

Family and Consumer Sciences Education
Grades 9-12

Food Science



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Foreword

This publication provides guidance to help those responsible for planning, implementing, and assessing the commencement level Family and Consumer Sciences Food Science course. Food Science is a foods and nutrition cluster-level course that has been designed as a specialized option to fulfill the third year science graduation requirement for all students. All Family and Consumer Sciences courses allow students to apply the process skills of communication, leadership, management and thinking in an experiential setting. Commencement level Family and Consumer Sciences courses offer minimal duplication among courses and integration of content in an applied context.

Family and Consumer Sciences Core Courses:

- Food and Nutrition
- Lifespan Studies
- Housing and Environment
- Clothing and Textiles

Food and Nutrition cluster courses:

- Food Preparation and Nutrition
- Nutrition, Health and Fitness
- Culture and Foods
- Gourmet Foods
- Entrepreneurship
- Commercial Food Program
- Food Science (may be used for 1 science credit)

Each Family and Consumer Sciences course promotes student attainment of the commencement level New York State Learning Standards in Family and Consumer Sciences and New York State Learning Standards in Career Development and Occupational Studies. In addition, Food Science meets commencement level New York State Learning Standards in Math, Science, and Technology.

Family and Consumer Sciences education is one of the disciplines covered by the Career and Technical Education (CTE) umbrella. As such, Commissioner's Regulations and NYSED policies developed for CTE programs and students apply to Family and Consumer Sciences.

Message to the Teacher

All New York State students must complete three units of science at the commencement level. The Food Science curriculum has been designed to fulfill the third year science requirement for all students. This course can be used as a fourth or fifth unit in a career and technical education Family and Consumer Sciences sequence. This course invites all students to apply the process skills of communication, leadership, management, and thinking. The integration of these process skills into each of the content topics is a fundamental component of Food Science Curriculum. The content topics in the Food Science course are aligned with the commencement level New York State Learning Standards for Family and Consumer Sciences, Career Development and Occupational Studies, and Mathematics, Science and Technology. In addition, they are aligned with the National Learning Standards for Family and Consumer Sciences.

Students live in a rapidly changing and increasingly complex world. Our students are future family, community and career leaders, and citizens. As citizens of tomorrow, they need to be able to synthesize information, utilize prior knowledge, work cooperatively, and apply critical thinking skills as they progress along their divergent paths. As Family and Consumer Sciences teachers our charge is to empower students by engaging them in experiential activities that will guide them into the future.

Curriculum Overview — Food Science

1. What is Food Science?

Food Science is designed to reinforce and enhance the student's knowledge of scientific principles and processes through the study of foods and nutrition. An in-depth understanding of science as it applies to foods will assist students with interest in career and technical education, to understand the food industry as well as food preparation in their daily lives. Whenever possible, students should be involved in hands-on laboratory activities which verify the scientific concepts presented.

2. What is the mandated requirement for science education and how does Food Science meet the mandate?

New York State mandates completion of three units of commencement level science for all students. The three units must be comprised of commencement level science courses aligned with the New York State Learning Standards in Mathematics, Science, and Technology. Units must include one course from the physical setting (physical science) and one course from the living environment (life science). The third may be from either life sciences or physical sciences. The Food Science curriculum has been designed as a specialized course to fulfill the third year science requirement for all students. All commencement level science courses, including specialized courses, must include laboratory activities.

In science, specialized courses may include laboratory activities scheduled within the regular classroom instructional meeting time, or may include additional laboratory time associated with earning a unit of credit. They do not include the state-mandated laboratory requirement and do not end in a Regents examination for science.

Specialized courses must be approved for academic credit by the appropriate school official, usually the superintendent of schools.

3. Who can teach Food Science?

All Family and Consumer Sciences courses must be taught by a certified Family and Consumer Sciences teacher.

4. How is Food Science organized?

Food Science is organized into four disciplines and 15 content topics. The disciplines are Introduction to Food Science, Food Biochemistry, Food Microbiology, and The Future of Food Science. Each discipline is composed of content topics:

The Introduction to Food Science

- A. Food Science and Its Relevance to Global Society (FS)
- B. Research Practices in Food Science (RP)
- C. Concepts of Physical Sciences Relevant to Food Science (PS)
- D. Concepts of Life Sciences Relevant to Food Science (LS)

Food Biochemistry

- E. Water (W)
- F. Carbohydrates (C)
- G. Lipids (L)
- H. Proteins (P)
- I. Vitamins and Minerals (VM)

Food Microbiology

- J. Introduction to Microorganisms (IM)
- K. Microorganisms in Food Science (MFS)
- L. Food Preservation (FP)
- M. Food Safety (FS)

The Future of Food Science

- N. Technology Advances in Food Science (TA)
- O. Food Industry Careers (FIC)

Each content topic is introduced with an Essential Question which will allow the students to focus on the process skills involved. This is followed by:

- The Standards Connection(s)
- Key Ideas
- A Rationale
- Performance Objectives and Supporting Competencies

The process skills of communication, leadership, management and thinking which have been studied in depth in Home and Career Skills are not to be taught separately but rather applied throughout the course using the focus of essential questions.

5. How does the Food Science curriculum relate to the Learning Standards?

This course is a vehicle through which commencement level New York State Learning Standards for Family and Consumer Sciences can be attained. It also addresses the commencement level New York State Learning Standards for Career and Occupational Studies. New York State Learning Standards for Math, Science, and Technology are a focus of this curriculum.

Food Science content topics align with the National Learning Standards for Family and Consumer Sciences.

6. Why is it important for students to study Food Science?

The Food Science course is based on the understanding that the ability to reason, to think critically and creatively, and to reflect on one's actions, will empower students to act responsibly toward themselves, their families, their peers, and the larger society. As technology advances and societies change, the basic need for food remains.

Research has shown that permanent acquisition of knowledge is most likely when learning occurs in context and repeated practice is allowed. The experiential, hands on, real life nature of Food Science promotes this type of learning.

7. What instructional strategies best support student learning in Food Science?

The purpose of instructional strategies is to deliver the New York State Learning Standards in Family and Consumer Sciences, Career Development and Occupational Studies, and Mathematics, Science, and Technology. Teachers should select strategies and sample tasks that are aligned with the key ideas and performance indicators for each standard.

The Food Science course should be taught using a hands-on, experiential approach to learning so that knowledge and skills are applied in a planned, sequential manner.

Strategies could include, but are not limited to:

- Applied Academics
- Demonstrations
- Experiments
- FCCLA activities
- Group discussions
- Group problem solving
- Interviews
- Laboratory experiences
- Library research
- Multi-age activities
- Preschool activities
- Projects
- Scenarios
- Shadowing

Appropriate technology should be incorporated into any selected strategy.

It is recommended that the course be delivered within a laboratory setting and involve a minimum of 75% hands-on instruction. The use of real world relevant tasks, laboratories, simulations, and scenarios, is an integral part of the course as is the use of library research, class discussions, and group activities. The student is expected to be actively involved in learning in a participatory, supportive environment and to have the opportunity to practice and develop skills related to the course content.

The Food Science classroom affords hands-on, relevant, real world applications of academic standards in a nurturing environment. Students in Food Science may experience success in attaining academic standards that have given them difficulty in traditional academic settings.

Providing student access to other school staff (i.e. guidance counselors, nurses, librarians, special education teachers, etc.) and community members will strengthen their network of academic and personal support.

8. How does Food Science support positive youth development?

In addition to strong academic achievement, positive youth development is essential in educating youth today. Projects, leadership opportunities, and service learning experiences through Family, Career and Community Leaders of America (FCCLA) and Food Science enhance the process skills and content topics. Students have the advantage of a practical forum to demonstrate leadership skills in an action oriented format and have the potential for recognition of their achievement at the local, state, and national levels.

9. How can special needs students succeed in Food Science?

Students with special educational needs are included in Food Science classes. Family and Consumer Sciences educators acknowledge the need to differentiate instruction, recognize multiple intelligences and maximize the strengths of varied learning styles to accommodate all students. This can be accomplished through a variety of alternative instructional and assessment strategies. Alternate performance indicators and sample tasks for Family and Consumer Sciences and Career Development and Occupational Studies New York State Learning Standards have been developed for students with special educational needs. The alternate indicators and tasks can be accessed at the New York State Education Department website www.nysed.gov/vls. Information on adapting space and equipment for these students can be found in the Family and Consumer Sciences Facilities Guide available online at <http://www.emsc.nysed.gov/cte/facse/>.

10. How can student achievement of New York State learning standards through Food Science be assessed?

Students should be assessed on a regular basis. All students can demonstrate the acquisition of skills learned, and apply those skills to real world situations, through the use of:

- Authentic Assessments
- Math computations
- Written reflections
- Tests and quizzes
- Public speaking
- Projects
- Portfolios
- Laboratories
- Scenarios

Course: Food Science

Content Topics

The Introduction to Food Science

- A. Food Science and Its Relevance to Global Society (FS)
- B. Research Practices in Food Science (RP)
- C. Concepts of Physical Sciences Relevant to Food Science (PS)
- D. Concepts of Life Sciences Relevant to Food Science (LS)

Food Biochemistry

- E. Water (W)
- F. Carbohydrates (C)
- G. Lipids (L)
- H. Proteins (P)
- I. Vitamins and Minerals (VM)

Food Microbiology

- J. Introduction to Microorganisms (IM)
- K. Microorganisms in Food Science (MFS)
- L. Food Preservation (FP)
- M. Food Safety (FS)

The Future of Food Science

- N. Technological Advances in Food Science (TA)
- O. Food Industry Careers (FIC)

Appendices

- Appendix A - Suggested Laboratory Experiences
- Appendix B - Best Practices Rubric and Template
- Appendix C - Compilation of Performance Objectives and Supporting Competencies
- Appendix D - Home and Career Skills Process Skills

A. Food Science and Its Relevance to Global Society (FS) *How will I be able to understand basic concepts, history, and advancement of food science?*

Standards Connections

Food Science and Its Relevance to Global Society supports the NYS Family and Consumer Sciences Learning Standards 1 – Personal Health and Fitness, 2 – A Safe and Healthy Environment and 3 – Resource Management; NYS Career Development and Occupational Studies Standards 1 – Career Development, 2 – Integrated Learning and 3a – Universal Foundation Skills; and NYS MST Standards 1 – Analysis, Inquiry, and Design and 4 – Science

Rationale

The purpose of this content topic is to explore and understand factors connecting food science to all other relevant sciences while providing the historical and scientific developments of foods in a global society. This content topic will provide opportunities for students to apply communication, leadership, management, and thinking skills to the study of Food Science.

Key Ideas

NYS FACS 1 - Students will have the necessary knowledge and skills to establish and maintain physical fitness, participate in physical activity, and maintain personal health.

NYS FACS 2 - Students will acquire the knowledge and ability necessary to create and maintain a safe and healthy environment.

NYS FACS 3 - Students will understand and be able to manage personal resources of talent, time, energy, and money and make effective decisions in order to balance their obligations to work, family, and self.

NYS MST 1 - Students will use mathematical analysis, scientific inquiry, and engineering design, as appropriate, to pose questions, seek answers, and develop solutions.

NYS MST 4 Living Environment 6 - Plants and animals depend on each other and their physical environment.

NYS MST 4 Living Environment 7 - Human decisions and activities have had a profound impact on the physical and living environment.

NYS CDOS 1 - Students will learn about the changing nature of the workplace, the value of work to society, and the connection of work to the achievement of personal goals.

NYS CDOS 2 - Students will use essential academic concepts, facts, and procedures in applications related to life skills and the world of work.

NYS CDOS 3a2 - Thinking Skills

NYS CDOS 3a3 - Personal Qualities

NYS CDOS 3a4 - Interpersonal Skills

NYS CDOS 3a6 - Managing Information

NYS CDOS 3a8 - Systems

Performance Objectives and Supporting Competencies for Food Science and Its Relevance to Global Society

Food Science and Its Relevance to Global Society Performance Objective 1

FS.1 Recognize food science as a relevant science including current and historical developments and advancements of global food production

- FS.1.1. Define food science and relate it to other science disciplines
- FS.1.2. Recognize the history and development of food into a highly regulated industry
- FS.1.3. Relate the contribution of food scientists to the advancement of global food production
- FS.1.4. Explain the importance of studying food science

B. Research Practices in Food Science (RP) *How can I use basic research practices to investigate and study food science?*

Standards Connections

Research Practices in Food Science supports the NYS Family and Consumer Sciences Learning Standards 1 – Personal Health and Fitness and 2 – A Safe and Healthy Environment; NYS Career Development and Occupational Studies Standards 1 – Career Development, 2 – Integrated Learning and 3a – Universal Foundation Skills; and NYS MST Standard 1 – Analysis, Inquiry, and Design

Rationale

The purpose of this content topic is to understand the role of research in food science as it relates to scientific practices and the development of the food industry. This content topic will provide opportunities for student to apply communication, leadership, management, and thinking skills to research practices in food science.

Key Ideas

NYS FACS 1 - Students will have the necessary knowledge and skills to establish and maintain physical fitness, participate in physical activity, and maintain personal health.

NYS FACS 2 - Students will acquire the knowledge and ability necessary to create and maintain a safe and healthy environment.

NYS MST 1 - Students will use mathematical analysis, scientific inquiry, and engineering design, as appropriate, to pose questions, seek answers, and develop solutions.

NYS CDOS 1 - Students will learn about the changing nature of the workplace, the value of work to society, and the connection of work to the achievement of personal goals.

NYS CDOS 2 - Students will use essential academic concepts, facts, and procedures in applications related to life skills and the world of work.

NYS CDOS 3a2 - Thinking Skills

NYS CDOS 3a3 - Personal Qualities

NYS CDOS 3a4 - Interpersonal Skills

NYS CDOS 3a6 - Managing Information

NYS CDOS 3a8 - Systems

Performance Objectives and Supporting Competencies for Research Practices in Food Science

Research Practices in Food Science Performance Objective 1

RP.1 Explain the role of science in food science as it relates to research practices and practical scientific experiments

- RP.1.1. Relate the role of science to the development of the food industry
- RP.1.2. Identify and develop science skills necessary for successful scientific research
- RP.1.3. Explain the steps of the scientific method and demonstrate its use in science investigations
- RP.1.4. Design proper science experiments
- RP.1.5. Demonstrate the knowledge and use of good and safe laboratory practices
- RP.1.6. Explain the unique nature of clinical studies and acquire skills in evaluating scientific studies

C. Concepts of Physical Sciences Relevant to Food Science (PS) *How will basic concepts of the physical sciences help me understand Food Science?*

Standards Connections

Concepts of Physical Sciences Relevant to Food Science supports the NYS Family and Consumer Sciences Learning Standard 2 – A Safe and Healthy Environment; NYS Career Development and Occupational Studies Standards 1 – Career Development, 2 – Integrated Learning and 3a – Universal Foundation Skills; and NYS MST Standards 1 – Analysis, Inquiry, and Design and 4 – Science

Rationale

The purpose of this content topic is to understand those concepts of the physical sciences that are relevant to Food Science. Students will identify and classify elements, compounds and mixtures. Students will be able to identify chemicals, classify reactions, and understand factors that affect chemical reactions. Students will be able to identify examples of the various types of chemical reactions. Students will be able to explain concepts of energy and how it is used in food science. Students will be able to understand the processes of mechanical and physical separation and relate these to food science processes. This content topic will provide opportunities for students to apply communication, leadership, management, and thinking skills to the study of food science.

