

Food Science & Technology



CDE Handbook

FOOD SCIENCE AND TECHNOLOGY

New for 2020

1. Purpose

The food science and technology career development event is designed to promote learning activities in food science and technology related to the food industry and to assist students in developing practical knowledge of principles used in a team decision-making process.

Each year this career development event will focus on one food product category as a theme. Each activity in this event will use the theme food product category to achieve the project objectives. The state event will follow the theme selected by the National FFA.

Possible Products:

Ready-to-Eat Cereal	Breakfast Bars	Candy
Ready to Eat Snacks	Cheese	Ice Cream
Processed Fruit Snacks	Stir-Fried Vegetables	Processed Meat
Imitation Seafood		

2. Objectives

The Food Science and Technology Career Development event provides the opportunity for the participant to:

- a. Gain an awareness of career and professional opportunities in the field of food science and technology.
- b. Experience group participation and leadership responsibilities in a competitive food science and technology program.
- c. Develop technical competence and personal initiative in a food science and technology occupation.

3. Rules

- a. This event will be a four (4) or 5 (five) person team activity. Individuals may participate and will not complete the team activity.
- b. All team members will participate in each of the activities.
- c. No programmable calculators will be allowed to be used during any part of this CDE.
- d. Participants will utilize Food Science Form #479-4 for the entire event.
- e. See Career Development Events section for further rules on eligibility, selection of teams, and general rules.

4. Format

The Food Science and Technology CDE will consist of four activities:

a. Written Test

1. The written test questions will be designed to determine each team member's understanding of the basic principles of food science and technology. It will encompass the knowledge required of the team event and the two practicums, as

well as test a participant's knowledge of the equipment used to manufacture the theme product and product nutritional analysis.

2. Team members will work individually to answer each of the fifty (50) questions. Fifty (50) minutes will be given to complete the examination.
3. Each question will be worth three (3) points.

b. Problem Solving/Math Practicum

1. Participants will answer a series of five mathematical calculations based on common food science themes. Questions may include nutrition calculations, ingredient quantity, cost benefit analysis, estimation of cost/margin of good sold, conversions, processing conditions, etc.
2. This section is worth 25 points.
3. Example:

The perfect glass of sweet tea is 20 percent sugar. Jim is making a one-gallon container of sweet tea. How many cups of sugar should he add?

- a. 2.4 cups **b. 3.2 cups** c. 3.4 cups d. 4 cups

c. Food Safety and Quality Practicums

1. Customer Inquiry

- a. Each participant will be given five scenarios representing general consumer inquiries. Participants must determine if the consumer inquiry reflects a quality or safety issue (2 points per scenario) and determine if it is a biological, chemical, or physical concern or hazard (3 points per section).
- b. This is for a total of 25 points.

2. Product Specification Compliance

- a. Students will be given sample sets (actual products and/or data sets) and will be responsible for determining compliance with the provided specification requirements.
- b. This may include, but is not limited to, determining if the product(s) is within the net weight standards, product sizing requirements, pH, color, analysis, viscosity measurement, fill level tolerance, packaging specification compliance, etc.
- c. Participants will be asked five questions regarding potential compliance violations presented within the sample set.
- d. This is for a total of 25 points.

d. Sensory Evaluation

1. Aroma Identification

- a. Each participant will be asked to identify four different aromas from vials provided. A list of potential aromas is included on the scorecard and listed below.
- b. Each aroma is worth 5 points for a total of 20 points.

Apple	Chocolate	Garlic	Lime	Orange	Sage
Banana	Cinnamon	Ginger	Maple	Oregano	Smoke (liquid)
Basil	Clove	Grape	Molasses	Peach	Strawberry
Butte	Coconut	Lemon	Nutmeg	Peppermint	Vanilla
Cherry	Coffee	Licorice (anise)	Onion	Raspberry	Watermelon
					Wintergreen

2. Triangle Tests

- a. Four triangle tests will be conducted. In each test, there will be three samples, two that are the same and one that is different in some way. Participants are expected to identify the different sample through aroma, visual cues or textural differences.
- b. Each test is worth 5 points for a total of 20 points.

