

Food Science

Subject: Career and Technical Education

Grade: 11

Expectations: 94

Breakouts: 262

(a) Introduction.

1. Career and technical education instruction provides content aligned with challenging academic standards, industry-relevant technical knowledge, and college and career readiness skills for students to further their education and succeed in current and emerging professions.
2. The Hospitality and Tourism Career Cluster focuses on the management, marketing, and operations of restaurants and other food/beverage services, lodging, attractions, recreation events, and travel-related services.
3. In Food Science, students examine the nature and properties of foods, food microbiology, and the principles of science in food production, processing, preparation, and preservation; use scientific methods to conduct laboratory and field investigations; and make informed decisions using critical thinking and scientific problem solving. This course provides students a foundation for further study that leads to occupations in food and beverage services; the health sciences; agriculture, food, and natural resources; and human services.
4. Science, as defined by the National Academy of Sciences, is the "use of evidence to construct testable explanations and predictions of natural phenomena, as well as the knowledge generated through this process." This vast body of changing and increasing knowledge is described by physical, mathematical, and conceptual models. Students should know that some questions are outside the realm of science because they deal with phenomena that are not currently scientifically testable.
5. Scientific hypotheses and theories. Students are expected to know that:
 - a. hypotheses are tentative and testable statements that must be capable of being supported or not supported by observational evidence. Hypotheses of durable explanatory power that have been tested over a wide variety of conditions are incorporated into theories; and
 - b. scientific theories are based on natural and physical phenomena and are capable of being tested by multiple independent researchers. Unlike hypotheses, scientific theories are well established and highly reliable explanations, but they may be subject to change as new areas of science and new technologies are developed.
6. Scientific inquiry is the planned and deliberate investigation of the natural world using scientific and engineering practices. Scientific methods of investigation are descriptive, comparative, or experimental. The method chosen should be appropriate to the question being asked. Student learning for different types of investigations include descriptive investigations, which involve collecting data and recording observations without making comparisons; comparative investigations, which involve collecting data with variables that are manipulated to compare results; and experimental investigations, which involve processes similar to comparative investigations but in which a control is identified.
 - a. Scientific practices. Students should be able to ask questions, plan and conduct investigations to answer questions, and explain phenomena using appropriate tools and models.
 - b. Engineering practices. Students should be able to identify problems and design solutions using appropriate tools and models.

7. Scientific decision making is a way of answering questions about the natural world involving its own set of ethical standards about how the process of science should be carried out. Students should be able to distinguish between scientific decision-making methods (scientific methods) and ethical and social decisions that involve science (the application of scientific information).
8. Science consists of recurring themes and making connections between overarching concepts. Recurring themes include systems, models, and patterns. All systems have basic properties that can be described in space, time, energy, and matter. Change and constancy occur in systems as patterns and can be observed, measured, and modeled. These patterns help to make predictions that can be scientifically tested, while models allow for boundary specification and provide a tool for understanding the ideas presented. Students should analyze a system in terms of its components and how these components relate to each other, to the whole, and to the external environment.
9. Students are encouraged to participate in extended learning experiences such as career and technical student organizations and other leadership or extracurricular organizations.
10. Statements that contain the word "including" reference content that must be mastered, while those containing the phrase "such as" are intended as possible illustrative examples.

(b) Knowledge and Skills Statements

- (1) The student demonstrates professional standards/employability skills as required by the food service business and industry. The student is expected to:
 - (A) apply interpersonal communication skills in the food service business and industry settings;
 - (i) apply interpersonal communication skills in the food service business settings
 - (ii) apply interpersonal communication skills in the food service industry settings
 - (B) explain and recognize the value of collaboration within the workplace;
 - (i) explain the value of collaboration within the workplace
 - (ii) recognize the value of collaboration within the workplace
 - (C) examine the importance of time management to succeed in the workforce;
 - (i) examine the importance of time management to succeed in the workforce
 - (D) identify work ethics and professionalism in a job setting;
 - (i) identify work ethics in a job setting
 - (ii) identify professionalism in a job setting
 - (E) describe problem-solving and critical-thinking skills used in the workplace; and
 - (i) describe problem-solving skills used in the workplace
 - (ii) describe critical-thinking skills used in the workplace
 - (F) explore careers and professions in food science.
 - (i) explore careers in food science
 - (ii) explore professions in food science