Key Ideas

NYS FACS 2 - Students can demonstrate the skills necessary to maintain their workplaces in a safe and comfortable condition. They can provide a safe and nurturing environment for themselves and others.

NYS MST 1 - Students will use mathematical analysis, scientific inquiry, and engineering design, as appropriate, to pose questions, seek answers, and develop solutions.

NYS MST 4 Physical Setting 3 - Matter is made up of particles whose properties determine the observable characteristics of matter.

NYS MST 4 Physical Setting 4 - Energy exists in many forms, and when these forms change energy is conserved.

NYS MST 4 Physical Setting 5 - Energy and matter interact through forces that result in changes in motion.

NYS CDOS 1 - Students will learn about the changing nature of the workplace, the value of work to society, and the connection of work to the achievement of personal goals.

NYS CDOS 2 - Students will use essential academic concepts, facts, and procedures in applications related to life skills and the world of work.

NYS CDOS 3a2 - Thinking Skills
NYS CDOS 3a3 - Personal Qualities
NYS CDOS 3a4 - Interpersonal Skills
NYS CDOS 3a6 - Managing Information
NYS CDOS 3a7 - Managing Resources
NYS CDOS 3a8 - Systems

Performance Objectives and Supporting Competencies for Concepts of Physical Sciences Relevant to Food Science

Concepts of Physical Sciences Relevant to Food Science Performance Objective 1

PS.1 Identify and classify selected elements, interpret chemical symbols for elements, and describe atomic particles

- PS.1.1. Classify elements into appropriate categories based on their properties
- PS.1.2. List subatomic particles
- PS.1.3. Identify elements by their chemical symbols
- PS.1.4. Explain properties characteristic of selected elements

Concepts of Physical Sciences Relevant to Food Science Performance Objective 2

PS.2 Classify and identify compounds and common properties

- PS.2.1. Explain the various types of chemical bonds and relate to the properties of compounds
- PS.2.2. Classify compounds into appropriate categories based on their types of bonding and properties
- PS.2.3. List examples of compounds used in the home and in occupations

Concepts of Physical Sciences Relevant to Food Science Performance Objective 3

PS.3 Distinguish between the different kinds of chemical reactions and understand the factors that effect them

- PS.3.1. Describe the nature of synthesis reactions and recognize examples of this type of reaction
- PS.3.2. Describe the nature of decomposition reactions and recognize examples of this type of reaction
- PS.3.3. Understand the concept of pH and explain its relationship to neutralization reactions, and recognize examples of neutralization reactions
- PS.3.4. Explain the effect of factors on the rate of chemical reactions such as but not limited to temperature, pH, and energy

Concepts of Physical Sciences Relevant to Food Science Performance Objective 4

PS.4 Define and classify mixtures based on their chemical properties

- PS.4.1. Classify mixtures into appropriate categories based on the distribution of particles
- PS.4.2. List examples of mixtures used in the home and in occupations
- PS.4.3. Explain the differences between compounds and mixtures

Concepts of Physical Sciences Relevant to Food Science Performance Objective 5

PS.5 Identify the forms and sources of energy and understand their relationship to physical and chemical processes

- PS.5.1. Explain the various forms of energy such as but not limited to heat, light and electricity and understand the conversion from one form of energy to another
- PS.5.2. Recognize the various sources of energy
- PS.5.3. Identify and explain the relationship between potential and kinetic energy
- PS.5.4. Explain the concept of calories and temperature as measurements relevant to food science
- PS.5.5. Explain the ways energy flows and its relationship to food processes
- PS.5.6. Describe the relationship between energy and different phases of matter
- PS.5.7. Distinguish between endothermic and exothermic reactions
- PS.5.8. Explain the conditions that influence energy utilization in food preparation

Concepts of Physical Sciences Relevant to Food Science Performance Objective 6

PS.6 Recognize the use of mechanical and chemical processes of separation in food science

- PS.6.1. Recognize the process of mechanical separation based on physical properties such as but not limited to size and shape of particles
- PS.6.2. Recognize the processes of mechanical separation based on density such as but not limited to sedimentation and creaming
- PS.6.3. Recognize the processes of mechanical separation based on increased force such as but not limited to centrifuging and pressurization
- PS.6.4. Recognize the processes of chemical separation such as but not limited to distillation, evaporation, and crystallization
- PS.6.5. Recognize the process of selective separation using barriers such as filters and semi-permeable membranes

D. Concepts of Life Sciences Relevant to Food Science (LS) *How will basic concepts of the life sciences help me understand Food Science?*

Standards Connections

Concepts of Life Sciences Relevant to Food Science supports the NYS Family and Consumer Sciences Learning Standards 1 – Personal Health and Fitness, 2 – A Safe and Healthy Environment and 3 – Resource Management; NYS Career Development and Occupational Studies Standards 1 – Career Development, 2 – Integrated Learning and 3a – Universal Foundation Skills; and NYS MST Standards 1 - Analysis, Inquiry, and Design and 4 – Science

Rationale

The purpose of this content topic is to understand those concepts of the life sciences that are relevant to food science. Students will identify metabolic reactions as either anabolism or catabolism. Students will understand the structure of the cell membrane and relate it to movement of substances into and out of cells. Students will understand the concept of homeostasis and its relationship to proper function in the human body. The students will understand the organization of life from cell to organ system and identify the functions of the various body systems. The students will understand the functions of the body systems as an integrated process. This content topic will provide opportunities for students to apply communication, leadership, management, and thinking skills to the study of food science.

Key Ideas

NYS FACS 1 - Students will have the necessary knowledge and skills to establish and maintain physical fitness, participate in physical activity, and maintain personal health.

NYS FACS 2 - Students can demonstrate the skills necessary to maintain their workplaces in a safe and comfortable condition. They can provide a safe and nurturing environment for themselves and others.

NYS FACS 3 - Students will understand and be able to manage personal resources of talent, time, energy, and money and make effective decisions in order to balance their obligations to work, family, and self.

NYS MST 1 - Students will use mathematical analysis, scientific inquiry, and engineering design as appropriate to pose questions, seek answers, and develop solutions.

NYS MST 4 Physical Setting 3 - Matter is made up of particles whose properties determine the observable characteristics of matter.

NYS MST 4 Physical Setting 5 - Energy and matter interact through forces that result in changes in motion.

NYS MST 4 Living Environment 1 - Living things are both similar to and different from each other and nonliving things.

NYS MST 4 Living Environment 5 - Organisms maintain a dynamic equilibrium that sustains life.

NYS MST 4 Living Environment 6 - Plants and animals depend on each other and their physical environment.

NYS CDOS 1 - Students will learn about the changing nature of the workplace, the value of work to society, and the connection of work to the achievement of personal goals.

NYS CDOS 2 - Students will use essential academic concepts, facts, and procedures in applications related to life skills and the world of work.

NYS CDOS 3a2 - Thinking Skills

NYS CDOS 3a3 - Personal Qualities

NYS CDOS 3a4 - Interpersonal Skills

NYS CDOS 3a6 - Managing Information

NYS CDOS 3a7 - Managing Resources

NYS CDOS 3a8 - Systems

Performance Objectives and Supporting Competencies for Concepts of Life Sciences Relevant to Food Science

Concepts of Life Sciences Relevant to Food Science Performance Objective 1

LS.1 Explain the process of metabolism and relate to the body's utilization of nutrients; explain the organization of the human body and the factors controlling efficient functioning of the body

- LS.1.1. Define metabolism and distinguish between anabolism and catabolism
- LS.1.2. Recognize the structure of biological membranes and its relationships to movement of substances into and out of cells
- LS.1.3. Recognize the process of diffusion and its relationship to osmosis and movement of substances across semi-permeable membranes
- LS.1.4. Explain the influence of pH on biological systems
- LS.1.5. Examine the relationship of variations in metabolic rate and factors such as but not limited to body types, nutrient intake and physical activity

LS.2. Describe the levels of organization of life and the relationship to the human body

- LS.2.1. Recognize the structure and functions of cells
- LS.2.2. Recognize the relationship among cells, tissues, organs, and organ systems with respect to the human body
- LS.2.3. Describe the basic functions of human body systems
- LS.2.4. Explain the integrated function of human body systems for maintenance of life
- LS.2.5. Recognize the importance of recommended dietary allowances and their effect on homeostasis for the efficient functioning of human body systems

E. Water (W) *How can I explain the properties and role of water in food science?*

Standards Connections

Food Science Applications of Water supports the NYS Family and Consumer Sciences Learning Standards 1 – Personal Health and Fitness, 2 – A Safe and Healthy Environment and 3 – Resource Management; NYS Career Development and Occupational Studies Standards 1 – Career Development and 2 – Integrated Learning; and NYS MST Standards 1 – Analysis, Inquiry, and Design, 2 – Information Systems and 4 – Science

Rationale

The purpose of this content topic is to explore the properties of water in a scientific setting. Students will understand the composition and chemical formula of water and determine the freezing, melting, boiling and vaporization points of water and the influence of altitude on these temperatures. Students will understand the role of water in biological systems. Students will understand the body's requirements for water. This content topic will provide opportunities for students to apply communication, leadership, management, and thinking skills to the study of the properties and role of water in food science.

Key Ideas

NYS FACS 1 - Students will have the necessary knowledge and skills to establish and maintain physical fitness, participate in physical activity, and maintain personal health.

NYS FACS 2 - Students will acquire the knowledge and ability necessary to create and maintain a safe and healthy environment.

NYS FACS 3 - Students will understand and be able to manage personal resources of talent, time, energy, and money and make effective decisions in order to balance their obligations to work, family, and self.

NYS MST 1 - Students will use mathematical analysis, scientific inquiry, and engineering design, as appropriate, to pose questions, seek answers, and develop solutions.

NYS MST 4 Physical Setting 3 - Matter is made up of particles whose properties determine the observable characteristics of matter.

NYS MST 4 Physical Setting 4 - Energy exists in many forms, and when these forms change energy is conserved.

NYS MST 4 Living Environment 5 - Organisms maintain a dynamic equilibrium that sustains life.

NYS CDOS 1 - Students will be knowledgeable about the world of work, explore career options, and relate personal skills, aptitudes, and abilities to future career decisions.

NYS CDOS 2 - Students will demonstrate how academic knowledge and skills are applied in the workplace and other settings.

Performance Objectives and Supporting Competencies for Water

Water Performance Objective 1

W.1 Analyze and describe the chemical composition and the three phases of water in the role of food preparation

- W.1.1. Cite the composition and chemical formula of water
- W.1.2. Determine the freezing, melting, boiling, and vaporization points of water and the influence of atmospheric pressure (altitude)
- W.1.3. Demonstrate the use of water in food preparation for heat transfer and solutions
- W.1.4. Describe the body requirements for water and its nutritional value
- W.1.5. Demonstrate an understanding of osmosis

F. Carbohydrates (C) *How can I analyze the properties and roles of carbohydrates in food science?*

Standards Connection

Food Science Applications of Carbohydrates supports the NYS Family and Consumer Sciences Learning Standards 1 – Personal Health and Fitness, 2 – A Safe and Healthy Environment and 3 – Resource Management; NYS Career Development and Occupational Studies Standards 1 – Career Development and 2 – Integrated Learning; and NYS MST Standards 1 – Analysis, Inquiry, and Design and 4 – Science

Rationale

The purpose of this content topic is to study the properties of carbohydrates. Students will be able to define mono- and poly-saccharides and explain the body's method of digestion, absorption and assimilation of carbohydrates. Students will be able to explain the nature of several carbohydrate-related diseases such as diabetes and hypoglycemia. Students will demonstrate caramelization and crystallization. Students will understand the composition of starches and their relationship with simple sugars. Students will be able to use starch cookery to demonstrate the use of starch in techniques such as gelatinization and thickening of sauces. Students will explain the sources and role of fiber in diets. This content topic will provide opportunities for students to apply communication, leadership, management, and thinking skills to the study of carbohydrates in food science.

Key Ideas

NYS FACS 1 - Students will have the necessary knowledge and skills to establish and maintain physical fitness, participate in physical activity, and maintain personal health.

NYS FACS 2 - Students will acquire the knowledge and ability necessary to create and maintain a safe and healthy environment.

NYS FACS 3 - Students will understand and be able to manage personal resources of talent, time, energy, and money and make effective decisions in order to balance their obligations to work, family, and self.

NYS MST 1 - Students will use mathematical analysis, scientific inquiry, and engineering design, as appropriate, to pose questions, seek answers, and develop solutions.

NYS MST 4 Physical Setting 3 - Matter is made up of particles whose properties determine the observable characteristics of matter.

NYS MST 4 Living Environment 1 - Living things are both similar to and different from each other and nonliving things.

NYS MST 4 Living Environment 5 - Organisms maintain a dynamic equilibrium that sustains life.

NYS MST 4 Living Environment 6 - Plants and animals depend on each other and their physical environment.

NYS CDOS 1 - Students will be knowledgeable about the world of work, explore career options, and relate personal skills, aptitudes, and abilities to future career decisions.

NYS CDOS 2 - Students will demonstrate how academic knowledge and skills are applied in the workplace and other settings.

Performance Objectives and Supporting Competencies for Carbohydrates

Carbohydrates Performance Objective 1

C.1 Analyze carbohydrates in food products, their role in the body, and implications for preparation of these food products

- C.1.1. Identify the basic structure properties of carbohydrates
- C.1.2. Identify the dietary sources of carbohydrates
- C.1.3. Define mono-, di-, and poly- saccharides
- C.1.4. Identify the composition of starches
- C.1.5. Explain the ingestion, digestion, absorption, and use of carbohydrates in the human body
- C.1.6. Recognize diseases related to carbohydrate usage such as diabetes, hypoglycemia, and tooth decay
- C.1.7. Investigate advances in dietary carbohydrate management including, but not limited to, use of artificial sweeteners, and the concept of sugar alcohol
- C.1.8. Explain the functions of sugars in food preparations including, but not limited to, caramelization and crystallization
- C.1.9. Explain the functions of complex carbohydrates (starch) including, but not limited to, gelatinization and thickening processes
- C.1.10. Explain the sources and role of fiber in the diet

G. Lipids (L) *How can I analyze the properties and roles of lipids in food science?*

Standards Connections

Food Science Applications of Lipids supports the NYS Family and Consumer Sciences Learning Standards 1 – Personal Health and Fitness, 2 – A Safe and Healthy Environment and 3 – Resource Management; NYS Career Development and Occupational Studies Standards 1 – Career Development and 2 – Integrated Learning; and NYS MST Standards 1 – Analysis, Inquiry, and Design and 4 – Science

Rationale

The purpose of this content topic is to study the properties of lipids. Students will be able to differentiate between saturated and unsaturated fats. Students will recognize Triglycerides, cis-, trans-, and omega fats and explain their impact on overall health. Students will be able to explain the five functions of fat including tenderizing, aeration, heat medium, emulsions, and flavorings. Students will explain the positive and negative roles of fats in the body and the implications for healthy hearts and weight control. Students will identify ways to reduce fat consumption through food preparation modifications. This content topic will provide opportunities for students to apply communication, leadership, management, and thinking skills to the study of lipids in food science.

Key Ideas

NYS FACS 1 - Students will have the necessary knowledge and skills to establish and maintain physical fitness, participate in physical activity, and maintain personal health.

