

Food Science and Technology

A Special Project of the South Dakota FFA Foundation

Important Note: Please thoroughly read the General Rules at the beginning of this handbook for complete rules and procedures that are relevant to all South Dakota FFA Career Development Events.

Purpose

The purpose of the Food Science and Technology Career Development Event is 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 team decision making processes.

Objectives

- To encourage FFA members to gain an awareness of career and professional opportunities in the field of food science and technology, marketing, and management occupations.
- To provide FFA members with the opportunity to experience group participation and leadership responsibilities in a competitive food science and technology program.
- To help FFA members develop technical competence and personal initiative in a food science and technology-related occupation.
- To provide an opportunity for FFA members to participate in activities where they gain an appreciation for cooperative effort in the food industry.

Event Rules

A team will consist of four members with all four members' scores being totaled for the team score.

Event Format

The Food Science and Technology CDE will consist of four activities, including a team product development project, an objective test, a practicum in food safety and quality, and a practicum in sensory evaluation.

Team Product Development Project – 400 points

Product development scenarios will describe a category, platform and market. The selected category/platform/market will be posted to the state website (<http://aged.sdstate.edu>)

Categories:

Cereal
Snacks
Meals
Side dishes
Beverages
Supplements
Condiments
Desserts

Platforms:

Frozen
Refrigerated
Shelf-stable
Convenience
Read-to-eat
Heat and serve

Markets:

Retail
Wholesale
Food service
Convenience store

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, competition, and potential target market segment to be served by the new product. It is the task of the team to design a new food product or reformulate an existing product. The team will be responsible for understanding and using the following concepts:

- Formulation of a product to meet specified market requirements.
- New package design to reflect the developed product.
- Nutritional label development and adjustments.
- Equipment used to formulate the product. (*List following the event rules*)
- Address any potential quality control programs (ex. good manufacturing practices (GMP) and hazard analysis critical control point analysis (HAACP)).

Each team will be provided with packaging materials, ingredients, and information necessary on each ingredient in order to develop a final product label. No outside materials may be brought in to use during the team product development project.

Each team will have 60 minutes to respond to the marketing scenario and reformulate or develop a new product, 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.

Following the 60 minutes, each team member will contribute a 10-minute oral product development proposal. Thereafter, there will be a 10-minute question period from the judges in which each team member will be expected to answer questions about the development of their particular product.

Product development projects will be scored using the Team Product Development Project Scorecard. (*See end of rules for scorecards*)

Objective Test – 100 points

The objective questions administered during the test 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.

Team members will work individually to answer each of the 50 questions. Each person will have 50 minutes to complete the examination. Each question will be worth two points for a correct answer. The test will be based on the list of references.

Food Safety and Quality Practicum – 150 points

Customer Inquiry – Each participant will be given five scenarios representing general consumer inquiries. Participants must determine if the consumer inquiry reflects a quality or safety issue and determine if it is a biological, chemical, or physical concern or hazard.

Food Safety/Sanitation – Each participant will be given 10 photos of potential food safety and/or sanitation problems. A numbered list of problems will also be provided at the beginning of this practicum segment. The list will contain more potential problems than the number of

photographs. Each participant will start at a station to view a photograph, and record an answer.

Triangle Test – 20 points

Four different triangle tests will be conducted. Participants are expected to identify the different samples through flavor, aroma, visual cues and/or textural differences. Answers will be given on the sheet provided. No list will be provided for this segment of the practicum. Each test is worth five points.

Sensory Evaluation Practicum – 50 points

Each participant will be asked to identify 10 different aromas from vials provided at each station and record the answer on the sheet provided. A list of the potential aromas will be provided to each person. Each participant will be given one minute at each station.

Scoring

	Possible Points
Individual Test (50 questions, 2 points per question)	100
Customer Inquiry (5 scenarios, 10 points each)	50
Food Safety/Sanitation (10 problems, 10 points each)	100
Sensory Evaluation Practicum (10 aromas, 5 points each)	50
Triangle Test (Four sets, 5 points each)	20
Total Possible Individual Score	320
Team Product Development Project	400
Total Possible Team Score (4 participants count)	1680

Tiebreakers

In the case of a team tie, the order to break the tie will be:

1. Highest Team Product Development Score
2. Highest Total Team Points from the Objective Test
3. Highest Judges' Response to Team Question (from the Team Product Development Project)

In the case of an individual tie, the order to break the tie will be:

1. Highest Objective Test Score
2. Highest Food Safety and Quality Practicum Score
3. Customer Inquiry Score

References

- National FFA Core Catalog – Past CDE Materials (<http://shop.ffa.org/cde-materials-c1289.aspx>) Food Science, Safety and Nutrition instructional materials
- *Introduction to Food Science*. Rick Parker, Delmar Publishing.
- Institute of Food Technology: <http://www.ift.org>
- USDA Food Safety and Inspection Service: <http://www.fsis.usda.gov>
- Penn State Kitchen Chemistry: Experiments, resources and materials for educators and students: <http://foodscience.psu.edu/public/kitchen-chemistry>
- FoodSafety.gov: <http://www.foodsafety.gov>

