to conduct a sensory using appropriate controls.
Utilize the FCCLA Food Innovation Competitive Event specifications for students to create a product.