NYS FACS 2 - Students will acquire the knowledge and ability necessary to create and maintain a safe and healthy environment.

NYS FACS 3 - Students will understand and be able to manage personal resources of talent, time, energy, and money and make effective decisions in order to balance their obligations to work, family, and self.

NYS MST 1 - Students will use mathematical analysis, scientific inquiry, and engineering design, as appropriate, to pose questions, seek answers, and develop solutions.

NYS MST 4 Physical Setting 3 - Matter is made up of particles whose properties determine the observable characteristics of matter.

NYS MST 4 Living Environment 1 - Living things are both similar to and different from each other and nonliving things.

NYS MST 4 Living Environment 5 - Organisms maintain a dynamic equilibrium that sustains life.

NYS MST 4 Living Environment 6 - Plants and animals depend on each other and their physical environment.

NYS CDOS 1 - Students will be knowledgeable about the world of work, explore career options, and relate personal skills, aptitudes, and abilities to future career decisions.

NYS CDOS 2 - Students will demonstrate how academic knowledge and skills are applied in the workplace and other settings.

Performance Objectives and Supporting Competencies for Lipids

Lipids Performance Objective 1

- L.1 Analyze and describe the structure and compositions of lipids; explain lipid metabolism; develop techniques in selection and preparation of foods that avoid health problems related to lipids**
- L.1.1. Identify the basic structure and properties of lipids
 - L.1.2. Identify the dietary sources of lipids
 - L.1.3. Differentiate between saturated and unsaturated fats
 - L.1.4. Identify triglycerides and their roles as lipids
 - L.1.5. Explain advances in research regarding lipid metabolism included but not limited to omega, cis-fats and trans-fats
 - L.1.6. Describe the ingestion, digestion, absorption, and use of lipids in the human body
 - L.1.7. Examine diseases related to lipid consumption such as hypertension, atherosclerosis and obesity and heart disease
 - L.1.8. Examine the relationship between cholesterol and lipids
 - L.1.9. Explain the five functions of fat in food preparation (tenderizing, aeration, heat medium, emulsions, and flavorings)
 - L.1.10. Develop techniques of food preparation that minimize fat absorption
 - L.1.11. Identify ways to reduce fat consumption through food preparation modifications

H. Proteins (P) *How can I analyze the properties and roles of protein in food science?*

Standards Connections

Food Science Applications of Proteins supports the NYS Family and Consumer Sciences Learning Standards 1 – Personal Health and Fitness, 2 – A Safe and Healthy Environment and 3 – Resource Management; NYS Career Development and Occupational Studies Standards 1 – Career Development and 2 – Integrated Learning; and NYS MST Standards 1 – Analysis, Inquiry, and Design and 4 – Science

Rationale

The purpose of this content topic is to explore proteins, identify structure and nature of proteins and how these relate to functions of the body. Students will be able to define essential and non-essential amino acids and their sources. Students will be able to understand the processes of denaturation and coagulation and application to food preparation. Students will recognize the special features of proteins such as gelatinization and their roles in food preparation. Students will identify sources of plant and animal proteins. Students will demonstrate the impact of preparation methods on meat proteins, and identify analogs. This content topic will provide opportunities for students to apply communication, leadership, management, and thinking skills to the study of protein in food science.

Key Ideas

NYS FACS 1 - Students will have the necessary knowledge and skills to establish and maintain physical fitness, participate in physical activity, and maintain personal health.

NYS FACS 2 - Students will acquire the knowledge and ability necessary to create and maintain a safe and healthy environment.

NYS FACS 3 - Students will understand and be able to manage personal resources of talent, time, energy, and money and make effective decisions in order to balance their obligations to work, family, and self.

NYS MST 1 - Students will use mathematical analysis, scientific inquiry, and engineering design, as appropriate, to pose questions, seek answers, and develop solutions.

NYS MST 4 Physical Setting 3 - Matter is made up of particles whose properties determine the observable characteristics of matter.

NYS MST 4 Living Environment 1 - Living things are both similar to and different from each other and nonliving things.

NYS MST 4 Living Environment 5 - Organisms maintain a dynamic equilibrium that sustains life.

NYS MST 4 Living Environment 6 - Plants and animals depend on each other and their physical environment.

NYS CDOS 1 - Students will be knowledgeable about the world of work, explore career options, and relate personal skills, aptitudes, and abilities to future career decisions.

NYS CDOS 2 - Students will demonstrate how academic knowledge and skills are applied in the workplace and other settings.

Performance Objectives and Supporting Competencies for Proteins

Proteins Performance Objective 1

P.1 Analyze and understand the chemical composition of proteins and recognize the essential and non essential amino acids and their sources

- P.1.1. Identify the basic structure of amino acids and recognize their importance as building blocks of proteins
- P.1.2. Distinguish between essential and non-essential amino acids and their role in the body
- P.1.3. Relate protein shape to function in the body

Proteins Performance Objective 2

P.2 Identify sources of proteins and understand the various forms of proteins and how they are utilized by the body

- P.2.1. Identify sources of protein and their relative content
- P.2.2. Differentiate between complete, incomplete, and high quality protein and their relationship to vegetarian diets
- P.2.3. Describe the ingestion, digestion, absorption, and use of proteins in the human body
- P.2.4. Recognize conditions associated with protein deficiency
- P.2.5. Analyze the role of proteins as enzymes in regulating body metabolism

Proteins Performance Objective 3

P.3 Recognize the changes that take place during the preparation of proteins, and identify protein analogs

- P.3.1. Recognize causes of denaturation and coagulation of protein
- P.3.2. Relate the structure and nature of protein to specific types of food preparation such as but not limited to gelatinization and emulsification
- P.3.3. Demonstrate the impact of cooking methods on meat proteins
- P.3.4. Identify protein analogs

I. Vitamins and Minerals (VM) *How can I analyze the properties and roles of vitamins and minerals in food science?*

Standards Connections

Food Science Applications of Vitamins and Minerals supports the NYS Family and Consumer Sciences Learning Standards 1 – Personal Health and Fitness, 2 – A Safe and Healthy Environment and 3 – Resource Management; NYS Career Development and Occupational Studies Standards 1 – Career Development and 2 – Integrated Learning; and NYS MST Standards 1 – Analysis, Inquiry, and Design and 4 – Science

Rationale

The purpose of this content topic is to study the properties of vitamins and minerals. Students will describe fat and water soluble vitamins and their functions in the body. After reviewing a variety of vitamins and minerals, students will be able to distinguish between micro- and macro- minerals required for health, as well as their sources. Through investigation the students will identify deficiency and toxicity conditions associated with vitamins and minerals. Students will recognize the growing interest in phytochemicals that prevent various diseases. Students will recognize the need for nutrient retention as a goal of food preparation. This content topic will provide opportunities for students to apply communication, leadership, management, and thinking skills to the study of vitamins and minerals in food science.

Key Ideas

NYS FACS 1 - Students will have the necessary knowledge and skills to establish and maintain physical fitness, participate in physical activity, and maintain personal health.

NYS FACS 2 - Students will acquire the knowledge and ability necessary to create and maintain a safe and healthy environment.

NYS FACS 3 - Students will understand and be able to manage personal resources of talent, time, energy, and money and make effective decisions in order to balance their obligations to work, family, and self.

NYS MST 1 - Students will use mathematical analysis, scientific inquiry, and engineering design, as appropriate, to pose questions, seek answers, and develop solutions.

NYS MST 4 Physical Setting 3 - Matter is made up of particles whose properties determine the observable characteristics of matter.

NYS MST 4 Living Environment 1 - Living things are both similar to and different from each other and nonliving things.

NYS MST 4 Living Environment 5 - Organisms maintain a dynamic equilibrium that sustains life.

NYS MST 4 Living Environment 6 - Plants and animals depend on each other and their physical environment.

NYS CDOS 1 - Students will be knowledgeable about the world of work, explore career options, and relate personal skills, aptitudes, and abilities to future career decisions.

NYS CDOS 2 - Students will demonstrate how academic knowledge and skills are applied in the workplace and other settings.

Performance Objectives and Supporting Competencies for Vitamins and Minerals

Vitamins and Minerals Performance Objective 1

VM.1 Recognize the sources and types of vitamins and identify the role of vitamins in the efficient functioning of the body

- VM.1.1. Describe the general chemical structure of vitamins
- VM.1.2. Distinguish between fat and water soluble vitamins and their function in the body and implications to food preparation
- VM.1.3. Identify sources of vitamins
- VM.1.4. Explain the function of vitamins and identify conditions associated with deficiency and toxicity
- VM.1.5. Recognize the concept of bioavailability of vitamins and the factors that affect the bioavailability of vitamins

Vitamins and Minerals Performance Objective 2

VM.2 Recognize the sources and types of minerals and identify the role of minerals in the efficient functioning body

- VM.2.1. Describe the chemical nature of minerals
- VM.2.2. Distinguish between micro and macro minerals and their functions in the body
- VM.2.3. Identify sources of minerals
- VM.2.4. Identify conditions associated with mineral deficiency and toxicity
- VM.2.5. Recognize the importance of phytochemicals that reduce health risks for conditions such as but not limited to cancer and high cholesterol levels

J. Introduction to Microorganisms (IM) *How can I identify the types and characteristics of microorganisms associated with food science?*

Standards Connections

Introduction to Microorganism supports the NYS Family and Consumer Sciences Learning Standards 2 – A Safe and Healthy Environment and 3 – Resource Management; NYS Career Development and Occupational Studies Standards 1 – Career Development, 2 – Integrated Learning and 3a – Universal Foundation Skills; and NYS MST Standards 1 – Analysis, Inquiry, and Design and 4 – Science

Rationale

The purpose of this content topic is to analyze microorganisms and their relation to food science. Students will identify major groups of microorganisms. Students will be able to distinguish various microorganisms based on structure, shape, temperature and oxygen requirement. Students will explore the impact of microorganisms as they relate to food products. This content topic will provide opportunities for students to apply communication, leadership, management, and thinking skills to the study of microorganisms in food science.

Key Ideas

NYS FACS 2 - Students will acquire the knowledge and ability necessary to create and maintain a safe and healthy environment.

NYS FACS 3 - Students will understand and be able to manage personal resources of talent, time, energy, and money and make effective decisions in order to balance their obligations to work, family, and self.

NYS MST 1 - Students will use mathematical analysis, scientific inquiry, and engineering design, as appropriate, to pose questions, seek answers, and develop solutions.

NYS MST 4 Living Environment 1 - Living things are both similar to and different from each other and nonliving things.

NYS MST 4 Living Environment 2 - Organisms inherit genetic information in a variety of ways that result in continuity of structure and function between parents and offspring.

NYS MST 4 Living Environment 4 - The continuity of life is sustained through reproduction and development.

NYS MST 4 Living Environment 5 - Organisms maintain a dynamic equilibrium that sustains life.

NYS MST 4 Living Environment 6 - Plants and animals depend on each other and their physical environment.

NYS CDOS 1 - Students will be knowledgeable about the world of work, explore career options, and relate personal skills, aptitudes, and abilities to future career decisions.

NYS CDOS 2 - Students will demonstrate how academic knowledge and skills are applied in the workplace and other settings.

NYS CDOS 3a1 - Basic Skills

NYS CDOS 3a2 - Thinking Skills

NYS CDOS 3a3 - Personal Qualities

NYS CDOS 3a4 - Interpersonal Skills

NYS CDOS 3a5 - Technology

NYS CDOS 3a6 - Managing Information

NYS CDOS 3a7 - Managing Resources

NYS CDOS 3a8 - Systems

Performance Objectives and Supporting Competencies for Introduction to Microorganisms

Introduction to Microorganisms Performance Objective 1

IM.1 Investigate microorganisms in terms of classification and growth and their application to food science

- IM.1.1. Recognize the general groups into which microorganisms are classified
- IM.1.2. Distinguish bacteria based on shape, structure, temperature, and oxygen requirement
- IM.1.3. Recognize general features and types of fungi
- IM.1.4. Identify the various reproductive processes of bacteria, fungi, and other microorganisms
- IM.1.5. Identify the factors that impact the growth of microorganisms
- IM.1.6. Recognize the characteristics of microorganisms that are applicable to food science

K. Microorganisms in Food Science (MFS) *How can I understand the roles of microorganisms in food science?*

Standards Connection

Microorganisms in Food Science supports the NYS Family and Consumer Sciences Learning Standards 1 – Personal Health and Fitness, 2 – A Safe and Healthy Environment and 3 – Resource Management; NYS Career Development and Occupational Studies Standards 1 – Career Development, 2 – Integrated Learning, 3a - Universal Foundation Skills and 3b – Career Majors; and NYS MST Standards 1 – Analysis, Inquiry, and Design and 4 – Science

Rationale

The purpose of this content topic is to identify useful and harmful microorganisms and their effects on food products. Students will be able to identify the different types of fermentation processes. Students will understand the changes in nutritional values of foods caused by microorganisms. This content topic will provide opportunities for students to apply communication, leadership, management, and thinking skills to the study of specific microorganisms in food science.

Key Ideas

NYS FACS 1 - Students will have the necessary knowledge and skills to establish and maintain physical fitness, participate in physical activity, and maintain personal health.

NYS FACS 2 - Students will acquire the knowledge and ability necessary to create and maintain a safe and healthy environment.

NYS FACS 3 - Students will understand and be able to manage personal resources of talent, time, energy, and money and make effective decisions in order to balance their obligations to work, family, and self.

NYS MST 1 - Students will use mathematical analysis, scientific inquiry, and engineering design, as appropriate, to pose questions, seek answers, and develop solutions.

NYS MST 4 Living Environment 1 - Living things are both similar to and different from each other and nonliving things.

NYS MST 4 Living Environment 5 - Organisms maintain a dynamic equilibrium that sustains life.

NYS MST 4 Living Environment 6 - Plants and animals depend on each other and their physical environment.

NYS CDOS 1 - Students will be knowledgeable about the world of work, explore career options, and relate personal skills, aptitudes, and abilities to future career decisions.

NYS CDOS 2 - Students will demonstrate how academic knowledge and skills are applied in the workplace and other settings.

NYS CDOS 3a1 - Basic Skills

NYS CDOS 3a2 - Thinking Skills

NYS CDOS 3a3 - Personal Qualities

NYS CDOS 3a4 - Interpersonal Skills

NYS CDOS 3a5 - Technology

NYS CDOS 3a6 - Managing Information

NYS CDOS 3a7 - Managing Resources

NYS CDOS 3a8 - Systems

NYS CDOS 3b Human and Public Service - The student will be able to demonstrate a knowledge of the principles of sanitation used to prevent the transmission of disease-producing microorganisms from one person/object to another.