- Food Safety Education: http://www.fsis.usda.gov/food_safety_education/for_kids_&_teens/index.asp
- Partnership for Food Safety Education: <http://www.fightbac.org>

Equipment and Sensory Evaluation Lists

Food Processing Equipment List

1. **Adhesive Applicator:** applies bonding materials to labels, containers and cartons
2. **Aerator:** incorporates air chemically or mechanically in various food products
3. **Air Compressor:** supplies air under pressure for temperature control, agitation and life equipment.
4. **Air Curtain:** provides air flow across doorways to reduce refrigerated air losses and control pests
5. **Aseptic Processing System:** a continuous thermal sterilization process and aseptic packaging for preserving foods
6. **Bar Code Printer/Applicator:** a system of coding products for computer readout to improve inventory control, pricing, and manufacturing schedules
7. **Blancher:** immerses food in hot water or exposes them to live steam, hot gases, or microwave enzymes and sets or fixes color, and removes air and undesirable odors
8. **Bowl Chopper:** rotating bowl with sharp knives for cutting raw meat into small pieces or into ground emulsions
9. **Box Making Machinery:** forms food cartons from various types of paper
10. **Can Closing and Sealing Machines:** removes residual air from surface of foods filled into metal containers, applies lid, and seals the lid to the container
11. **Capping Machine:** removes residual air from surface of foods filled into bottles or jars, applies cap, and seals the cap to the container
12. **Carton Handling Machine:** (Forming, Filling and Closing)
13. **Clean-in-Place System (CIP):** fluid cleaning materials are held in tanks and re-circulated under pressure through pipelines around the plant or within a specific equipment system
14. **Coder, Dater and Imprinter:** applies identifying numbers, letters, or marks to foods or containers to indicate to the producer or consumer the product date of manufacture and/or usage or freshness dates
15. **Conveyer:** mechanical devices used to assist in the movement of ingredients, food products or packaging supplies
16. **Cutting Machine, Dicer, Flaker, Slicer:** reduces or changes size, volume, or shape of raw food materials
17. **Dough-Proofing:** enclosed room or cabinet with controlled environment (temperature, humidity) used for final fermentation step prior to baking to allow dough to warm up and accelerate production of carbon dioxide by yeast (rising)
18. **Dryer:** use of forced hot air, dehydro-freezing or freeze-drying for removal of moisture from foods for purposes of preservation, texture improvement, weight reduction, or cost savings
19. **Enrober:** coats food products, generally by dipping or flowing liquid coating over the product (such as chocolate or candy)
20. **Evaporator:** removes water from raw food materials as a first step to drying
21. **Extractor/Press:** for separation of solids and liquids

22. **Stuffer:** device for holding quantities of meat emulsions (or other extricable products) and pressurized extrusion through a die into a finished food package
23. **Thermometer:** instruments for measuring temperatures

Food Laboratory Equipment List

1. **Abbe refractometer:** used to measure the refractive index of compounds; for example, used to measure the soluble solids of juices
2. **Accelerated Shelf Life Chamber:** chambers set at various temperature to conduct accelerated shelf life testing
3. **Adhesive Bond Test Equipment:** measures adhering strength of sealants or glues
4. **Autoclave:** heated chamber for sterilization of equipment & microbiological media
5. **Automatic Colony Counter:** for laser counting of mold colonies grown on Petri dishes
6. **Balance:** analytical, top-loading device for measuring weight
7. **Brabender Amylograph:** records changes in viscosity of starch under controlled temperatures and stirring used in baking and food processing industries to measure starch characteristics
8. **Centrifuge:** instrument that rotates at very high speeds allowing the separation of compounds -- **Colony Counter:** used to count mold colonies on a Petri dish
9. **Color Measuring Instruments (Laboratory or Portable):** color, an important attribute of foods, may be measured with a variety of instruments
10. **Colored blocks or chips:** used to compare with products.
11. **Hunter color difference meter:** provide standardized objective measurement of food color
12. **High Pressure Liquid Chromatograph (HPLC):** measures level of the separation of mixtures into individual components by passing a liquid or gas along a stationary material such as paper or gels. One example of its use in the food industry is to determine flavor compounds in coffee.
13. **Hot Plate:** a flat portable electric heating unit
14. **Impulse Sealer:** seals seasoning pouches or plastic bags for send out or sample storage
15. **Incubators:** heated chamber used for storage of Petri dishes & culture to grow microorganisms - **Impedance Monitoring System:** rapid method for determining the number of microorganisms in a sample
16. **Kjeldahl Method:** laboratory equipment and technique for determining nitrogen content of food samples (mostly grains) to calculate the protein percentage
17. **Laboratory Glassware:** a variety of sizes of beakers, tubes, pipettes, dishes and covers used for running tests and other products
18. **Luminometer:** instrument of instantaneously determining sanitation of food handling equipment
19. **Microscope:** an optical instrument consisting of lenses for making enlarged images of minute objects
20. **Petri Dish:** glass or disposable plastic plates or dishes for growing microbiological cultures
21. **pH Meter:** measure the hydrogen ion concentration of foods and determines if a food is acid or basic. pH is an important basic attribute of foods.
22. **Pipette:** glass or disposable plastic tubes for siphoning or adding small, measured amounts of liquids
23. **Refrigerator-Freezer:** to store microbiological cultures and keep samples