- (2) The student, for at least 40% of instructional time, asks questions, identifies problems, and plans and safely conducts classroom, laboratory, and field investigations to answer questions, explain phenomena, or design solutions using appropriate tools and models. The student is expected to:
- (A) ask questions and define problems based on observations or information from text, phenomena, models, or investigations;
 - (i) ask questions based on observations or information from text, phenomena, models, or investigations
 - (ii) define problems based on observations or information from text, phenomena, models, or investigations
 - (B) apply scientific practices to plan and conduct descriptive, comparative, and experimental investigations and use engineering practices to design solutions to problems;
 - (i) apply scientific practices to plan descriptive investigations
 - (ii) apply scientific practices to plan comparative investigations
 - (iii) apply scientific practices to plan experimental investigations
 - (iv) apply scientific practices to conduct descriptive investigations
 - (v) apply scientific practices to conduct comparative investigations
 - (vi) apply scientific practices to conduct experimental investigations
 - (vii) use engineering practices to design solutions to problems
 - (C) use appropriate safety equipment and practices during laboratory, classroom, and field investigations as outlined in Texas Education Agency-approved safety standards;
 - (i) use appropriate safety equipment during laboratory investigations as outlined in Texas Education Agency-approved safety standards
 - (ii) use appropriate safety equipment during classroom investigations as outlined in Texas Education Agency-approved safety standards
 - (iii) use appropriate safety equipment during field investigations as outlined in Texas Education Agency-approved safety standards
 - (iv) use appropriate safety practices during laboratory investigations as outlined in Texas Education Agency-approved safety standards
 - (v) use appropriate safety practices during classroom investigations as outlined in Texas Education Agency-approved safety standards
 - (vi) use appropriate safety practices during field investigations as outlined in Texas Education Agency-approved safety standards
 - (D) use appropriate tools such as calculators, spreadsheet software, data-collecting probes, computers, standard laboratory glassware, microscopes, various prepared slides, metric rulers, electronic balances, hand lenses, Celsius thermometers, hot plates, lab notebooks or journals, timing devices, cameras, Petri dishes, lab incubators, and models, diagrams, or samples of biological specimens or structures, vacuum sealer, oven, cook top, cookware, bakeware, cutlery, and measuring cups and spoons;
 - (i) use appropriate tools

- (E) collect quantitative data using the International System of Units (SI) and United States customary units and qualitative data as evidence;
 - (i) collect quantitative data using the International System of Units (SI)
 - (ii) collect quantitative data using the United States customary units
 - (iii) collect qualitative data as evidence
 - (F) organize quantitative and qualitative data using lab reports, labeled drawings, graphic organizers, journals, summaries, oral reports, and technology-based reports;
 - (i) organize quantitative data using lab reports
 - (ii) organize quantitative using labeled drawings
 - (iii) organize quantitative data using graphic organizers
 - (iv) organize quantitative data using journals
 - (v) organize quantitative data using summaries
 - (vi) organize quantitative data using oral reports
 - (vii) organize quantitative data using technology-based reports
 - (viii) organize qualitative data using lab reports
 - (ix) organize qualitative data using labeled drawings
 - (x) organize qualitative data using graphic organizers
 - (xi) organize qualitative data using journals
 - (xii) organize qualitative data using summaries
 - (xiii) organize qualitative data using oral reports
 - (xiv) organize qualitative data using technology-based reports
 - (G) develop and use models to represent phenomena, systems, processes, or solutions to engineering problems; and
 - (i) develop models to represent phenomena, systems, processes, or solutions to engineering problems
 - (ii) use models to represent phenomena, systems, processes, or solutions to engineering problems
 - (H) distinguish between scientific hypotheses, theories, and laws.
 - (i) distinguish between scientific hypotheses, theories, and laws.
- (3) The student analyzes and interprets data to derive meaning, identify features and patterns, and discover relationships or correlations to develop evidence-based arguments or evaluate designs. The student is expected to:
- (A) identify advantages and limitations of models such as their size, scale, properties, and materials;
 - (i) identify advantages of models
 - (ii) identify limitations of models