e. Team Product Development

1. Each team will receive a marketing scenario describing a need for a new or redesigned product that would appeal to a potential market segment. This scenario will contain a description of the existing marketing situation, and potential target market segment to be served by the new product. Each team will be provided with package materials, supplies for designing package, ingredients and ingredient labels.
2. The team will be responsible for understanding and using the following concepts:
 - a. Formulation of a product to meet specific market requirements
 - b. New package design to reflect the developed product
 - c. Nutritional label development and adjustments
 - d. Equipment used to formulate the product
 - e. Address any potential quality control and assurance issues
3. The team will have sixty (60) minutes to respond to the marketing scenario and reformulate or develop a new product, correctly calculate a nutritional label, develop the ingredient statement and educational panel and develop the front or principal display panel to reflect the new product and its market.
4. After this time period, each team member will be expected to participate in a ten (10) minute oral product development proposal.
5. In addition, there will be a five (5) minute question period in which each team member will be expected to answer questions from the judges

f. Food Safety/Sanitation Team activity (80 points possible per team)

1. Each team will be given a situation (e.g., photos, videos, written scenarios, live demonstrations or a combination). The team will work together to evaluate the situation and complete a safety/sanitation report evaluation that will include observations, degree of concern and recommendations/corrective actions.
2. Scoring criteria can be found on the Team Activity Preparation Rubric.

5. Resources

- a. National FFA Food Science and Technology CDE guide/materials.

6. Scoring

Activities	Individual Points	Team Points
Team Product Development		400
Food Safety/Sanitation Team Activity		80
Written Test	150	600
Problem Solving/Math Practicum	25	100
Food Safety and quality	50	200
Sensory Evaluation	40	160
Maximum Points	265	1540

7. Awards

a. Individual

3. Individual scores will be tabulated (and do not include the team activity) and broken into gold, silver, and bronze award areas.
4. Individual ties will not be broken
5. The high individual receives the “baby bison” trophy and a \$100 stipend.

b. Team

1. Team scores will be tabulated by adding all four team member scores and the team activity. They will be broken into gold, silver, and bronze.
2. The high team shall be eligible to represent North Dakota in the National FFA Food Science career development event. The high team receives the traveling trophy and travel stipends from the ND FFA Foundation to participate in the National Event.

Team Tie Breakers:

- 1) Team Product Development Score
- 2) Team Written Test Score
- 3) Team Questions to Product Development Score

ND FFA - Food Science & Technology

Team Product Development Project Scorecard

400 POINTS



Chapter	State	Team Number	Possible Score	Team Score
Package Display Components				
Use and development of nutrition label				
• Required information present			10	
• Correct calculations			10	
• Correct organization			10	
Use and development of the ingredient statement				
▪ Present			10	
▪ Correct order and all ingredients included			10	
▪ Location on package			10	
Use of principle display panel to convey information				
▪ All required components			15	
▪ Correct information			15	
▪ Location on package			10	
<i>Package Design Subtotal</i>			100	
Product Development Oral Presentation				
Cost of goods sold				
• Costing			20	
• Accuracy				
Nutrition				
• Communicate nutritional quality of product			20	
• Apply nutritional quality to health benefits				
Target audience				
• Identification of key consumer			20	
Quality control				
• Key quality attribute of consistent product			20	
• Examples: flavor, color, texture, net weight, size, etc.				
Marketing and sales				
• Communicated with future users			20	
• Promotions				
• Market location				
Product				
• Appearance			20	
• Texture				
• Shelf-life				
• Interaction of ingredients				
• Creativity				
Processing				
• Description of how to make product			20	
• Equipment				
• Flow diagram, unit operations				
• People				
Packaging				
• Materials used			20	
• Appropriate for use of product				
• Creativity				

	Possible Score	Team Score
Food Safety • Discussed potential hazards/concerns associated with products	20	
Formulation concepts		
• How well did product match concept/product development scenario?	30	
• Category	5	
• Platform	5	
Quality of presentation		
• Equitable participation of team members	5	
• Organization	5	
• Use of time allowed	5	
• Professionalism	5	
• Presence and enthusiasm	5	
• Mannerisms	5	
<i>Product Development Oral Presentation Subtotal</i>	250	
Response to judges' questions		
Team participation in question response • All team members contributed	25	
Quality of response • Accuracy • Ability to answer • Originality • Knowledge	25	
<i>Response to Judges' Questions Subtotal</i>	50	
TOTAL POINTS	400	