24. **Rotap:** sieve analysis of ingredients
25. **Safety Hood:** instrument in which to handle hazardous cultures and/or food samples usually containing an exhaust fan
26. **Salmonella Testing Kit:** measures pathogenic bacteria which causes food poisoning
27. **Scale:** measures weight of ingredients for testing
28. **Shear Press:** instrument that pushes a metal probe through a food sample, gives an indication of how tough a food is
29. **Spectrophotometer:** measures the light energy absorption by food samples. This instrument is used in determining such attributes as lactose in milk. Near—infrared spectroscopy provides quantitative determination of moisture, fat, protein, and sugar contents of a wide variety of foods. - **Spiral Plater:** laboratory equipment for a rapid method of preparing petri dishes to enumerate microorganisms in foods
30. **Stomacher Blender:** blender that utilizes sterile plastic bags & paddles to macerate a sample
31. **Testing Kit:** self-contained units that include all the materials to test foods for microorganisms (for example, salmonella, E. coli), pesticides, or toxicants (Alfa toxins)
32. **Thermometer:** basic instrument in the food laboratory used to measure the heat of food samples. Various types include liquid thermometers and thermocouples.
33. **Titration:** used to measure the concentration of components of a solution. For example, titration may be used to measure the amount of malic acid in apple juice or the salt in seasonings.
34. **Vacuum Oven:** vacuumized chamber for drying samples for moisture analysis
35. **Water Activity Meter:** measures water activity for shelf life testing
36. **Water Bath:** for incubation or storage of melted media

Sensory Evaluation Aroma List

Banana	Garlic	Maple	Peppermint
Basil	Ginger	Menthol	Pine
Butter	Grape	Molasses	Raspberry
Cherry	Lemon	Nutmeg	Smoke (liquid)
Chocolate	Licorice (anise)	Onion	Strawberry
Cinnamon	Lilac	Orange	Vanilla
Clove	Lime	Oregano	Wintergreen
Coconut			

Team Product Development Project Scorecard

Chapter: _____

Package Design	Possible Score	Team Score
A. Use and development of nutritional label		
a. Required information present	10	
b. Correct calculations	10	
c. Correct organization	10	
B. Use and development of the ingredient statement		
a. Present	10	
b. Correct order and all ingredients included	10	
c. Location on package	10	
C. Use of principle display panel to convey information		
a. All required components	15	
b. Correct information	15	
c. Location on package	10	
Product Design Subtotal	100	
Product Development Oral Presentation	Possible Score	Team Score
D. Cost of Goods Sold		
a. Costing		
b. Accuracy	20	
E. Nutrition		
a. Communicate nutritional quality of product		
b. Apply nutritional quality to health benefits	20	
F. Target Audience		
a. Identification of key consumer	20	
G. Quality Control		
a. Key quality attribute of consistent product		
b. Examples: flavor, color, texture, net weight, size, etc.	20	

H. Marketing and Sales a. Communicated with future users b. Promotions c. Market location	20	
I. Product a. Appearance b. Texture c. Shelf-life d. Interaction of ingredients e. Creativity	20	
J. Processing a. Description of how to make product b. Equipment c. Flow diagram, unit operations d. People	20	
K. Packaging a. Materials used b. Appropriate for use of product c. Creativity	20	
L. Food Safety a. Discussed potential hazards/concerns	20	
M. Formulation Concepts		
a. How well did product match concept/product development scenario	30	
b. Category	5	
c. Platform	5	
N. Quality of Presentation		
a. Equitable participation of team members	5	
b. Organization	5	
c. Use of time allowed	5	
d. Professionalism	5	

e. Presence and enthusiasm	5	
f. Mannerisms	5	
Product Development Oral Presentation Subtotal	250	
Response to Judges' Questions	Possible Score	Team Score
O. Team participation in question response a. All team members contributed	25	
P. Quality of Response a. Accuracy b. Ability to answer c. Originality d. Knowledge	25	
Response to Judges' Questions Subtotal	50	
Total Points	400	