- (B) analyze data by identifying significant statistical features, patterns, sources of error, and limitations;
 - (i) analyze data by identifying significant statistical features
 - (ii) analyze data by identifying patterns
 - (iii) analyze data by identifying sources of error
 - (iv) analyze data by identifying limitations
 - (C) use mathematical calculations to assess quantitative relationships in data; and
 - (i) use mathematical calculations to assess quantitative relationships in data
 - (D) evaluate experimental and engineering designs.
 - (i) evaluate experimental designs
 - (ii) evaluate engineering designs
- (4) The student develops evidence-based explanations and communicates findings, conclusions, and proposed solutions. The student is expected to:
- (A) develop explanations and propose solutions supported by data and models consistent with scientific ideas, principles, and theories;
 - (i) develop explanations supported by data consistent with scientific ideas
 - (ii) develop explanations supported by data consistent with scientific principles
 - (iii) develop explanations supported by data consistent with scientific theories
 - (iv) develop explanations supported by models consistent with scientific ideas
 - (v) develop explanations supported by models consistent with scientific principles
 - (vi) develop explanations supported by models consistent with scientific theories
 - (vii) propose solutions supported by data consistent with scientific ideas
 - (viii) propose solutions supported by data consistent with scientific principles
 - (ix) propose solutions supported by data consistent with scientific theories
 - (x) propose solutions supported by models consistent with scientific ideas
 - (xi) propose solutions supported by models consistent with scientific principles
 - (xii) propose solutions supported by models consistent with scientific theories
 - (B) communicate explanations and solutions individually and collaboratively in a variety of settings and formats; and
 - (i) communicate explanations individually in a variety of settings
 - (ii) communicate explanations individually in a variety of formats
 - (iii) communicate explanations collaboratively in a variety of settings
 - (iv) communicate explanations collaboratively in a variety of formats

- (v) communicate solutions individually in a variety of settings
 - (vi) communicate solutions individually in a variety of formats
 - (vii) communicate solutions collaboratively in a variety of settings
 - (viii) communicate solutions collaboratively in a variety of formats
- (C) engage respectfully in scientific argumentation using applied scientific explanations and empirical evidence.
- (i) engage respectfully in scientific argumentation using applied scientific explanations
 - (ii) engage respectfully in scientific argumentation using applied scientific empirical evidence
- (5) The student knows the contributions of scientists and engineers and recognizes the importance of scientific research and innovation on society. The student is expected to:
- (A) analyze, evaluate, and critique scientific explanations and solutions by using empirical evidence, logical reasoning, and experimental and observational testing so as to encourage critical thinking by the student;
- (i) analyze scientific explanations and solutions by using empirical evidence so as to encourage critical thinking by the student
 - (ii) analyze scientific explanations and solutions by using logical reasoning so as to encourage critical thinking by the student
 - (iii) analyze scientific explanations and solutions by using experimental testing so as to encourage critical thinking by the student
 - (iv) analyze scientific explanations and solutions by using observational testing so as to encourage critical thinking by the student
 - (v) evaluate scientific explanations and solutions by using empirical evidence so as to encourage critical thinking by the student
 - (vi) evaluate scientific explanations and solutions by using logical reasoning so as to encourage critical thinking by the student
 - (vii) evaluate scientific explanations and solutions by using experimental testing so as to encourage critical thinking by the student
 - (viii) evaluate scientific explanations and solutions by using observational testing so as to encourage critical thinking by the student
 - (ix) critique scientific explanations and solutions by using empirical evidence so as to encourage critical thinking by the student
 - (x) critique scientific explanations and solutions by using logical reasoning so as to encourage critical thinking by the student
 - (xi) critique scientific explanations and solutions by using experimental testing so as to encourage critical thinking by the student
 - (xii) critique scientific explanations and solutions by using observational testing so as to encourage critical thinking by the student