Performance Objectives and Supporting Competencies for Microorganisms in Food Science

Microorganisms in Food Science Performance Objective 1

MFS.1 Investigate useful microorganisms and their effects on food products

- MFS.1.1. Distinguish between aerobic and anaerobic respiration
- MFS.1.2. Define and identify the different kinds of fermentation processes
- MFS.1.3. Describe the process involved in the production of fermented products such as but not limited to yeast bread, vinegar, and cheeses
- MFS.1.4. Recognize the changes in nutritional value of foods caused by fermentation

Microorganisms in Food Science Performance Objective 2

MFS.2 Investigate harmful microorganisms and their effects on food products

- MFS.2.1. Distinguish between food intoxication and food infection
- MFS.2.2. Identify and understand the metabolism of microbes that results in food intoxication
- MFS.2.3. Identify and understand the metabolism of microbes that results in food infections
- MFS.2.4. Identify the sources of microbial food contamination

L. Food Preservation (FP) *How will I explain the concepts of food preservation as they relate to microorganisms and additives?*

Standards Connections

Food Preservation supports the NYS Family and Consumer Sciences Learning Standards 1 – Personal Health and Fitness, 2 – A Safe and Healthy Environment and 3 – Resource Management; NYS Career Development and Occupational Studies Standards 1 – Career Development, 2 – Integrated Learning, 3a – Universal Foundation Skills and 3b – Career Majors; and NYS MST Standards 1 – Analysis, Inquiry, and Design and 4 – Science

Rationale

The purpose of this content topic is to understand concepts of food related to preservation. Students will identify methods of preventing food spoilage and their relationship to food safety. Students will explain the importance of additives in food. Students will describe the desirable and undesirable properties of food additives. This content topic will provide opportunities for students to apply communication, leadership, management, and thinking skills to the study of food preservation strategies in food science.

Key Ideas

NYS FACS 1 - Students will have the necessary knowledge and skills to establish and maintain physical fitness, participate in physical activity, and maintain personal health.

NYS FACS 2 - Students will acquire the knowledge and ability necessary to create and maintain a safe and healthy environment.

NYS FACS 3 - Students will understand and be able to manage personal resources of talent, time, energy, and money and make effective decisions in order to balance their obligations to work, family, and self.

NYS MST 1 - Students will use mathematical analysis, scientific inquiry, and engineering design, as appropriate, to pose questions, seek answers, and develop solutions.

NYS MST 4 Physical Setting 3 - Matter is made up of particles whose properties determine the observable characteristics of matter.

NYS MST 4 Physical Setting 4 - Energy exists in many forms, and when these forms change energy is conserved.

NYS MST 4 Physical Setting 5 - Energy and matter interact through forces that result in changes in motion.

NYS MST 4 Living Environment 6 - Plants and animals depend on each other and their physical environment.

NYS MST 4 Living Environment 7 - Human decisions and activities have had a profound impact on the physical and living environment.

NYS CDOS 1 - Students will be knowledgeable about the world of work, explore career options, and relate personal skills, aptitudes, and abilities to future career decisions.

NYS CDOS 2 - Students will demonstrate how academic knowledge and skills are applied in the workplace and other settings.

NYS CDOS 3a1 - Basic Skills

NYS CDOS 3a2 - Thinking Skills

NYS CDOS 3a3 - Personal Qualities

NYS CDOS 3a4 - Interpersonal Skills

NYS CDOS 3a5 - Technology

NYS CDOS 3a6 - Managing Information

NYS CDOS 3a7 - Managing Resources

NYS CDOS 3a8 - Systems

NYS CDOS 3b Human and Public Service - The student will be able to demonstrate a knowledge of the principles of sanitation used to prevent the transmission of disease-producing microorganisms from one person/object to another.

Performance Objectives and Supporting Competencies for Food Preservation

Food Preservation Performance Objective 1

FP.1 Analyze and describe methods of food preservation and their relationship to food safety

- FP.1.1. Identify and explain methods of thermal preservation such as but not limited to blanching, pasteurization, and sterilization
- FP.1.2. Recognize changes caused by processing food
- FP.1.3. Explain dehydration as a means of food preservation
- FP.1.4. Identify methods of packing and processing foods
- FP.1.5. Describe the process of food irradiation and its effect on food
- FP.1.6. Examine the procedural considerations for freezing various foods
- FP.1.7. Describe the process of concentration and its effects on food
- FP.1.8. Explain the effects of packaging on foods
- FP.1.9. Review current research in the preservation and processing of food

Food Preservation Performance Objective 2

FP.2 Analyze types and functions of food additives, and identify common food additives and their roles in foods

- FP.2.1. Define the functions of additives
- FP.2.2. Identify the natural and synthetic additives used in foods
- FP.2.3. Differentiate incidental and intentional additives
- FP.2.4. Describe the desirable and undesirable properties of food additives
- FP.2.5. Identify problems associated with food additives
- FP.2.6. Outline the process of FDA approval of food additives

M. Food Safety (FS) *How will I explain the contamination of foods by non- microbial sources?*

Standards Connections

Food Safety supports the NYS Family and Consumer Sciences Learning Standards 1 – Personal Health and Fitness, 2 – A Safe and Healthy Environment and 3 – Resource Management; NYS Career Development and Occupational Studies Standards 1 – Career Development, 2 – Integrated Learning, 3a – Universal Foundation Skills and 3b – Career Majors; and NYS MST Standards 1 – Analysis, Inquiry, and Design and 4 – Science

Rationale

The purpose of this content topic is to understand sources of physical and chemical contamination in foods. Students will understand concepts of toxicity and bioaccumulation in foods. Students will demonstrate proper food handling techniques. Students will investigate government sanitation regulations in the food industry. This content topic will provide opportunities for students to apply communication, leadership, management, and thinking skills to the study of non-microbial contaminants in food science.

Key Ideas

NYS FACS 1 - Students will have the necessary knowledge and skills to establish and maintain physical fitness, participate in physical activity, and maintain personal health.

NYS FACS 2 - Students will acquire the knowledge and ability necessary to create and maintain a safe and healthy environment.

NYS FACS 3 - Students will understand and be able to manage personal resources of talent, time, energy, and money and make effective decisions in order to balance their obligations to work, family, and self.

NYS MST 1 - Students will use mathematical analysis, scientific inquiry, and engineering design, as appropriate, to pose questions, seek answers, and develop solutions.

NYS MST 4 Physical Setting 3 - Matter is made up of particles whose properties determine the observable characteristics of matter.

NYS MST 4 Living Environment 1 - Living things are both similar to and different from each other and nonliving things.

NYS MST 4 Living Environment 5 - Organisms maintain a dynamic equilibrium that sustains life.

NYS MST 4 Living Environment 6 - Plants and animals depend on each other and their physical environment.

NYS MST 4 Living Environment 7 - Human decisions and activities have had a profound impact on the physical and living environment.

NYS CDOS 1 - Students will be knowledgeable about the world of work, explore career options, and relate personal skills, aptitudes, and abilities to future career decisions.

NYS CDOS 2 - Students will demonstrate how academic knowledge and skills are applied in the workplace and other settings.

NYS CDOS 3a1 - Basic Skills

NYS CDOS 3a2 - Thinking Skills

NYS CDOS 3a3 - Personal Qualities

NYS CDOS 3a4 - Interpersonal Skills

NYS CDOS 3a5 - Technology

NYS CDOS 3a6 - Managing Information

NYS CDOS 3a7 - Managing Resources

NYS CDOS 3a8 - Systems

NYS CDOS 3b Human and Public Service - The student will be able to demonstrate a knowledge of the principles of sanitation used to prevent the transmission of disease-producing microorganisms from one person/object to another.

Performance Objectives and Supporting Competencies for Food Safety

Food Safety Performance Objective 1

FS.1 Analyze and describe methods of food preservation and their relationship to food safety

FS.1.1. Identify the sources of physical contamination

FS.1.2. Identify the sources of chemical contamination

FS.1.3. Identify the sources of toxic contamination

FS.1.4. Recognize the complications of improper food handling including, but not limited to, cross-contamination, temperature control, and poor personal hygiene

FS.1.5. Recognize and explain the concepts of bioaccumulation in the food supply

- FS.1.6. Outline voluntary efforts and government regulations related to sanitation in the food industry

Food Safety Performance Objective 2

FS.2 Establish a safe working environment within the food industry

- FS.2.1. Analyze and describe examples of health and safety problems in career areas
- FS.2.2. Identify and describe safety equipment appropriate for handling specific kinds of job-related materials
- FS.2.3. Analyze and develop safety rules to minimize health and safety hazards
- FS.2.4. Describe procedures necessary to combat an emergency in a workplace
- FS.2.5. Identify government regulations for workers in the food industry

N. Technological Advances in Food Science (TA) *What is the impact of technology on the development of food science?*

Standards Connections

Technological Advances in Food Science supports the NYS Family and Consumer Sciences Learning Standards 1 – Personal Health and Fitness, 2 – A Safe and Healthy Environment and 3 – Resource Management; NYS Career Development and Occupational Studies Standards 1 – Career Development, 2 – Integrated Learning and 3a – Universal Foundation Skills; and NYS MST Standard 4 – Science

Rationale

The purpose of this content topic is to exam technological advances as well as current trends and issues in the food industry. This content topic will provide opportunities for students to apply communication, leadership, management, and thinking skills to the study of technology in food science.

Key Ideas

NYS FACS 1 - Students will have the necessary knowledge and skills to establish and maintain physical fitness, participate in physical activity, and maintain personal health.

NYS FACS 2 - Students will acquire the knowledge and ability necessary to create and maintain a safe and healthy environment.

NYS FACS 3 - Students will understand and be able to manage personal resources of talent, time, energy, and money and make effective decisions in order to balance their obligations to work, family, and self.

NYS MST 4 Physical Setting 4 - Energy exists in many forms, and when these forms change energy is conserved.

NYS MST 4 Living Environment 2 - Organisms inherit genetic information in a variety of ways that result in continuity of structure and function between parents and offspring.

NYS MST 4 Living Environment 6 - Plants and animals depend on each other and their physical environment.

NYS MST 4 Living Environment 7 - Human decisions and activities have had a profound impact on the physical and living environment.

NYS CDOS 1 - Students will be knowledgeable about the world of work, explore career options, and relate personal skills, aptitudes, and abilities to future career decisions.

NYS CDOS 2 - Students will demonstrate how academic knowledge and skills are applied in the workplace and other settings.

NYS CDOS 3a1 - Basic Skills

NYS CDOS 3a2 - Thinking Skills

NYS CDOS 3a3 - Personal Qualities

NYS CDOS 3a4 - Interpersonal Skills

NYS CDOS 3a5 - Technology

NYS CDOS 3a6 - Managing Information

NYS CDOS 3a7 - Managing Resources

NYS CDOS 3a8 - Systems

Performance Objectives and Supporting Competencies for Technological Advances in Food Science

Technological Advances in Food Science Performance Objective 1

TA.1 Explore technological advances in food science

- TA.1.1. Examine the uses of biotechnology to improve the food supply
- TA.1.2. Examine the uses of genetic engineering to improve the food supply
- TA.1.3. Examine the process of developing new products in the food industry
- TA.1.4. Examine current issues and trends in the food industry

O. Food Industry Careers (FIC) *How will I be able to increase my knowledge of career opportunities in the food industry?*

Standards Connections

Food Industry Careers supports the NYS Family and Consumer Sciences Learning Standards 2 – A Safe and Healthy Environment and 3 – Resource Management; NYS Career Development and Occupational Studies Standards 1 – Career Development, 2 – Integrated Learning and 3a -Universal Foundation Skills; and NYS MST Standard 1 – Analysis, Inquiry, and Design and 4 – Science

Rationale

The purpose of this content topic is to explore careers. Students will research, perform site visits or achieve experience through internships or apprenticeships in the food industry. Students will understand the necessary preparation required for specific careers in the food industry. This content topic will provide opportunities for students to apply communication, leadership, management, and thinking skills to the study of careers in the food industry.

Key Ideas

NYS FACS 2 - Students will acquire the knowledge and ability necessary to create and maintain a safe and healthy environment.

NYS FACS 3 - Students will understand and be able to manage personal resources of talent, time, energy, and money and make effective decisions in order to balance their obligations to work, family, and self.

NYS MST 1 - Students will use mathematical analysis, scientific inquiry, and engineering design, as appropriate, to pose questions, seek answers, and develop solutions.

NYS MST 4 Living Environment 7 - Human decisions and activities have had a profound impact on the physical and living environment.

NYS CDOS 1 - Students will be knowledgeable about the world of work, explore career options, and relate personal skills, aptitudes, and abilities to future career decisions.

NYS CDOS 2 - Students will demonstrate how academic knowledge and skills are applied in the workplace and other settings.

NYS CDOS 3a1 - Basic Skills
NYS CDOS 3a2 - Thinking Skills
NYS CDOS 3a3 - Personal Qualities
NYS CDOS 3a4 - Interpersonal Skills
NYS CDOS 3a5 - Technology
NYS CDOS 3a6 - Managing Information
NYS CDOS 3a7 - Managing Resources
NYS CDOS 3a8 - Systems

Performance Objectives and Supporting Competencies for Food Industry Careers

Food Industry Careers Performance Objective 1

FIC.1 Identify occupations associated with food production, processing, preparation, and delivery

- FIC.1.1. Locate resources to research food industry jobs
- FIC.1.2. Relate careers with all the aspects of the food industry
- FIC.1.3. Determine the training or qualifications required to perform specific jobs in the food industry
- FIC.1.4. List personal attributes necessary for a successful career in the food industry

Appendix A

Suggested Laboratory Experiences for Food Science

Food Science is a Family and Consumer Sciences foods and nutrition cluster-level course that has been designed as a specialized option to fulfill the third year science graduation requirement for all students.

New York State mandates completion of three units of commencement level science for all students. The three units must be comprised of commencement level science courses aligned with the New York State Learning Standards in Mathematics, Science, and Technology. Units must include one course from the physical setting (physical science) and one course from the living environment (life science). The third may be from either life sciences or physical sciences. Food Science has been designed as a specialized course to fulfill the third year science requirement for all students. All commencement level science courses, including specialized courses, include laboratory activities.

In science, specialized courses may include laboratory activities scheduled within the regular classroom instructional meeting time, or may include additional laboratory time associated with earning a unit of credit. They do not include state-mandated laboratory experiments and do not end in a Regents examination.

Laboratory experiences are an integral part of the Food Science course. Laboratory experiences enable students to see how scientific principles are involved in food selection, preparation, and storage by applying knowledge, skills, and concepts introduced through classroom instruction.

The suggested laboratory experiences and Student Laboratory Form which follow are offered as suggestions to assist teachers in planning laboratories that promote a hands-on, experiential approach to learning. Each of the following laboratories is connected to the objectives and supporting competencies in Food Science:

- Acidity of Foods
- Canning of Simple Items
- Cheese Making
- Density Differences and Separations
- Effectiveness of Cleaning Products and Procedures on Microorganisms
- Effects of Salt on Boiling Point
- Fat and Water Content of Ground Meat Products
- Gluten Development in Dough
- Grocery Store Visit
- Nutritional Main Meals and Global Issues
- Oxidation of Foods
- Product Production and Presentation
- Salt and Water Balance in Vegetables
- Shortening Properties of Lipids in Pastry
- Vitamin C in Fruits and Vegetables
- Water Content in Foods
- Student laboratory Form

Acidity of Foods

Content Connections:

The Introduction to Food Science

B. Research Practice in Food Science (RFS)

C. Concepts of Physical Sciences relevant to Food Science (PS)

D. Concepts of Life Sciences relevant to Food Science (LS)

Objectives:

Students will identify and develop science skills necessary for successful scientific research. Students will be able to explain the steps of the scientific method and demonstrate its use in science investigations. Students will understand the concept of pH and explain its relationship to neutralization reactions, and recognize examples of neutralization reactions and indicate the influence of pH on biological systems.

Materials:

Litmus Paper

Water

Foods: pasta sauce, fruit yogurt, citrus juice, soups and foods common and easy to test.