ND FFA - Food Science & Technology Safety Sanitation Report Form



80 POINTS

Plant _____ Date _____

Location _____

Inspection Team Members' State _____ Team Number _____

Plant Contact _____

Contact Information _____

Category	Observation and Concern	Recommendation or Corrective Action
1. General maintenance of physical facilities		
2. Cleaning and sanitizing of equipment and utensils		
3. Storage and handling of clean equipment and utensils		

Category	Observation and Concern	Recommendation or Corrective Action
4. Pest control		
5. Proper use and storage of cleaning compounds, sanitizers, and pesticides		
6. Employee Training		
7. Plant Design		
8. Quality Assurance Assessment		

Inspection Team Representative Signature _____

Customer Inquiry Rubric



25 POINTS

	Points Possible	Points Earned
Scenario # 1: This issue represented in this scenario is a: <input type="checkbox"/> Food Quality Issue <input type="checkbox"/> Food Safety Issue	2	
Is the concern or hazard primarily (<i>Check only one</i>): <input type="checkbox"/> Biological <input type="checkbox"/> Physical <input type="checkbox"/> Chemical	3	
Scenario # 2: This issue represented in this scenario is a: <input type="checkbox"/> Food Quality Issue <input type="checkbox"/> Food Safety Issue	2	
Is the concern or hazard primarily (<i>Check only one</i>): <input type="checkbox"/> Biological <input type="checkbox"/> Physical <input type="checkbox"/> Chemical	3	
Scenario # 3: This issue represented in this scenario is a: <input type="checkbox"/> Food Quality Issue <input type="checkbox"/> Food Safety Issue	2	
Is the concern or hazard primarily (<i>Check only one</i>): <input type="checkbox"/> Biological <input type="checkbox"/> Physical <input type="checkbox"/> Chemical	3	
Scenario # 4: This issue represented in this scenario is a: <input type="checkbox"/> Food Quality Issue <input type="checkbox"/> Food Safety Issue	2	
Is the concern or hazard primarily (<i>Check only one</i>): <input type="checkbox"/> Biological <input type="checkbox"/> Physical <input type="checkbox"/> Chemical	3	
Scenario # 5: This issue represented in this scenario is a: <input type="checkbox"/> Food Quality Issue <input type="checkbox"/> Food Safety Issue	2	
Is the concern or hazard primarily (<i>Check only one</i>): <input type="checkbox"/> Biological <input type="checkbox"/> Physical <input type="checkbox"/> Chemical	3	
TOTAL	25	

Appendix A: AFNR Career Cluster Content Standards-**Food Science**

	Performance Measurement Levels	Event Activity Addressing Measurement	Related Academic Standards
ABS.04.01. Performance Indicator: Use accounting fundamentals to accomplish dependable bookkeeping and fiscal management.			Math: 1C, 5A, 5C Social Studies: 7h
	ABS.04.01.02.b. Use accounting information to estimate the cost of goods sold and margins on the goods.	team activity	
ABS.06.01. Performance Indicator: Conduct appropriate market and marketing research.			Social Studies: 7b, 7h
	ABS.06.01.01.b. Apply benefit/cost analysis to marketing in AFNR businesses.	team activity	
ABS.07.02. Performance Indicator: Develop a production and operational plan.			Language Arts: 4, 5, 6, 12
	ABS.07.02.02.b. Examine legal and industry requirements for a production facility.	team activity, exam	
BS.03.01. Performance Indicator: Evaluate the application of genetic engineering to improve products of AFNR systems.			Math: 2C Science: A2, C2, E2, F4 Language Arts: 7 and 8
	BS.03.01.02.a. Describe enzymes, the changes they cause in foods and the physical and chemical parameters that affect enzymatic reactions.	exam	
BS.03.02. Performance Indicator: Perform biotechnology processes used in AFNR systems.			Science: B3, C5, D1, E2 Language Arts: 4
	BS.03.02.02.a. Identify foods produced through fermentation.	exam	
FPP.01.01. Performance Indicator: Evaluate the significance and implications of changes and trends in the food products and processing industry.			Science: F1 Language Arts: 7 and 8 Social Studies: 1g and 8c
	FPP.01.01.02.c. Determine appropriate industry response to consumer concerns to assure a safe and wholesome food supply.	consumer inquiry	
FPP.01.02. Performance Indicator: Work effectively with industry organizations, groups and regulatory agencies affecting the food products and processing industry.			Language Arts: 12 Social Studies: 6c and 8f
	FPP.01.02.01.a. Explain the purposes of organizations that are part of or regulate the food products and processing industry.	exam	