- (B) relate the impact of past and current research on scientific thought and society, including research methodology, cost-benefit analysis, and contributions of diverse scientists and engineers as related to the content; and
- (i) relate the impact of past research on scientific thought, including research methodology as related to the content
 - (ii) relate the impact of past research on scientific thought, including cost-benefit analysis as related to the content
 - (iii) relate the impact of past research on scientific thought, including contributions of diverse scientists as related to the content
 - (iv) relate the impact of past research on scientific thought, including contributions of diverse engineers as related to the content
 - (v) relate the impact of past research on society, including research methodology as related to the content
 - (vi) relate the impact of past research on society, including cost-benefit analysis as related to the content
 - (vii) relate the impact of past research on society, including contributions of diverse scientists as related to the content
 - (viii) relate the impact of past research on society, including contributions of diverse engineers as related to the content
 - (ix) relate the impact of current research on scientific thought, including research methodology as related to the content
 - (x) relate the impact of current research on scientific thought, including cost-benefit analysis as related to the content
 - (xi) relate the impact of current research on scientific thought, including contributions of diverse scientists as related to the content
 - (xii) relate the impact of current research on scientific thought, including contributions of diverse engineers as related to the content
 - (xiii) relate the impact of current research on society, including research methodology as related to the content
 - (xiv) relate the impact of current research on society, including cost-benefit analysis as related to the content
 - (xv) relate the impact of current research on society, including contributions of diverse scientists as related to the content
 - (xvi) relate the impact of current research on society, including contributions of diverse engineers as related to the content
- (C) research and explore resources such as museums, libraries, professional organizations, private companies, online platforms, and mentors employed in a science, technology, engineering, and mathematics or food science field.
- (i) research resources
 - (ii) explore resources

(6) The student analyzes household and commercial sustainability and regulatory practices in food production. The student is expected to:

- (A) research and investigate resource use, sustainability, and conservation in food production such as with water, land, and oceans;
 - (i) research resource use in food production
 - (ii) research sustainability in food production
 - (iii) research conservation in food production
 - (iv) investigate resource use in food production
 - (v) investigate sustainability in food production
 - (vi) investigate conservation in food production
- (B) analyze the effect of food on the decomposition cycle, including composting, recycling, and disposal; and
 - (i) analyze the effect of food on the decomposition cycle, including composting
 - (ii) analyze the effect of food on the decomposition cycle, including recycling
 - (iii) analyze the effect of food on the decomposition cycle, including disposal
- (C) demonstrate appropriate methods for sorting and disposing of food waste, including fats and oils, and packaging waste from food production.
 - (i) demonstrate appropriate methods for sorting food waste, including fats
 - (ii) demonstrate appropriate methods for sorting food waste, including oils
 - (iii) demonstrate appropriate methods for disposing of food waste, including fats
 - (iv) demonstrate appropriate methods for disposing of food waste, including oils
 - (v) demonstrate appropriate methods for packaging waste from food production

(7) The student analyzes the role of acids and bases in food science. The student is expected to:

- (A) evaluate physical and chemical properties of acids and bases; and
 - (i) evaluate physical properties of acids
 - (ii) evaluate physical properties of bases
 - (iii) evaluate chemical properties of acids
 - (iv) evaluate chemical properties of bases
- (B) analyze the relationship of pH to the properties, safety, and freshness of food.
 - (i) analyze the relationship of pH to the properties of food
 - (ii) analyze the relationship of pH to the safety of food
 - (iii) analyze the relationship of pH to the freshness of food

(8) The student evaluates the principles of microbiology and food safety practices. The student is expected to:

- (A) investigate the properties of microorganisms that cause food spoilage;
 - (i) investigate the properties of microorganisms that cause food spoilage
- (B) compare food intoxication and food infection;
 - (i) compare food intoxication and food infection

- (C) examine methods to destroy or inactivate harmful pathogens in foods;
 - (i) examine methods to destroy or inactivate harmful pathogens in foods
 - (D) compare beneficial and harmful microorganisms, including lactic acid bacteria, acetic acid bacteria, various baking and brewing yeasts, E. coli, Staphylococcus, Clostridium botulinum, Clostridium perfringens, Salmonella, Listeria, and Shigella;
 - (i) compare beneficial and harmful microorganisms, including lactic acid bacteria
 - (ii) compare beneficial and harmful microorganisms, including acetic acid bacteria
 - (iii) compare beneficial and harmful microorganisms, including various baking yeasts
 - (iv) compare beneficial and harmful microorganisms, including various brewing yeasts
 - (v) compare beneficial and harmful microorganisms, including E. coli
 - (vi) compare beneficial and harmful microorganisms, including Staphylococcus
 - (vii) compare beneficial and harmful microorganisms, including Clostridium botulinum
 - (viii) compare beneficial and harmful microorganisms, including Clostridium perfringens
 - (ix) compare beneficial and harmful microorganisms, including Salmonella
 - (x) compare beneficial and harmful microorganisms, including Listeria
 - (xi) compare beneficial and harmful microorganisms, including Shigella
 - (E) analyze sanitary food-handling practices such as personal hygiene or equipment sanitation; and
 - (i) analyze sanitary food-handling practices
 - (F) prepare for a state or national food manager sanitation certification or alternative credential within the field of food science technology.
 - (i) prepare for a state or national food manager sanitation certification or alternative credential within the field of food science technology
- (9) The student examines the chemical properties of food. The student is expected to:
- (A) describe acids, bases, salts, carbohydrates, lipids, proteins and other elements, compounds, and mixtures related to food science;
 - (i) describe acids related to food science
 - (ii) describe bases related to food science
 - (iii) describe salts related to food science
 - (iv) describe carbohydrates related to food science
 - (v) describe lipids related to food science
 - (vi) describe proteins and other elements related to food science
 - (vii) describe compounds related to food science
 - (viii) describe mixtures related to food science
 - (B) compare heterogeneous and homogeneous mixtures;
 - (i) compare heterogeneous and homogeneous mixtures