Procedure:

Acid level of foods has become a health issue for those millions that suffer from acid reflux and other digestion problems associated with high acidity of the stomach and esophagus. Simple litmus paper can be used to test several prepared foods and their approximate acidity.

A review of the pH scale is critical. 14 would be the highest base or Alkaline number and 1 the most dangerous acidity. 7 is neutral and a persons stomach acid is somewhere in the 3 to 4 range.

Foods such as pasta sauce, fruit yogurt, citrus juice and soups could be some foods that are common and easy to test. In all a variety of foods that might fall into basic or acidic should be chosen. Even water can and should be tested since it may be added to some of the products chosen.

A list should be kept and recorded. Foods could also be mixed (as throughout a meal) and a final pH could be taken of the mixed foods. Tomato sauce should always be used because of the extremely high levels of acid it can achieve.

At the end of the activity have students mix some baking soda (bicarbonate of soda) into tomato sauce and note the result. The baking soda will react and bubble in the very acid environment. Have students take the acid readings before and after adding the baking soda. Finally, a separate batch of sauce could have bay leaves added to note the change they have on acid levels.

Extensions:

Students can research the amount of money spent on digestive medications in the United States. Long term health effects can also be explored. Conditions of ulcerations (stomach/esophagus), inflammations, and cancers associated with high digestive acid levels.

Canning of Simple Items

Content Connections:

Food Microbiology

K. Microorganisms in food science (MFS)

L. Food Preservation (FP)

M. Food Safety (FS)

Objectives:

Students will gain the understanding of clean kitchen practices by preparing foods for canning. Students will practice sterilization process. Students will measure the proper temperatures that ensure a safe jellied product. Students will diagram the steps needed to can fruits and vegetables. Students will complete process to can fruits and vegetables utilizing a non-pressure cooking technique. Students will sample their creations and evaluate how the process could be improved.

Materials:

Recommended resource - Ball-Blue Book of Preserving, ISBN # 0-9727537-0-2 Jarden Home Brands, Consumer Department, PO Box 2729, Muncie, IN 47307 - 0729

Common fruits or vegetables that are easy to prepare and can

Sugar

Pectin (Sure-Jell)

Pint size canning jars, lids, and rims

Large steaming pot or canner

Cooking thermometer

Procedure:

Students will take class time to review the steps in simple canning process. Sterilization process utilizing a non-pressure canner will be practiced prior to canning. Preparation of fruit or vegetables will be conducted before canning.

Studying the techniques will be conducted before activity.

Extensions:

Research the history of canning and pasteurization

Estimations will be made to the shelf life of the product they have produced

Jams or pickled products will be sampled by the class as the course comes to a close

Cheese Making

Content Connections:

Introduction to Food Science

C. Concepts of Physical Sciences Relevant to Food Science (PS)

Food Microbiology

K. Microorganisms in Food Science (M)

Objectives:

Students will recognize the processes of chemical separation such as but not limited to distillation, evaporation, and crystallization. Students will know the process involved in the production of fermented products such as but not limited to yeast bread, vinegar, and cheeses. Students will demonstrate how simple processes (chemical bonding, natural bacterial processes, and precipitation) can yield a useful food source high in calcium and protein and easy to preserve with vinegar, salting, and waxing. Students will use of various dairy products (butter milk, goat milk, and whole) to produce a variety of cheeses

Materials:

Cheese making is a common lab activity done in biology classes across the country. The use of vinegar, hydrochloric acid - HCL (1 molar or 8% solution), or the enzyme, rennilase, can all be used safely and effectively to produce large amounts of simple cheeses. Salting or adding other spice can also be done with partial melting.

Precipitation agent (HCL 8%/ 1 molar or white vinegar, or rennilase enzyme)

Cheese cloth (to separate the whey from curd)

Set of large spoons

Colander

Set of measuring cups

Variety of milks

Set of glass (non-aluminum) bowls

Procedure:

Teacher will demonstrate the process to the students. In a 1 quart pot milk is added and then the precipitant agent can be added. With gentle stirring the curd and whey will have separated to the point where the combination can be poured through a cheese cloth and colander.

This lab activity can be taken very far. Some that were researched included overnight clabbering of milk letting the natural lactobacilli bacteria create lactic acid which becomes the natural curdling agent.

Cheese-making kits can be purchased for classroom use. Kits contain dried milk, dried bacteria capsule, curdling enzyme and enough materials to use in a class of 30 students.

Extensions:

During yogurt making, watch the separation

Allow students to use a variety of milks (1%, 2%, whole, chocolate) and then speed things up with the 1% molar hydrochloric acid solution.

Density Differences and Separations

Content Connections:

The Introduction to Food Science

C. Concepts of Physical Sciences Relevant to Food Science (PS)

Food Biochemistry

G. Lipids (L)

Objective:

To observe and effectively separate liquids and foods utilizing separation due to density differences. Predict the outcome of two substances with unknown densities, and calculate them.

Materials:

Large eggs

Red Wine vinegar

Olive oil

Chicken stock

Saran or plastic wrap

Wire ties

Digital scale or triple beam balance

Metric calibrated clear measuring cup(s)

Procedure:

First Section

A group of three students will receive one large egg. The egg's density will be determined by weighing the egg, using a water displacement method (dropping egg into clear measuring cup to determine the amount of milliliters displaced) to determine volume, and then subtracting the mass of the shell after the egg has been emptied.

$$\text{Density} = \text{Mass/Volume}$$

The egg white will then be separated from the yolk using an egg separator or the shell. As the egg is being separated each part should be isolated into or onto a 5 in. by 5 in. sheet of plastic wrap. Once isolated each should be wrapped and tied. The separated egg section's density will be weighed and submerged to find out the yolk vs. the white density. Finally, the mass of tie and plastic wrap will be subtracted. Discussion can be generated on which will be less dense than water. Nutrition of each part as well as allergies can be discussed.

Second Section

Materials:

Glass 6 oz. containers or canning jars.

A variety of oils, (ie. canola, olive, corn, peanut, etc.)

A variety of vinegars (ie. white, apple cider, balsamic, etc.)

A variety of herbs and spices

Students in the same group will be timing how long it takes various types of vinegars and oils to separate after being shaken for 30 seconds. Students will predict what the separation rate will be if the two components are shaken for a longer period of time.

Tie-ins can be made with serving food and dressing preparation, minimum time to mix properly, and limit to separation time.

Dressing recipes can then be explored. After recipes have been completed the observation should once again be conducted. Did the separation time increase or decrease? Did the use of spices and other ingredients increase the density and did it inhibit separation?

Extensions:

Culminating activity can be testing the dressings that have been created. Special attention should be paid to greens and their preparation. Stress the importance of serving dried or spun greens so that water is removed from the surface. Have students mix their dressings with water and observe. Water and dressing rarely mix and to have their creation stick to the salad it should be served over dried greens.

The Effectiveness of Cleaning Products and Procedures on Microorganisms in the Home

Content Connections:

Intro to Food Science

B. Research Practices in Food Science (RP)

Food Microbiology

J. Introduction to Microorganisms (IM)

K. Microorganisms in Food Science (MFS)

Objectives:

Students will evaluate the effectiveness of eliminating microorganisms from household surfaces through various cleaning processes and agents. Students will set up the parameters of their experiment using scientific method. An artificial work surface will be made using flat baking sheets and plastic film. A liquid solution of water and the juices from spoiled meat or poultry will be applied in a thin film and allowed to dry. Then, sectioning the surface off, students will “clean” the sections under different methods they have chosen to apply, trying to replicate what they think the typical person would do at home. After cleaning the surface, they will collect samples from the cleaned surface and see if there are any microorganisms present.

Materials:

Petri dishes prepared with nutrient agar

Stretch film to secure Petri dishes

Cotton swabs

Sterile water

Permanent markers

Masking tape

Plastic disposable glove

Safety goggles

Liquid from spoiled meat

Tap water

Flat surfaces – (ex.: cardboard or baking sheets)

Dish detergent

Household sponges

Dish washing cloths

Paper towels

Various household (spray) cleansers appropriate for kitchen use

Plastic food storage wrap

Extra cardboard (old file folders will do)

Procedure:

Student lab groups will cover the flat surface with a layer of plastic food wrap, section the surface into large grids with masking tape, and cover with another layer of plastic wrap. Students will then apply the juice of the spoiled meat onto the entire surface, and allow it to dry. While protecting the grids from overspray with the extra cardboard, they will spray one section with a chosen household cleanser, wipe it clean with a paper towel, and then collect a sample

from the recently cleaned grid section to swab the prepared Petri dish. Repeat with different cleansers in a different grid section. Allow the samples to set at room temperature for several days or until a culture grows.

For variations, wipe a grid section with a sponge dampened with tap water, only; with a cloth dipped in a basin filled with water and dish detergent. Make your own household cleanser using ammonia and water; alcohol and water; household cleansers purchased in concentrate, and diluted with water. Have students use one cleanser only, but allow it to remain on the grid sections for different amounts of time (one minute, two minutes, three minutes, etc.) before wiping with a paper towel.

Extensions:

Have students take a poll of the student body about their practices for household cleanliness.

Have students research restaurant health codes for New York State.

Have students research local incidences of health code violations in restaurants and discuss what cleaning practices the food establishment could have implemented.

Effects of Salt on Boiling Point

Content Connections:

Introduction to Food Science

C. Concepts of Physical Sciences relevant to Food Science (PS)

Objective:

Students will use a variety of salts and concentrations in water to observe the effect salt has on boiling point temperatures

Materials:

Variety of salts (i.e. iodized and non-iodized, sea, organic salts)

Measuring utensils / cups

1 quart pots

Cooking thermometers

Procedure:

Students will measure equal amounts of three types of salts into equal amounts of water.

Students will take temperature measurements in both Fahrenheit and Celsius scales. Students will note any changes between varieties of salts

Students will conduct several more trials in which each time the concentration of salt is doubled

Data pertaining to salt concentration on boiling point will be kept

Five to six trials should be conducted and several groups may want to replicate procedure so several groups data can be plotted. Using log pro software or pencil on paper plot the results.

Students will create a mathematical ratio to determine how much quicker food could be cooked with a higher salt content in cooking water. Base lines will need to be established for common boiled foods like potatoes, pasta, and poached eggs.

Extension:

Explore the aspect of changing boiling point on elevation. To cook in the mile high city of Denver, CO requires only a 206° F and in Lake Tahoe water boils at 202° F. The drop is caused by the decrease in air pressure (which allows liquid to go to a gas much easier) and translates into a loss of .9° F for every 500 feet.

Some students might research the health aspects of non-iodized salt (goiter formation) in history, as well as health related issues to a high sodium diet.

Fat and Water Content of Ground Meat Products

Content Connections:

The Introduction to Food Science

B. Research Practices in Food Science (RP)

Food Biochemistry

E. Water (W)

G. Lipids (L)

H. Proteins (P)

Objectives:

Students will evaluate the fat and water content of different types of ground meat products. Fat will be rendered from the meat products by broiling them. The fat will be removed from the bottom of the broiling pan and placed in a container to harden overnight. Students will mass the fat and calculate how much of the ground meat sample is fat and how much of the mass lost is water. Students will also compare taste and juiciness of burgers from each ground meat product and compare it to the fat and water content.

Materials:

Balance

Bent-edged spatula

Rubber spatula

Instant-read thermometer

Marking pen

Masking tape

Cooking spray

Wax paper

454 g (1 pound) assigned ground meat product (meat samples may include beef containing 80%, 85%, 90%, 93%, or 97% fat as well as other options such as ground turkey, chicken, buffalo, or soy protein substitute)

Broiling rack

Beaker or cup

Paper towels

Procedure:

Student lab groups will be assigned their ground meat variation. Students will mass their ground meat sample. Students will divide ground meat into four hamburger patties and place on a broiling rack, broiling to an internal temperature of 74⁰C (165⁰F). Students will remove the cooked hamburger patties and mass them. Students will scrape the drippings from the bottom of the broiling rack into a beaker or cup and set aside to cool. It may cool overnight if necessary. When cool, the students will carefully lift the fat out of the beaker and blot dry on paper towels. Students will then mass the fat. Students will calculate what percentage of the ground meat sample consists of fat and conclude the remaining mass loss is water. Students will conduct a sensory evaluation of the four patties.

Extensions:

Research the role of fat in the diet and compare the nutritional value of animal fats to plant lipids.

Using Nutrition Facts Labels and on-line nutrient analysis, research the water and fat content of various meat products, such as hot dogs, and determine the relationship between fat content and water content in these products.

Research food issues related to meat consumption and compare to plant sources of protein in terms of health, cost, food safety issues, and protein content.

Gluten Development in Dough

Content Connections:

Food Biochemistry

F. Carbohydrates (C)

G. Lipids (L)

H. Proteins (P)

Objectives:

Students will learn that gluten ingredients are the main ingredient in baked goods because its elasticity allows gases to be trapped inside, giving a lighter structure to the baked product.

Students will prepare two doughs, one containing the assigned flour with fat, and one containing the assigned flour without fat. Students will observe characteristics of the two doughs and explain the effect of working the dough, as well as the effect fat has on gluten development.

Students will compare various flours and compare gluten development, concluding which flour contains the most gluten.

Materials:

Balance

Graduated cylinder

String

Scissors

16 g assigned flour for each group (i.e., bread, all-purpose, cake, whole wheat, gluten-free)

12 g shortening

2 bowls

Wooden spoon

Water (about 30 ml per sample)

Fork

Metric ruler

Procedure:

Student lab groups will prepare dough, using their assigned their flour variation. Students will blend 12 g shortening and 8 g assigned flour with a fork, adding enough water to hold the dough together. Students will prepare second dough using 8 g assigned flour and enough water to hold the dough together. Students will shape their two dough samples into uniform length tube-shaped rolls. Students will hold each end of the dough tube and pull along the length of a string. Cutting each string at the length at which the dough breaks, students will measure the length of each string. Taking the dough with only flour and water, students will work and knead it for 3 minutes. Students will shape it into a tube and stretch it along a length of string, cutting and measuring the string. Students will work and knead the same dough for another 3 minutes, and repeat the measurement process. Students will compare results with other student lab groups using other flours.

Extensions:

Research health conditions as they relate to wheat consumption and wheat alternatives in food preparation.

Research the fiber content of various flours and the role of fiber in health.

Students can present their findings and recommendations to the rest of the class.

Grocery Store Visit

Content Connections:

Food Microbiology

L. Food Preservation (FP)

The Future of Food Science

O. Food Industry Careers (FIC)

Objective:

Students will identify methods of packing and processing foods. Students will locate resources to research food industry jobs.

Procedure:

The teacher should create a check list of food items to investigate: fresh produce, baked items, dried goods, canned foods, and frozen meats and vegetables

Each student group will investigate:

1. How freshness is maintained (fresh, dried, irradiated, pasteurized, frozen)
2. What form of preservation is used (citric acid, ascorbic acid, chemical additives, etc.)
3. Where the product came from (location of origin)
4. Shelf life of each product

Extension:

Students can present their findings. Bring in a digital camera so that images of what was investigated can be used in a power point presentation. Products that can be used in the home for long term storage should also be discussed.

Students can review current research in the preservation and processing of food.