FPP.02.02. Performance Indicator: Implement Hazard Analysis and Critical Control Point (HACCP) procedures to establish operating parameters.			Science: F5 Language Arts: 8
	FPP.02.02.01.a. Describe contamination hazards (physical, chemical and biological) associated with food products and processing.	consumer inquiry, exam	
	FPP.02.02.02.a. Identify the seven principles of HACCP.	team activity, exam	
FPP.02.03. Performance Indicator: Apply safety and sanitation procedures in the handling, processing and storing of food products.			Science: A2 and F5
	FPP.02.03.01.a. Explain techniques and procedures for the safe handling of food products.	team activity, exam, consumer inquiry, safety/sanitation	
	FPP.02.03.02.b. Perform quality-assurance tests on food products.	sensory	
FPP.03.01. Performance Indicator: Apply principles of science to food processing to provide a safe, wholesome and nutritious food supply.			Science: A2, B3 and F1
	FPP.03.01.02.b. Explain how the chemical and physical properties of foods influence nutritional value and eating quality.	team activity, exam	
	FPP.03.01.05.b. Describe the purpose of common food additives.	exam	
	FPP.03.01.06.c. Prepare and label foods according to the established standards of regulatory agencies.	team activity	
	FPP.03.01.07.b. Plan and create a new food product.	team activity	
FPP.04.03. Performance Indicator: Process, preserve, package and present food and food products for sale and distribution.			Math: 1C, 4A and 4B Science: F1
	FPP.04.03.01.c. Use weights and measures to formulate and package food products.	team activity, exam	
	FPP.04.03.02.a. Explain methods and materials for processing foods for sale as fresh-food products.	team activity	
	FPP.04.03.03.b. Explain the processes of food preservation methods.	team activity, exam	
	FPP.04.03.04.a. Explain techniques for preparing ready-to-eat food products.	team activity	
	FPP.04.03.05.b. Select and utilize packaging materials in storing processed foods and raw food products.	team activity	
	FPP.04.03.06.a. Identify and explain storage conditions to preserve product quality.	team activity, exam	

CS.01.01. Performance Indicator: Action: Exhibit the skills and competencies needed to achieve a desired result.			Social Studies: 4d and 4h
	CS.01.01.01.c. Work independently and in group settings to accomplish a task.	all event	
	CS.01.01.04.b. Use appropriate and reliable resources to complete an action or project.	team activity	
	CS.01.01.06.b. Assign project parts equitably amongst team members to achieve a given task.	team activity	
CS.02.04. Performance Indicator: Mental Growth: Demonstrate the effective application of reasoning, thinking and coping skills.			Math: 6C Science: A4 Language Arts: 4 and 8
	CS.02.04.01.c. Demonstrate critical and creative thinking skills while completing a task.	team activity, safety & quality	
	CS.02.04.02.c. Implement effective problem solving strategies.	team activity, safety & quality	
CS.03.01. Performance Indicator: Communication: Demonstrate oral, written and verbal skills.			Language Arts: 4, 5 and 12
	CS.03.01.01.b. Select the appropriate form of technical and business writing or communication for a specific situation.	team activity	
	CS.03.01.03.c. Make effective business presentations.	team activity	
CS.03.02. Performance Indicator: Decision Making –Analyze situations and execute an appropriate course of action.			Science: A1 and A5 Social Studies: 1c and 4h
	CS.03.02.02.c. Use problem-solving skills.	team activity, sensory, safety & quality	
CS.06.01. Performance Indicator: Observe required regulations to maintain/improve safety health and environmental management systems.			Science: F4 and F5 Social Studies: 3g
	CS.06.01.01.a. Examine major health, safety, and environmental management system components in AFNR organizations.	quality & safety, exam	

Appendix B: Related Academic Standards- **Food Science**

National academic standards for mathematics, science, English language arts and social studies related to this event are reported below. The statements are based on information in reports of the respective associations/organizations in the academic areas. Some adjustment of numbering was done to facilitate the process of alignment with the standards that have been developed in the pathways of the Agriculture, Food and Natural Resources (AFNR) Career Cluster.