- (C) analyze chemical and physical changes in food; and
 - (i) analyze chemical changes in food
 - (ii) analyze physical changes in food
- (D) use chemical symbols, formulas, and equations in food science such as oxidation of sugars in a cut apple or fermentation in the production of yogurt.
 - (i) use chemical symbols in food science
 - (ii) use chemical formulas in food science
 - (iii) use chemical equations in food science

(10) The student analyzes solutions, colloids, solids, gels, foams, and emulsions in food science. The student is expected to:

- (A) identify the solvent and solute in various solutions such as brines;
 - (i) identify the solvent in various solutions
 - (ii) identify the solute in various solutions
- (B) compare unsaturated, saturated, and supersaturated solutions, including their effects on boiling and freezing points in food preparation such as when making candy or ice cream;
 - (i) compare unsaturated, saturated, and supersaturated solutions, including their effects on boiling points in food preparation
 - (ii) compare unsaturated, saturated, and supersaturated solutions, including their effects on freezing points in food preparation
- (C) calculate the concentration of a solution using mass percent such as the concentration of sugar needed for crystallization;
 - (i) calculate the concentration of a solution using mass percent
- (D) describe the properties of colloidal dispersions such as gelatin, mayonnaise, or milk;
 - (i) describe the properties of colloidal dispersions
- (E) differentiate between and give examples of temporary, semi-permanent, and permanent emulsions;
 - (i) differentiate between temporary, semi-permanent, and permanent emulsions
 - (ii) give examples of temporary emulsions
 - (iii) give examples of semi-permanent emulsions
 - (iv) give examples of permanent emulsions
- (F) investigate the relationships between the three parts of a permanent emulsion; and
 - (i) investigate the relationships between the three parts of a permanent emulsion
- (G) create temporary, semi-permanent, and permanent food emulsions.
 - (i) create temporary food emulsions
 - (ii) create semi-permanent food emulsions
 - (iii) create permanent food emulsions

(11) The student analyzes the functions of enzymes in food science. The student is expected to:

- (A) describe the role of enzymes as catalysts in chemical reactions of food, including cheese-making, the enzymatic tenderization of meat, and oxidation of sugars in fruit;
 - (i) describe the role of enzymes as catalysts in chemical reactions of food, including cheese-making
 - (ii) describe the role of enzymes as catalysts in chemical reactions of food, including the enzymatic tenderization of meat
 - (iii) describe the role of enzymes as catalysts in chemical reactions of food, including [the] oxidation of sugars in fruit
- (B) explain the relationship between an enzyme and a substrate;
 - (i) explain the relationship between an enzyme and a substrate
- (C) analyze the functions of enzymes in digestion, including the factors that influence enzyme activity, and relate enzymatic activity in digestion to dietary restrictions; and
 - (i) analyze the functions of enzymes in digestion, including the factors that influence enzyme activity
 - (ii) relate enzymatic activity in digestion to dietary restrictions
- (D) analyze enzyme reactions in food preparation, including cheese-making, the enzymatic tenderization of meat, and oxidation of sugars in fruit.
 - (i) analyze enzyme reactions in food preparation, including cheese-making
 - (ii) analyze enzyme reactions in food preparation, including the enzymatic tenderization of meat
 - (iii) analyze enzyme reactions in food preparation, including [the] oxidation of sugars in fruit

(12) The student evaluates the role of fermentation in food science. The student is expected to:

- (A) analyze modern and historical reasons food is fermented;
 - (i) analyze modern reasons food is fermented
 - (ii) analyze historical reasons food is fermented
- (B) describe the conditions under which bacterial fermentation of food occurs and use chemical equations to describe the products of fermentation; and
 - (i) describe the conditions under which bacterial fermentation of food occurs
 - (ii) use chemical equations to describe the products of fermentation
- (C) prepare various fermented food products.
 - (i) prepare various fermented food products

(13) The student assesses the reaction of leavening agents in baked products. The student is expected to:

- (A) describe the physical and chemical changes that occur in leavening;
 - (i) describe the physical changes that occur in leavening
 - (ii) describe the chemical changes that occur in leavening

- (B) identify various leavening agents and describe their functions in food production;
 - (i) identify various leavening agents
 - (ii) describe [leavening agents'] functions in food production
- (C) use chemical equations to describe how acids act as leavening agents;
 - (i) use chemical equations to describe how acids act as leavening agents
- (D) conduct laboratory experiments with various types and amounts of leavening agents to compare the doughs and batters produced; and
 - (i) conduct laboratory experiments with various types of leavening agents to compare the doughs produced
 - (ii) conduct laboratory experiments with various types of leavening agents to compare the batters produced
 - (iii) conduct laboratory experiments with various amounts of leavening agents to compare the doughs produced
 - (iv) conduct laboratory experiments with various amounts of leavening agents to compare the batters produced
- (E) create baked products using various leavening agents.
 - (i) create baked products using various leavening agents

(14) The student explores the roles of food additives. The student is expected to:

- (A) evaluate the various types of food additives such as incidental, intentional, natural, and artificial;
 - (i) evaluate the various types of food additives
- (B) investigate the various functions of food additives such as preserving food, increasing nutritive value, and enhancing sensory characteristics; and
 - (i) investigate the various functions of food additives
- (C) research local, state, national, and international agencies involved in regulating food additives.
 - (i) research local agencies involved in regulating food additives
 - (ii) research state agencies involved in regulating food additives
 - (iii) research national agencies involved in regulating food additives
 - (iv) research international agencies involved in regulating food additives

(15) The student analyzes the effects of heat energy transfer in food production. The student is expected to:

- (A) analyze the relationship between molecular motion and temperature;
 - (i) analyze the relationship between molecular motion and temperature
- (B) compare heat transfer processes, including conduction, convection, and radiation;
 - (i) compare heat transfer processes, including conduction, convection, and radiation

- (C) investigate the role of phase changes in food production, including crystallization, coagulation, and reduction; and
 - (i) investigate the role of phase changes in food production, including crystallization
 - (ii) investigate the role of phase changes in food production, including coagulation
 - (iii) investigate the role of phase changes in food production, including reduction
- (D) demonstrate rates of reaction using various temperatures and describe the effects of temperature on the characteristics of food products.
 - (i) demonstrate rates of reaction using various temperatures
 - (ii) describe the effects of temperature on the characteristics of food products

(16) The student evaluates the properties of carbohydrates in food and their effects on food production. The student is expected to:

- (A) identify the physical properties and chemical structures of simple and complex carbohydrates;
 - (i) identify the physical properties of simple carbohydrates
 - (ii) identify the physical properties of complex carbohydrates
 - (iii) identify the chemical structures of simple carbohydrates
 - (iv) identify the chemical structures of complex carbohydrates
- (B) describe the functions of carbohydrates such as caramelization, crystallization, and thickening agents in food production;
 - (i) describe the functions of carbohydrates in food production
- (C) describe the processes of gelatinization and retrogradation in food production; and
 - (i) describe the processes of gelatinization in food production
 - (ii) describe the processes of retrogradation in food production
- (D) create food products using simple and complex carbohydrates.
 - (i) create food products using simple carbohydrates
 - (ii) create food products using complex carbohydrates

(17) The student evaluates the properties of fats in food and their effects on food production. The student is expected to:

- (A) identify the physical properties and chemical structures of saturated and unsaturated fats;
 - (i) identify the physical properties of saturated fats
 - (ii) identify the physical properties of unsaturated fats
 - (iii) identify the chemical structures of saturated fats
 - (iv) identify the chemical structures of unsaturated fats
- (B) describe the functions of different types of fats in food production;
 - (i) describe the functions of different types of fats in food production