Nutritional Main Meals and Global Issues

Content Connections:

The Introduction to Food Science

- A. Food Science and Its Relevance to Global Society (FS)
- B. Research Practices in Food Science (RP)

Food Biochemistry

- F. Carbohydrates (C)
- G. Lipids (L)
- H. Proteins (P)
- I. Vitamins and Minerals (VM)

Food Microbiology

- M. Food Safety (FS)

Objectives:

Students will evaluate and compare the nutrient content, cost, and number of servings for meals when the main course ingredient is one pound of ground beef; dried beans and rice (1/2 pound each); tofu; quinoa; and farm-raised fresh salmon.

Materials:

List of protein “main dish” ingredient

Advance time for students to go to grocery store to obtain cost per pound

Computer time and internet access (class period reservation in school library)

Access to printer

Procedure:

Student lab groups will be research the cost and availability of one pound of each ingredient in the local supermarket. Using the USDA on-line database, students will identify the nutrient contributions of said ingredient (carbohydrate, protein, fat, vitamins, minerals and water) and record this information for each main-course ingredient. Search the USDA data-base for reported incidences of food recalls for each ingredient.

Extensions:

Research the health benefits of a vegetarian diet vs. a diet rich in protein from animal sources.

Research the reported incidences of food borne illnesses and food contamination in foods of animal sources vs. foods of plant sources in the last two years.

Research the environmental and economic issues of *farm-raised* fish.

Research the availability of each ingredient worldwide, and how it is grown or harvested; analyze the environmental issues surrounding each food, and its sustainability as a world crop.

Oxidation of Foods

Content Connections:

Introduction of Food Science

C. Concepts of Physical Sciences Relevant to Food Science (PS)

Objectives:

Students will be able to describe the nature of decomposition reactions and recognize examples of this type of reaction

Materials:

Variety of fruits: apples, pears, peaches, pineapple, light colored melon, bananas and avocado
Lemon juice

Procedure:

Food preparation includes how well the food can be stored and kept fresh as possible. Oxidation of foods causes them to dry out, discolor (meats) and to brown (fruits and vegetables). Observe how quickly various food items prepared under the same conditions will brown or oxidize.

Fruit is the easiest to prepare and visually watch for change. Some examples will be apples, pears, peaches, pineapple, light colored melon, bananas, and avocado. Students will cut pieces close in size and shape so as to keep surface area relatively uniform. Each student will record the time the piece was cut and when it appears to become brown.

A second group can prepare the same fruit varieties but dip their fruit pieces in lemon juice. Observe how long it takes before the oxidizing occurs.

Data should be collected and analyzed. Leading questions should also be generated. Which fruit lasted the longest? Why? How well did the lemon juice prevent oxidation? Did the lemon juice also kill or prevent bacteria from digesting the fruit's surface?

Extensions:

Use of sugar and water sprays to prevent oxidation.

Product Production and Presentation (Suggested culminating project)

Content Connections:

Future of Food Science

N. Technology Advances in Food Science (TFS)

O. Food Industry Careers (FIC)

Objective:

Working in pairs, students will create a food product that they will market to a group of peers. Student groups will conduct research and create a marketable food product, including nutritional information, health risk or benefit, target consumer, and comparison of production cost vs. consumer cost. Students will present their findings to a panel of teachers and peers. A question and answer session could culminate the presentation.

Project Outline:

Student groups will present a product idea.

Students will conduct a presentation.

Students should dress the part of a marketing professional.

A product prototype should be present.

Presentation should address the following concepts:

- Inspiration for the food product (health, nutritional, new market, diet / exercise)
- Research aspects (Is this a new product or one that is improved from an existing?)
- Ingredient research (What will go into your product and how will it be tested?)
- Health benefit / risks (documented study or ingredient breakdown)
- Packaging run down (How and what type of materials in product and packaging?)
- Shipping proposal (small to large production, by rail, road, air, local, etc.)
- Cost research (How much to produce, package, ship product vs. consumer product price?)
- Profit margin

Salt and Water Balance in Vegetables

Content Connections:

The Introduction to Food Science

D. Concepts of Life Sciences Relevant to Food Science (LS)

Food Biochemistry

E. Water (W)

I. Vitamins and Minerals (VM)

Objectives:

Students will learn how the concentration of salt affects the movement of water into and out of the cell through its membrane.

Materials:

Masking tape

Marking pen

250 ml distilled water

2 small bowls

15 ml table salt

Vegetable sample for each lab group (i.e., 2 large lettuce leaves, spinach, or sliced and quartered cucumber, eggplant, zucchini, celery)

Timer

Balance

Paper towels

Spoon

Procedure:

Students will pour half the water into each labeled bowl. Students will add the salt to one bowl and stir. Students will mass the vegetables before placing equal amounts into each bowl. After the vegetables soak in the bowls for 30 minutes, students will remove each of the vegetable samples, observing whether the vegetable is limp or crispy. After thoroughly drying each vegetable sample, they will be massed again and the amount of water loss will be calculated for each sample.

Extensions:

Research the health related issues related to both high and low sodium diets.

Research the amount of sodium in various processed foods (i.e., cereals, potato chips, tomato sauce, soup,) and compare to the sodium content of whole foods (i.e., fruits and vegetables)

Research health related issues related to other minerals (i.e., potassium, calcium, iron, or phosphorous)

Students can repeat this experiment, substituting monosodium glutamate or potassium chloride in place of sodium chloride.

Shortening Properties of Lipids in Pastry

Content Connections:

The Introduction to Food Science

B. Research Practices in Food Science (RP)

C. Concepts of Physical Sciences Relevant to Food Science (PS)

Food Biochemistry

G. Lipids (L)

Objectives:

Students will experience why lipids are an important ingredient in baked goods. Students will measure the shortening properties of various lipids. Students will compare the flavor and texture of piecrusts prepared with various lipids.

Materials:

Flour

Salt

Variety of lipids (i.e., hydrogenated shortening, lard, margarine, vegetable oil, butter, tub margarine, liquid margarine)

100-ml graduated cylinder

Balance

Fork or pastry blender

Cookie Sheet

Aluminum foil

Oven mitt or potholder

Pizza cutter or knife

Sifter

Mixing bowl

Metric measuring spoons

Turner or spatula

Pastry blender (for all variations, except oil)

2 rulers

Procedure:

Student lab groups will prepare a pie pastry using equal amounts of flour, salt, water, and one lipid. Students will pat out the pastry into a uniform-sized square on an aluminum foil covered cookie sheet, cutting it into an equal amount of squares before baking.

After baking, each student lab group will stack an equal number of the pastry squares and measure the height of the pastry stack.

Students will conduct a sensory evaluation of the remaining pastry samples.

Students will determine which lipid has the best shortening qualities as well as discuss which lipid might be best for various baked goods.

Extensions:

Research degree of saturation of various lipids and make a conclusion about the relationship between saturation and flakiness of pastries.

Research hydrogenation of lipids and their uses in extending shelf life of baked goods. Estimate the shelf life of pastry based on the degree of saturation in each lipid used in this experiment.

Research the effects of saturated fats, unsaturated fats, and trans-fatty acids in the diet.

Recognizing Sources of Vitamin C

Content Connections:

Intro to Food Science

A. Food Science and Its Relevance to Global Society (GS)

B. Research Practices in Food Science (RP)

Food Biochemistry

I. Vitamins and Minerals (VM)

Objectives:

Students will identify the presence of Vitamin C in a variety of fruits and vegetables.

Materials:

Tap Water

Cornstarch

Iodine

Liquid measuring cup

Measuring spoons

Blender

Mixing bowls

Mixing spoons

Knives

Cutting boards

Access to stove or burner

Tea kettle (to boil water)

Spoons or stirrers

Fresh fruits and vegetables *and/or* fruit and vegetable juice

Procedure:

Have students prepare an acid indicator of one teaspoon cornstarch dissolved in 1 cup of boiling water, set aside to cool for fifteen minutes. Add drops of iodine while stirring the cornstarch mixture until the mixture turns blue. This is the Vitamin C indicator. Place small amounts (about 1 teaspoon) of the indicator into clear glass test tubes or small drinking glasses or clear jars.

Meanwhile, extract juices from the various fruits and vegetables obtained. Either squeeze the juice, or mash the produce until there is juice to collect. You may have students pulse some fruits or vegetables in a blender. Using an eye dropper, slowly add the fruit or vegetable juice, one drop at a time, until the indicator is no longer blue. Have students record how many drops were necessary.

The higher the concentration of Vitamin C, the *fewer* drops of produce juice needed to make the blue color of the indicator disappear.

Extensions:

Research Hypo- and Hyper-vitaminosis and the diseases related to vitamin deficiency and excessive amounts.

Research how Food Scientists determined the minimum recommended dietary allowances for vitamins.

Research the effect of various lifestyle choices and health conditions on the body's ability to metabolize vitamins (smoking, drug abuse, alcohol consumption, etc.)

Water Content in Foods

Content Connections:

Food Biochemistry
E. Water (W)

Objective:

Students will calculate the % of water in fruits by the process of weighing and dehydrating common fruits (i.e. pineapple, apple, pears, mango,).

Materials:

Variety of fruits that can be easily sliced and dehydrated (ie. apples, pears, kiwi, mango, bananas)
Standard measuring cup(s)
Digital scale or triple beam balance
Standard stackable dehydrator unit

Procedure:

Students should work in a group setting for the initial part of the lab. A fruit must be selected by the group and 100 gms. (approx. 1/4 pound) will be prepared to the manufacturing guideline specification for the dehydrator chosen.

The group will make an estimate of what percentage water content their fruit possesses. As close to 100 gms. of fruit will be prepared and weighed. It is easiest to use 100 gms. so that calculations are simplified. Any amount may be used. Ratio / proportion calculations should be reviewed and employed during the lab. All measurements should be kept to the nearest tenth. All information should be kept in data table form.

Students can also take data during the days to dehydrate. Since many of the fruits will be sliced in a rounded fashion, measurements of the diameter can also be taken to note size loss.

At the end of the drying period the groups will once again weigh the original prepared fruit and compare and calculate the weight loss due to the evaporation of water.

Graphing of the data collected by all groups can be created as well as comparing the groups' predictions. Each group should create their own graphing display using a variety of mediums and technologies.

Extensions:

Further nutritional and preservation techniques can be discussed. Determining which fruits may last the longest can also be determined as the class progresses. Use of simple preserving agent (i.e. citric acid, light coating of sugar).

**FAMILY AND CONSUMER SCIENCES – FOOD SCIENCE
STUDENT LABORATORY REPORT FORM**

Student Name: _____

Laboratory Title: _____

Laboratory Date(s): _____

Laboratory Report Due Date: _____

Laboratory Purpose:

Materials:

Laboratory Procedure:

Hypothesis:

If, then statement

Calculations:

Observations:

Data Reporting:

Table, chart or graph

Questions:

Answer any questions the teacher has included for this laboratory

Conclusion:

This section of the laboratory report is where observations are discussed with respect to the objectives of the lab. You may want to start your conclusion with a phrase like “From this lab I learned....” or “I would like to know more about....”

Recommendations:

This section of your laboratory is where you discuss any extension activity you have done as recommended by this experiment. You may also recommend ways in which you and your lab partner could have achieved more accurate results with regard to laboratory procedure. You may state “To get more accurate results we could have....”

Further research suggestions can be included here.

Appendix B

FAMILY AND CONSUMER SCIENCES – FOOD SCIENCE BEST PRACTICES RUBRIC

Indicators	1 Falls Below Expectations	2 Approaches Expectations	3 Meets Expectations	4 Exceeds Expectations
NYS FACS Learning Standards	Does not connect to NYS FACS Learning Standards.	Has limited evidence of connection to 1 NYS FACS Learning Standard.	Adequate evidence of connection to 1 or more NYS FACS Learning Standards.	Evidence of strong connections to 2 or more NYS FACS Learning Standards
NYS CDOS Learning Standards	Does not connect to NYS CDOS Learning Standards.	Has limited evidence of connection to 1 NYS CDOS Learning Standard.	Adequate evidence of connection to 1 or more NYS CDOS Learning Standard including Standard 3b.	Evidence of strong connections to 2 or more NYS CDOS Learning Standards including Standard 3b.
NYS MST Learning Standard and NYS academic Learning Standards	Does not connect to NYS MST Learning Standards, or other NYS academic Learning Standards.	Has limited evidence of connection to NYS MST Learning Standard, or to 1 NYS academic Learning Standard.	Adequate evidence of connection NYS MST Learning Standard and to 1 or more NYS academic Learning Standard.	Evidence of strong connections to NYS MST Learning Standard and to 1 or more NYS academic Learning Standard.
Course Content Topics	Does not relate to Content Topics.	Addresses 1 Content Topic.	Integrates 2 Content Topics.	Integrates 3 or more Content Topics.
Process Skills	Does not integrate Process Skills.	Integrates 1 Process Skill.	Integrates 2 Process Skills.	Integrates 3 or more Process Skills.
Strategy	Instruction is dependent primarily on textbooks, lecture, paper, and pencil. Teacher driven.	Hands-on experiential learning is limited. Minimal student involvement.	Includes 75 percent hands-on experiential learning. Adequate student involvement.	Includes more than 75 percent hands-on experiential learning. Active student engagement. Teacher as facilitator.
Implementation	Does not flow in a logical sequence. Necessary resources would make implementation difficult.	Follows a logical sequence. Most necessary resources may make implementation difficult.	Follows a logical sequence. Some necessary resources may make implementation difficult.	Follows a logical sequence. All necessary resources make implementation easy.
Assessment	Cannot be assessed. Or Assessment not included.	Assessment is vaguely related to objectives and competencies.	Assessment relates to objectives and competencies.	Assessment is directly related to objectives and competencies.