The approach was to determine the presence of alignment between the content standards, expectations or thematic strands of the four academic areas and the performance indicators of the AFNR Standards. Supporting statements have been included to clarify content of the respective content standards, expectations or thematic strands. The statements were initially developed independently by the respective organizations and, therefore, are not parallel in wording and presentation. Occasionally minor editing was done to adjust the background or stem of a statement but not the statement itself.

Mathematics

1. Standard and Expectations: Number and Operations
 - 1C. Compute fluently and make reasonable estimates.
2. Standard and Expectations: Algebra
 - 2C. Use mathematical models to represent and understand quantitative relationships.
4. Standard and Expectations: Measurement
 - 4A. Understand measurable attributes of objects and the units, systems and processes of measurement.
 - 4B. Apply appropriate techniques, tools and formulas to determine measurements.
5. Standard and Expectations: Data Analysis and Probability
 - 5A. Formulate questions that can be addressed with data and collect, organize and display relevant data to answer them.
 - 5C. Develop and evaluate inferences and predictions that are based on data.
6. Standard and Expectations: Problem Solving
 - 6C. Apply and adapt a variety of appropriate strategies to solve problems.

Science

- A. Content Standard: Science as an Inquiry
 - A1. Identify questions and concepts that guide scientific investigation.
 - A2. Design and conduct scientific investigations.
 - A4. Formulate and revise scientific explanations and models using logic and evidence.
 - A5. Recognize and analyze alternative explanations and models.
- B. Content Standard: Physical Science
 - B3. Chemical reactions.
- C. Content Standard: Life Science
 - C2. Molecular basis of heredity.
 - C5. Matter, energy and organization in living systems.
- D. Content Standard: Earth and Space Science
 - D1. Energy in the earth system.
- E. Content Standard: Science and Technology
 - E2. Understanding about science and technology.

F. Content Standard: Science in Personal and Social Perspectives

F1. Personal and community health.

F4. Environmental quality.

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F5. Natural and human-induced ha:

English Language Arts

4. Students adjust their use of spoken, written and visual language (e.g., conventions, style, vocabulary) to communicate effectively with a variety of audiences and for different purposes.
5. Students employ a wide range of strategies as they write and use different writing process elements appropriately to communicate with different audiences for a variety of purposes.
6. Students apply knowledge of language structure, language conventions (e.g., spelling and punctuation), media techniques, figurative language and genre to create, critique and discuss print and non-print texts.
7. Students conduct research on issues and interests by generating ideas and questions and by posing problems. They gather, evaluate and synthesize data from a variety of sources (e.g., print and non-print texts, artifacts, people) to communicate their discoveries in ways that suit their purpose and audience.
8. Students use a variety of technological and information resources (e.g., libraries, databases, computer networks, video) to gather and synthesize information and to create and communicate knowledge.
12. Students use spoken, written, and visual language to accomplish their own purposes (e.g., for learning, enjoyment, persuasion and the exchange of information).

Social Studies

1. Thematic Strand: Culture

1c. apply an understanding of culture and an integrated whole that explains the functions and interactions of language, literature, the arts, traditions, beliefs and values and behavior patterns;

1g. construct reasoned judgments about specific cultural responses to persistent human issues;

3. Thematic Strand: People, Places and Environments

3g. describe and compare how people create places that reflect culture, human needs, government policy and current values and ideals as they design and build specialized buildings, neighborhoods, shopping centers, urban centers, industrial parks and the like;

4. Thematic Strand: Individual Development and Identity

4d. apply concepts, methods and theories about the study of human growth and development, such as physical endowment, learning, motivation, behavior, perception and personality;

4h. work independently and cooperatively within groups and institutions to accomplish goals;

6. Thematic Strand: Power, Authority and Governance

6c. analyze and explain ideas and mechanisms to meet needs and wants of citizens, regulate territory, manage conflict, establish order and security and balance competing conceptions of a just society;

7. Thematic Strand: Production, Distribution and Consumption

7b. analyze the role that supply and demand, prices, incentives and profits play in determining what is produced and distributed in a competitive market system;

- 7h. apply economic concepts and reasoning when evaluating historical and contemporary social developments and issues;
- 8. Thematic Strand: Science, Technology and Society
 - 8c. analyze how science and technology influence the core values, beliefs and attitudes of society, and how the core values, beliefs and attitudes of society shape scientific and technological change;
 - 8f. formulate strategies and develop policies for influencing public discussions associated with technology-society issues, such as the greenhouse effect.