- (C) demonstrate methods for controlling fat oxidation;
 - (i) demonstrate methods for controlling fat oxidation
- (D) analyze the effects of temperature on fats in food preparation;
 - (i) analyze the effects of temperature on fats in food preparation
- (E) conduct laboratory experiments using the scientific processes to explore the functions of fats in food production;
and
 - (i) conduct laboratory experiments using the scientific processes to explore the functions of fats in food production
- (F) create food products using saturated and unsaturated fats.
 - (i) create food products using saturated fats
 - (ii) create food products using unsaturated fats

(18) The student evaluates the properties of proteins and their effects on food production. The student is expected to:

- (A) identify the physical properties and chemical structures of proteins;
 - (i) identify the physical properties of proteins
 - (ii) identify the chemical structures of proteins
- (B) explain the processes of protein denaturation, coagulation, and syneresis;
 - (i) explain the processes of protein denaturation
 - (ii) explain the processes of protein coagulation
 - (iii) explain the processes of protein syneresis
- (C) describe the functions and uses of proteins such as in emulsions, foams, and gluten formation;
 - (i) describe the functions of proteins
 - (ii) describe the uses of proteins
- (D) analyze the effects of moisture and temperature on protein in food production such as moist and dry heat methods for preparation; and
 - (i) analyze the effects of moisture on protein in food production
 - (ii) analyze the effects of temperature on protein in food production
- (E) create food products using protein.
 - (i) create food products using protein

(19) The student evaluates the properties of vitamins and minerals and their interrelationships in food production. The student is expected to compare the effects of food production on water- and fat-soluble vitamins and minerals.

- (A) compare the effects of food production on water- and fat-soluble vitamins and minerals
 - (i) compare the effects of food production on water- and fat-soluble vitamins
 - (ii) compare the effects of food production on water- and fat-soluble minerals

(20) The student evaluates the properties of water and their effects on food production. The student is expected to:

- (A) identify the properties of water, including as a solvent or medium, and its effects on food production; and
 - (i) identify the properties of water, including as a solvent or medium
 - (ii) identify [water's] effects on food production
- (B) compare the effects of hard and soft water on food production.
 - (i) compare the effects of hard and soft water on food production

(21) The student explains nutritional aspects of food production. The student is expected to:

- (A) describe how variations in human digestion and metabolism affect dietary modifications;
 - (i) describe how variations in human digestion affect dietary modifications
 - (ii) describe how variations in human metabolism affect dietary modifications
- (B) identify common and special dietary modifications such as for food allergies, intolerances, or medical conditions;
 - (i) identify common dietary modifications
 - (ii) identify special dietary modifications
- (C) develop and modify recipes for dietary differences such as allergies and intolerances or for personal health preferences such as low-fat or sugar-free; and
 - (i) develop recipes for dietary differences or for personal health preferences
 - (ii) modify recipes for dietary differences or for personal health preferences
- (D) plan and create a dining experience using the most recent USDA dietary guidelines.
 - (i) plan a dining experience using the most recent USDA dietary guidelines
 - (ii) create a dining experience using the most recent USDA dietary guidelines

(22) The student analyzes processes that manage bacteria to safe levels during food production. The student is expected to investigate processes that manage food bacteria such as dehydration, pasteurization, and food irradiation.

- (A) investigate processes that manage food bacteria such as dehydration, pasteurization, and food irradiation
 - (i) investigate processes that manage food bacteria

(23) The student examines packaging and labeling guidelines. The student is expected to:

- (A) research and evaluate federal food packaging regulations, including the information required on a food label;
 - (i) research federal food packaging regulations, including the information required on a food label
 - (ii) evaluate federal food packaging regulations, including the information required on a food label
- (B) compare global food packaging regulations to those of the United States; and
 - (i) compare global food packaging regulations to those of the United States
- (C) analyze the effectiveness of commercial food packaging for specific foods.
 - (i) analyze the effectiveness of commercial food packaging for specific foods

(24) The student analyzes food preservation processes. The student is expected to:

- (A) describe the benefits of food preservation;
 - (i) describe the benefits of food preservation
- (B) compare various methods of household and commercial dehydration, canning, and freezing; and
 - (i) compare various methods of household and commercial dehydration
 - (ii) compare various methods of household and commercial canning
 - (iii) compare various methods of household and commercial freezing
- (C) create a food product using a selected preservation method.
 - (i) create a food product using a selected preservation method