FOOD SCIENCE BEST PRACTICES TEMPLATE

NYS LEARNING STANDARDS:

Family & Consumer Sci 1 _____

2 _____

3 _____

CDOS 1 _____

2 _____

3a _____

3b _____

MST 1 2 3 4 5 6

FOOD SCIENCE

CONTENT TOPICS:

Influences on Food Choices _____

Nutrition Principles & App. _____

Science & Tech. of Food _____

Safety & Sanitation _____

Foundations of Food Prod. _____

Grains & Grain Products _____

Fruits & Fruit Products _____

Vegetables & Veg Products _____

Milk & Milk Products _____

Meat & Meat Alternatives _____

Meal Mgmt. & Preparation _____

Food Product Marketing _____

Food Service & Etiquette _____

Career Pathways in F&N _____

APPLIED PROCESS SKILLS:

Communication _____

Leadership _____

Management _____

Thinking _____

APPLIED ACADEMICS:

Circle Standard Number(s)

ELA 1 2 3 4

Soc St 1 2 3 4 5

The Arts 1 2 3 4

LOTE 1 2

TITLE: _____

CONTENT TOPICS: (Complete only those that apply)

Food Science and Its Relevance to Global Society (FS)

- Performance Objective – FS
 - Supporting Competency – FS

Research Practices in Food Science (RP)

- Performance Objective – RP
 - Supporting Competency – RP

Concepts of Physical Sciences Relevant to Food Science (PS)

- Performance Objective – PS
 - Supporting Competency – PS

Concepts of Life Sciences Relevant to Food Science (LS)

- Performance Objective – LS
 - Supporting Competency – LS

Water (W)

- Performance Objective – W
 - Supporting Competency – W

Carbohydrates (C)

- Performance Objective – C
 - Supporting Competency – C

Lipids (L)

- Performance Objective – L
 - Supporting Competency – L

Proteins (P)

- Performance Objective – P
 - Supporting Competency – P

Vitamins and Minerals (VM)

- Performance Objective – VM
 - Supporting Competency – VM

Introduction to Microorganisms (IM)

- Performance Objective – IM
 - Supporting Competency – IM

Microorganisms in Food Science (MFS)

- Performance Objective – MFS
 - Supporting Competency – MFS

Food Preservation (FP)

- Performance Objective – FP
 - Supporting Competency – FP

Food Safety (FS)

- Performance Objective – FS
 - Supporting Competency – FS

Technological Advances in Food Science (TA)

- Performance Objective – TA
 - Supporting Competency – TA

Food Industry Careers (FIC)

- Performance Objective – FIC
 - Supporting Competency – FIC

TITLE:

GOAL:

STRATEGY:

ASSESSMENT (Attach rubric):

Appendix C

FOOD SCIENCE PERFORMANCE OBJECTIVES AND SUPPORTING COMPETENCIES

A. Food Science and Its Relevance to Global Society (FS)

FS.1 Recognize food science as a relevant science including current and historical developments and advancements of global food production

- FS.1.1. Define food science and relate it to other science disciplines
- FS.1.2. Recognize the history and development of food into a highly regulated industry
- FS.1.3. Relate the contribution of food scientists to the advancement of global food production
- FS.1.4. Explain the importance of studying food science

B. Research Practices in Food Science (RP)

RP.1 Explain the role of science in food science as it relates to research practices and practical scientific experiments

- RP.1.1. Relate the role of science to the development of the food industry
- RP.1.2. Identify and develop science skills necessary for successful scientific research
- RP.1.3. Explain the steps of the scientific method and demonstrate its use in science investigations
- RP.1.4. Design proper science experiments
- RP.1.5. Demonstrate the knowledge and use of good and safe laboratory practices
- RP.1.6. Explain the unique nature of clinical studies and acquire skills in evaluating scientific studies

C. Concepts of Physical Sciences Relevant to Food Science (PS)

PS.1 Identify and classify selected elements and interpret chemical symbols for elements, and describe atomic particles

- PS.1.1. Classify elements into appropriate categories based on their properties
- PS.1.2. List subatomic particles
- PS.1.3. Identify elements by their chemical symbols
- PS.1.4. Explain properties characteristic of selected elements

PS.2 Classify and identify compounds and common properties

- PS.2.1. Explain the various types of chemical bonds and relate to the properties of compounds
- PS.2.2. Classify compounds into appropriate categories based on their types of bonding and properties
- PS.2.3. List examples of compounds used in the home and in occupations

PS.3 Distinguish between the different kinds of chemical reactions and understand the factors that effect them

- PS.3.1. Describe the nature of synthesis reactions and recognize examples of this type of reaction

- PS.3.2. Describe the nature of decomposition reactions and recognize examples of this type of reaction
- PS.3.3. Understand the concept of pH and explain its relationship to neutralization reactions, and recognize examples of neutralization reactions
- PS.3.4. Explain the effect of factors on the rate of chemical reactions such as but not limited to temperature, pH, and energy

PS.4 Define and classify mixtures based on their chemical properties

- PS.4.1. Classify mixtures into appropriate categories based on the distribution of particles
- PS.4.2. List examples of mixtures used in the home and in occupations
- PS.4.3. Explain the difference between compounds and mixtures

PS.5 Identify the forms and sources of energy and understand their relationship to physical and chemical processes

- PS.5.1. Explain the various forms of energy such as but not limited to heat, light and electricity and understand the conversion from one form of energy to another
- PS.5.2. Recognize the various sources of energy
- PS.5.3. Identify and explain the relationship between potential and kinetic energy
- PS.5.4. Explain the concept of calories and temperature as measurements relevant to food science
- PS.5.5. Explain the ways energy flows and its relationship to food processes
- PS.5.6. Describe the relationship between energy and different phases of matter
- PS.5.7. Distinguish between endothermic and exothermic reactions
- PS.5.8. Explain the conditions that influence energy utilization in food preparation

PS.6 Recognize the use of mechanical and chemical processes of separation in food science

- PS.6.1. Recognize the process of mechanical separation based on physical properties such as but not limited to size and shape of particles
- PS.6.2. Recognize the processes of mechanical separation based on density such as but not limited to sedimentation and creaming
- PS.6.3. Recognize the processes of mechanical separation based on increased force such as but not limited to centrifuging and pressurization
- PS.6.4. Recognize the processes of chemical separation such as but not limited to distillation, evaporation, and crystallization
- PS.6.5. Recognize the process of selective separation using barriers such as filters and semi-permeable membranes

D. Concepts of Life Sciences Relevant to Food Science (LS)

LS.1 Explain the process of metabolism and relate it to the body's utilization of nutrients; explain the organization of the human body and the factors controlling efficient functioning of the body

- LS.1.1. Define metabolism and distinguish between anabolism and catabolism
- LS.1.2. Recognize the structure of biological membranes and its relationship to the movement of substances into and out of cells
- LS.1.3. Recognize the process of diffusion and its relationship to osmosis and movement of substances across semi-permeable membranes
- LS.1.4. Explain the influence of pH on biological systems
- LS.1.5. Examine the relationship of variations in metabolic rate and factors such as but not limited to body types, nutrient intake and physical activity

LS.2. Describe the levels of organization of life and the relationship to the human body

- LS.2.1. Recognize the structure and function of the cell
- LS.2.2. Recognize the relationship among cells, tissues, organs, and organ systems with respect to the human body
- LS.2.3. Describe the basic functions of human body systems
- LS.2.4. Explain the integrated function of human body systems for maintenance of life
- LS.2.5. Recognize the importance of recommended dietary allowances and their effect on homeostasis for efficient functioning of human body systems

E. Water (W)

W.1 Analyze and describe chemical composition and the three phases of water in the role of food preparation

- W.1.1. Cite the composition and chemical formula of water
- W.1.2. Determine the freezing, melting, boiling, and vaporization point of water and the influence of atmospheric pressure (altitude)
- W.1.3. Demonstrate the use of water in food preparation for heat transfer and solutions
- W.1.4. Describe the body requirements for water and its nutritional value
- W.1.5. Demonstrate an understanding of osmosis

F. Carbohydrates (C)

C.1 Analyze carbohydrates in food products, their role in the body, and implications for preparation of these food products

- C.1.1. Identify the basic structure properties of carbohydrates
- C.1.2. Identify the dietary sources of carbohydrates
- C.1.3. Define mono-, di-, and poly- saccharides
- C.1.4. Identify the composition of starches
- C.1.5. Explain the ingestion, digestion, absorption, and use of carbohydrates in the human body
- C.1.6. Recognize diseases related to carbohydrates such as diabetes, hypoglycemia, and tooth decay

- C.1.7. Investigate advances in dietary carbohydrate management including, but not limited to, use of artificial sweeteners, and the concept of sugar alcohol
- C.1.8. Explain the functions of sugars in food preparations including, but not limited to, caramelization and crystallization
- C.1.9. Explain the functions of complex carbohydrates (starch) including, but not limited to, gelatinization, thickening processes
- C.1.10. Explain the sources and role of fiber in the diet

G. Lipids (L)

L.1 Analyze and describe the structure and compositions of lipids; explain lipid metabolism; develop techniques in selection and preparation of foods that avoid health problems related to lipids

- L.1.1. Identify the basic structure and properties of lipids
- L.1.2. Identify the dietary sources of lipids
- L.1.3. Differentiate between saturated and unsaturated fats
- L.1.4. Identify triglycerides and their roles as lipids
- L.1.5. Explain advances in research regarding lipid metabolism included but not limited to omega, cis-fats and trans-fats
- L.1.6. Describe the ingestion, digestion, absorption, and use of lipids in the human body
- L.1.7. Examine diseases related to lipid consumption such as hypertension, atherosclerosis, obesity and heart disease
- L.1.8. Examine the relationship between cholesterol and lipids
- L.1.9. Explain the five functions of fat in food preparation (tenderizing, aeration, heat medium, emulsions, and flavorings)
- L.1.10. Develop techniques of food preparation that minimize fat absorption
- L.1.11. Identify ways to reduce fat consumption through food preparation modifications

H. Proteins (P)

P.1 Analyze and understand the chemical composition of proteins and recognize the essential and non essential amino acids and their sources

- P.1.1. Identify the basic structure of amino acids and recognize their importance as building blocks of proteins
- P.1.2. Distinguish between essential and non-essential amino acids and their role in the body
- P.1.3. Relate protein shape to function in the body

P.2 Identify sources of proteins and understand the various forms of proteins and how they are utilized by the body

- P.2.1. Identify sources of protein and their relative content
- P.2.2. Differentiate between complete, incomplete, and high quality proteins and their relationship to vegetarian diets
- P.2.3. Describe the ingestion, digestion, absorption, and use of proteins in the human body
- P.2.4. Recognize conditions associated with protein deficiency
- P.2.5. Analyze the role of proteins as enzymes in regulating metabolism

P.3 Recognize the changes that take place during the preparation of proteins and identify protein analogs

- P.3.1. Recognize causes of denaturation and coagulation of protein
- P.3.2. Relate the structure and nature of protein to specific types of food preparation such as but not limited to gelatinization and emulsification
- P.3.3. Demonstrate the impact of cooking methods on meat proteins
- P.3.4. Identify protein analogs

I. Vitamins and Minerals (VM)

VM.1 Recognize the sources and types of vitamins and identify the role of vitamins in the efficient functioning of the body

- VM.1.1. Describe the general chemical structure of vitamins
- VM.1.2. Distinguish between fat and water soluble vitamins and their function in the body and implications to food preparation
- VM.1.3. Identify sources of vitamins
- VM.1.4. Explain the function of vitamins and identify conditions associated with deficiency and toxicity
- VM.1.5. Recognize the concept of bioavailability of vitamins and the factors that affect the bioavailability of vitamins

VM.2 Recognize the sources and types of minerals; and identify the role of minerals in the efficient functioning body

- VM.2.1. Describe the chemical nature of minerals
- VM.2.2. Distinguish between micro and macro minerals and their functions in the body
- VM.2.3. Identify sources of minerals
- VM.2.4. Identify conditions associated with mineral deficiency and toxicity
- VM.2.5. Recognize the importance of phytochemicals that reduce the health risks of conditions such as but not limited to cancer and high cholesterol levels

J. Introduction to Microorganisms (IM)

IM.1 Investigate microorganisms in terms of classification and growth and their application to food science

- IM.1.1. Recognize the general groups into which microorganisms are classified
- IM.1.2. Identify bacteria based on shape, structure, temperature, and oxygen requirement
- IM.1.3. Recognize general features and types of fungi
- IM.1.4. Identify the various reproductive processes of bacteria, fungi, and other microorganisms
- IM.1.5. Identify the factors that impact the growth of microorganisms
- IM.1.6. Recognize the characteristics of microorganisms that are applicable to food science

K. Microorganisms in Food Science (MFS)

MFS.1 Investigate useful microorganisms and their effects on food products

- MFS.1.1. Distinguish between aerobic and anaerobic respiration
- MFS.1.2. Define and identify the different kinds of fermentation processes

- MFS.1.3. Describe the process involved in the production of fermented products such as but not limited to yeast bread, vinegar, and cheeses
- MFS.1.4. Recognize the changes in nutritional value of foods caused by fermentation

MFS.2 Investigate harmful microorganisms and their effects on food products

- MFS.2.1. Distinguish between food intoxication and food infection
- MFS.2.2. Identify and understand the metabolism of microbes that results in food intoxication
- MFS.2.3. Identify and understand the metabolism of microbes that results in food infections
- MFS.2.4. Identify the sources of microbial food contamination

L. Food Preservation (FP)

FP.1 Analyze and describe methods of food preservation and their relationship to food safety

- FP.1.1. Identify and explain methods of thermal preservation such as but not limited to blanching, pasteurization, and sterilization
- FP.1.2. Recognize changes caused by processing food
- FP.1.3. Explain dehydration as a means of food preservation
- FP.1.4. Identify methods of packing and processing foods
- FP.1.5. Describe the process of food irradiation and its effect on food
- FP.1.6. Examine the procedural considerations for freezing various foods
- FP.1.7. Describe the process of concentration and its effects on food
- FP.1.8. Explain the effects of packaging on foods
- FP.1.9. Review current research in the preservation and processing of food

FP.2 Analyze types and functions of food additives, and identify common food additives and their roles in foods

- FP.2.1. Define the functions of additives
- FP.2.2. Identify the natural and synthetic additives used in foods
- FP.2.3. Differentiate incidental and intentional additives
- FP.2.4. Describe the desirable and undesirable properties of food additives
- FP.2.5. Identify problems associated with food additives
- FP.2.6. Outline the process of FDA approval of food additives

M. Food Safety (FS)

FS.1 Analyze and describe methods of food preservation and their relationship to food safety

- FS.1.1. Identify the sources of physical contamination
- FS.1.2. Identify the sources of chemical contamination
- FS.1.3. Identify the sources of toxic contamination
- FS.1.4. Recognize the complications of improper food handling including, but not limited to, cross-contamination, temperature control, and poor personal hygiene
- FS.1.5. Recognize and explain the concepts of bioaccumulation in the food supply
- FS.1.6. Outline voluntary efforts and government regulations related to sanitation in the food industry

FS.2 Establish a safe working environment within the food industry

- FS.2.1. Analyze and describe examples of health and safety problems in career areas
- FS.2.2. Identify and describe safety equipment appropriate for handling specific kinds of job-related materials
- FS.2.3. Analyze and develop safety rules to minimize health and safety hazards
- FS.2.4. Describe procedures necessary to combat an emergency in a workplace
- FS.2.5. Identify government regulations for workers in the food industry

N. Technological Advances in Food Science (TA)

TA.1 Explore technological advances in food science

- TA.1.1. Examine the uses of biotechnology to improve the food supply
- TA.1.2. Examine the uses of genetic engineering to improve the food supply
- TA.1.3. Examine the process of developing new products in the food industry
- TA.1.4. Examine current issues and trends in the food industry

O. Food Industry Careers (FIC)

FIC.1 Identify occupations associated with food production, processing, preparation, and delivery

- FIC.1.1. Locate resources to research food industry jobs
- FIC.1.2. Relate careers with all the aspects of the food industry
- FIC.1.3. Determine the training or qualifications required to perform specific jobs in the food industry
- FIC.1.4. List personal attributes necessary for a successful career in the food industry

Appendix D

HOME AND CAREER SKILLS PROCESS SKILLS

The information below is excerpted from the New York State Home and Career Skills Core Curriculum Guide 2005. It is appended here as a reference and a review of the process skills for high school Family and Consumer Sciences teachers. Family and Consumer Sciences high school core courses were designed to provide opportunities for students to apply communication, leadership, management, and thinking skills through each content topic they study.

Introduction to Process Skills

Process is a vehicle for obtaining, analyzing, and using content. Process skills are the “how” of learning while content is the “what” of learning. The emphasis on process skills within Home and Career Skills is grounded in needs and issues of society and in developments in Family and Consumer Sciences education.

The need for process in education was emphasized in the report of the Secretary’s Commission on Achieving Necessary Skills (SCANS). Based on information gathered from businesses and industries across the country, the SCANS determined that process-oriented foundations and competencies are “at least as important as technical expertise...The competencies represent the attributes that today’s high performance employer seeks in tomorrow’s employee” (U.S. Department of Labor). The SCANS foundations and competencies harmonize closely with process skills developed through Family and Consumer Sciences. The New York State Education Department has adapted the SCANS skills into the Career Development and Occupational Studies (CDOS) Universal Foundation Skills.

Most process skills related to Family and Consumer Sciences can be categorized into four organizing skills:

- ❖ Communication (C)
- ❖ Leadership (L)
- ❖ Management (M)
- ❖ Thinking (T)

These process skills were selected in order to create a manageable structure for the development of essential questions for the Family and Consumer Sciences curricula.

- A. **Communication Skills (C)** *How can I develop effective communication skills to express thoughts, feelings, opinions, and information to enhance family, school, work, and community relationships?*

Standards Connections

Communications Skills support the NYS Family and Consumer Sciences Learning Standard 2 – A Safe and Healthy Environment and NYS Career Development and Occupational Studies Learning Standards 1 – Career Development, 2 – Integrated Learning, and 3a – Universal Foundation Skills.

Rationale

Communication is the transmission or interchange of thoughts, feelings, opinions, and information between a sender and a receiver. Communication process skills are first experienced and learned within the social environment of the family. The process of learning to be an effective communicator begins in infancy, with babies and care givers engaging in interactive behaviors. As communication learning continues, families, schools, and communities play critical roles in expanding students' communication skills.

Communication process skills include listening, speaking, reading, and writing. Together they build a sense of cohesiveness within family, school, work, and community settings. They are a powerful cultural tool, a means for creating a sense of group identity through exchange of values, expectations, and ways of thinking and perceiving. Conflict management is facilitated when individuals are able to express their own ideas and assert their own views effectively, while at the same time listening to and respecting the views of others. Effective communication skills help students meet the challenges of living and working in a diverse global society.

Key Ideas

NYS FACS 2 - Students can provide a safe and nurturing environment for themselves and others.

NYS CDOS 1 - Students will use communication skills to achieve personal goals.

NYS CDOS 2 - Students can use the essential academics concepts, facts, and procedures in applications related to life skills and the world of work.

NYS CDOS 3a - (Basic Skills) Students will acquire basic skills including the ability to read, write, listen, and speak.

(Interpersonal Skills) Students will develop positive interpersonal qualities leading to team work and cooperation in large and small groups in family, social, and work situations.

Performance Objectives and Supporting Competencies for Communication Skills

Communication Skills Performance Objective 1

C.1 Demonstrate communication skills that contribute to positive relationships.

Communication Skills Objective 1 Supporting Competencies

- C.1.1 Examine the roles and functions of communications in family, school, work, and community settings.
- C.1.2 Examine communication styles and their effects on relationships.
- C.1.3 Describe types of communication and characteristics of effective communication.
 - Verbal
 - Nonverbal
- C.1.4 Demonstrate verbal and nonverbal behaviors and attitudes that contribute to effective communication.
- C.1.5 Distinguish between hearing and listening.
- C.1.6 Demonstrate effective (active) listening and feedback techniques.
- C.1.7 Examine barriers to communication in family, school, work, and community settings.
- C.1.8 Demonstrate effective communication skills in a group setting to accomplish a task.
- C.1.9 Demonstrate effective communication skills in family, school, work, and community settings.

B. Leadership Skills (L) *How can I develop lifelong leadership skills to address important personal, family, school, work, and community issues?*

Standards Connections

Leadership Skills support the NYS Family and Consumer Sciences Learning Standards 2 – A Safe and Healthy Environment, 3 – Resource Management, and NYS Career Development and Occupational Studies Standards 1 – Career Development, 2 – Integrated Learning, and 3a – Universal Foundation Skills.

Rationale

Leadership process skills include helping a group, such as a family, school, or community shape a vision of purpose and goals, and encouraging others to commit themselves to accomplishing that vision. Being a responsible leader requires taking action for the common good of the group.

Leaders tell, sell, participate, and delegate, using different strategies at different times and with different group members, in order to involve and encourage everyone toward achieving the shared vision. Leadership skills are embraced in Home and Career Skills classes as students develop a common vision, cooperate with each other, and assume shared responsibility for their family, school, work, and community settings.

Key Ideas

NYS FACS 2 - Students can provide a safe and nurturing environment for themselves and others.

NYS FACS 3 - Students will understand and be able to manage personal resources of talent, time, energy, and money, and make effective decisions in order to balance their obligations to work, family, and self. They will nurture and support positive relationships in their homes, workplaces, and communities. They will develop and use their abilities to contribute to society through pursuit of a career and commitment to long-range planning for their personal, professional, and academic futures. They will know and access community resources.

NYS CDOS 1 - Students will use communication skills to achieve personal goals.

NYS CDOS 2 - Students can use the essential academic concepts, facts, and procedures in applications related to life skills and the world of work.

NYS CDOS 3a - (Thinking Skills) Students will use thinking skills for problem solving, experimenting, and focused observation, and apply the application of knowledge to new and unfamiliar situations.

(Personal Qualities) Students will develop competence in self-management and the ability to plan, organize, and take independent action.

(Interpersonal Skills) Students will develop positive interpersonal qualities leading to team work and cooperation in large and small groups in family, social, and work situations.

(Managing Information) Students will access and use information obtained from other people, community resources, and computer networks.

(Managing Resources) Students will use resources to successfully carry out a planned activity.

Performance Objectives and Supporting Competencies for Leadership Skills

Leadership Skills Performance Objective 1

L.1 Demonstrate teamwork and leadership skills in the family, school, workplace, and/or community.

Leadership Skills Objective 1 Supporting Competencies

- L.1.1 Examine the roles and functions of teamwork and leadership in family, school, work, and community settings.
- L.1.2 Identify qualities of effective leaders.
- L.1.3 Identify qualities of effective team members.
- L.1.4 Create an environment that encourages and respects the ideas, perspectives, and contributions of all group members.
- L.1.5 Demonstrate strategies to motivate and encourage group members.
- L.1.6 Create strategies to utilize the strengths and limitations of team members.
- L.1.7 Demonstrate techniques that develop team and community spirit.
- L.1.8 Demonstrate ways to organize and delegate responsibilities.
- L.1.9 Create strategies to integrate new members into the team.
- L.1.10 Demonstrate processes for cooperating, compromising, and collaborating.
- L.1.11 Demonstrate leadership and teamwork in a group setting to accomplish tasks.
- L.1.12 Demonstrate leadership and teamwork in family, school, work, and community settings.

C. Management Skills (M) *How can I develop effective management skills in order to achieve goals for self, family, school, work, and community?*

Standards Connections

Management Skills support the NYS Family and Consumer Sciences Learning Standards 2 – A Safe and Healthy Environment, 3 – Resource Management and NYS Career Development and Occupational Studies Learning Standards 1 – Career Development, 2 – Integrated Learning, and 3a – Universal Foundation Skills.

Rationale

Management process skills are used to carry out actions in order to meet individual, family, school, work, and community needs. They include goal setting, planning, implementing, evaluating, problem solving, and decision making. Management involves determining the goals that can be realistically accomplished; planning the steps to take and resources to use; carrying out the plan in an efficient and cost effective way; and evaluating the implementation process and the result. Students in Home and Career Skills classes practice managing resources such as time, talent, energy, and money, in order achieve goals for self, family, school, work, and community.

Key Ideas

NYS FACS 2 - Students can provide a safe and nurturing environment for themselves and others.

NYS FACS 3 - Students will understand and be able to manage personal resources of talent, time, energy, and money, and make effective decisions in order to balance their obligations to work, family, and self. They will nurture and support positive relationships in their homes, workplaces, and communities. They will develop and use their abilities to contribute to society through pursuit of a career and commitment to long-range planning for their personal, professional, and academic futures. They will know and access community resources.

NYS CDOS 1 - Students will use communication skills to achieve personal goals.

NYS CDOS 2 - Students can use the essential academic concepts, facts, and procedures in applications related to life skills and the world of work.

NYS CDOS 3a - (Thinking Skills) Students will use thinking skills for problem solving, experimenting, and focused observation and apply the application of knowledge to new and unfamiliar situations.

(Personal Qualities) Students will develop competence in self-management and the ability to plan, organize, and take independent

action.

(Interpersonal Skills) Students will develop positive interpersonal qualities leading to team work and cooperation in large and small groups in family, social, and work situations.

(Managing Information) Students will access and use information obtained from other people, community resources, and computer networks.

(Managing Resources) Students will use resources to successfully carry out a planned activity.

Performance Objectives and Supporting Competencies for Management Skills

Management Skills Performance Objective 1

M.1 Explain the importance of effective management of resources in a variety of relevant life situations.

Management Skills Objective 1 Supporting Competencies

M.1.1 Explain *management* as it relates to personal, family, and work life.

M.1.2 Compare ways in which different people make different choices in the same situation.

Management Skills Performance Objective 2

M.2 Explain how decision making, problem solving, and goal setting assist with management of resources (i.e. time, money, energy).

Management Skills Objective 2 Supporting Competencies

M.2.1 Explain the interrelatedness of the decision-making, problem-solving and goal-setting processes.

Management Skills Performance Objective 3

M.3 Explain how needs, wants, values, goals, and standards impact decision making, problem solving and goal setting.

Management Skills Objective 3 Supporting Competencies

M.3.1 Define *needs, wants, values, goals, and standards*.

M.3.2 Describe how needs, wants, values, goals, and standards influence decisions.

M.3.3 Examine how individuals and families make choices to satisfy needs and wants.

Management Skills Performance Objective 4

M.4 Identify human, economic, and environmental resources that are available and appropriate to use in decision making, problem solving and goal setting.

Management Skills Objective 4 Supporting Competencies

- M.4.1 Define *resources*
- M.4.2 Classify human, economic, and environmental resources.
- M.4.3 Identify human, economic, and environmental resources that are limited and/or expendable, and select those that are available and appropriate to the relevant life situation.
- M.4.4 Describe several ways to substitute or increase resources by combining them.
- M.4.5 Give examples and demonstrate how resources have credibility, change over the lifespan, and are influenced by changing needs and goals and availability.
- M.4.6 Determine individual and family responsibility in relation to the environmental trends and issues.
- M.4.7 Examine behaviors that conserve, reuse, and recycle resources to maintain the environment.

Management Skills Performance Objective 5

M.5 Apply the decision-making process in a logical, sequential manner to relevant life situations involving a choice.

Management Skills Objective 5 Supporting Competencies

- M.5.1 Define *decision making*.
- M.5.2 State sequentially the basic steps in the decision-making process.
- M.5.3 Apply the steps sequentially to make a decision.
- M.5.4 Apply the decision-making process in family, school, work, and community settings.

Management Skills Performance Objective 6

M.6 Use the problem-solving process to identify appropriate solutions, in a logical and sequential manner, and apply the solution chosen to real-life problem situations.

Management Skills Objective 6 Supporting Competencies

- M.6.1 Define *problem solving*.
- M.6.2 State sequentially the basic steps in the problem-solving process.
- M.6.3 Apply the steps sequentially to solve a problem situation.
- M.6.4 Apply the problem-solving process to solve problems in family, school, work, and community settings.
- M.6.5 Explain the appropriateness of alternative solutions.

Management Skills Performance Objective 7

M.7 Apply the goal-setting process in a logical and sequential manner to relevant life situations involving a goal.

Management Skills Objective 7 Supporting Competencies

- M.7.1 Define *goal*.
- M.7.2 Distinguish between long-term and short-term goals.
- M.7.3 State sequentially the basic steps in the goal-setting process.
- M.7.4 Apply the steps sequentially to achieve a goal.
- M.7.5 Apply the goal-setting process to set goals in family, school, work, and community settings.

Management Skills Performance Objective 8

M.8 Demonstrate management of individual and family resources, including food, clothing, shelter, money, time, and personal energy.

Management Skills Objective 8 Supporting Competencies

- M.8.1 Apply management skills to organize tasks and responsibilities.
- M.8.2 Implement management skills in the planning, purchasing, preparing, serving, and storing of safe and nutritious food.
- M.8.3 Implement management skills in the purchasing, creating, and/or maintenance of clothing
- M.8.4 Implement management skills involving personal space, housing, and furnishings.
- M.8.5 Implement management skills involving money.
- M.8.6 Implement management skills involving time.
- M.8.7 Implement management skills involving personal energy.

Management Skills Performance Objective 9

M.9 Demonstrate management of individual and family resources in family, school, work, and community settings.

Management Skills Objective 9 Supporting Competencies

- M.9.1 Allocate individual and family resources to complete a task.

D. Thinking Skills (T) *How can I apply effective critical and creative thinking skills to increase the probability of desired outcomes at home, school, work, and community settings?*

Standards Connections

Thinking Skills support the NYS Family and Consumer Sciences Learning Standards 1 – Personal Health and Fitness, 2 – A Safe and Healthy Environment, 3 – Resource Management and NYS Career Development and Occupational Studies Standards 1 – Career Development, 2 – Integrated Learning, and 3a – Universal Foundation Skills.

Rationale

Thinking process skills encompass complex, multifaceted activities of the mind. These skills lead to problem solving, experimenting, and focused observation, and allow the application of knowledge to new and unfamiliar situations (New York State Learning Standards for Career Development and Occupational Studies). Home and Career Skills classes provide students with opportunities to apply thinking strategies that are purposeful, reasonable, and goal-directed so that they may increase the probability of achieving desirable outcomes.

Two major types of thinking skills are critical thinking and creative thinking. Critical thinking emphasizes examination and critique of information in order to gain insight into meanings and interpretations. Home and Career Skills classes provide students with opportunities to use critical thinking skills to identify premises and conclusions; to distinguish among opinion, reasoned judgment, and fact; and to recognize underlying assumptions, biases, and values.

Creative thinking, in contrast, is the use of innovative, exploratory approaches to generate ideas. Home and Career Skills classes provide an environment where unusual ideas are valued and perspectives and explanations other than those which are immediately apparent are encouraged.

Key Ideas

NYS FACS 1 – Students will be able to plan and use tools and technologies appropriately.

NYS FACS 2 - Students can provide a safe and nurturing environment for themselves and others.

NYS FACS 3 - Students will understand and be able to manage personal resources of talent, time, energy, and money, and make effective decisions in order to balance their obligations to work, family, and self. They will develop and use their abilities to contribute to society through pursuit of a career and commitment to long-range planning for their personal, professional, and academic futures.

NYS CDOS 1 - Students will learn about the changing nature of the workplace, the value of work to society, and the connection of work to the achievement of personal goals.

NYS CDOS 2 - Students can use the essential academic concepts, facts, and procedures in applications related to life skills and the world of work.

NYS CDOS 3a - (Thinking Skills) Students will use thinking skills for problem solving, experimenting, and focused observation, and apply the application of knowledge to new and unfamiliar situations.

Performance Objectives and Supporting Competencies for Thinking Skills

Thinking Skills Performance Objective 1

T.1 Demonstrate creative and critical thinking skills in family, school, work, and/or community settings.

Thinking Skills Objective 1 Supporting Competencies

- T.1.1 Examine the roles and functions of creative and critical thinking skills in family, school, work, and community settings.
- T.1.2 Describe creative thinking skills.
- T.1.3 Describe critical thinking skills.
- T.1.4 Demonstrate creative and/or critical thinking skills to accomplish a task.