

Information Bulletin
for
Pre-Professional Assessment and Certification
in
Food Science Fundamentals



American Association of Family and Consumer Sciences
Alexandria, VA 22314

(703) 706-4600
www.aafcs.org

Information Bulletin
for
Pre-Professional Assessment and Certification
in
Food Science Fundamentals

Table of Contents

	<u>Page</u>
Overview	3
Description of the Assessment and Certification	3
Uses of the Assessment and Certification	4
Careers	4
Assessment Specifications	5
Format	5
Scoring	6
Assessment at a Glance	7
Content Outline of Domains and Competencies	7
Sample Assessment Items	13
Suggested Preparation Techniques	15
Suggested Instructional Resources	15
Acknowledgements	16

Overview

The American Association of Family and Consumer Sciences (AAFCS), a well-respected leader in the FCS field, proudly offers the Pre-Professional Assessment and Certification (Pre-PAC) Program, as the ***premier*** family and consumer sciences pre-professional assessment and certification system in the nation. AAFCS added a portfolio of standards-based assessments and industry-recognized certifications to support pre-professional level family and consumer sciences career areas and programs of study for the following reasons:

- To help satisfy the growing emphasis on assessment and accountability in secondary and postsecondary education, including requirements for Perkins funding for Career and Technical Education, and
- To help satisfy the growing emphasis on credentials as a human resource and quality control tool in employment settings throughout the career ladder.

Through these assessments, AAFCS assures that pre-professionals are effectively prepared with the knowledge and skills necessary for demanding career opportunities, therefore providing a workforce to meet the needs of business and industry in the demanding U.S. economy.

Given the recent efforts to increase the quantity and quality of food produced, the heightened awareness of the health effects of certain types of foods, and the enhanced focus on the environmental effects of food production, job growth in the food science industry is expected. To help ensure a quality workforce, AAFCS offers a national standards-based competency assessment measuring fundamental knowledge and skills in food science.

Description of the Pre-Professional Assessment and Certification

Assessments in the Pre-PAC portfolio are high quality, rigorous, valid, and reliable as documented through formal psychometric analysis of pilot test data. The assessments are delivered through a premier online testing platform and are used to validate competency at the pre-professional level.

The Food Science Fundamentals Assessment and Certification are:

- driven by business and industry standards;
- based on relevant content standards and consistent with the National Standards for Family and Consumer Sciences Education and the National Career Clusters Initiative;
- appropriate to validate achievement of competencies related to the fundamental principles of food science;
- useful in a broad range of education and employment settings, such as secondary and post-secondary education, community-based education programs, and employer-based human resource and staff development programs; and
- advantaged to utilize a gold-standard, computer-based testing platform format that provides for valid and reliable competency measurement and a reporting mechanism for data-driven program improvement, accountability, and individual remediation and acceleration.

Uses of the Pre-Professional Assessment and Certification

The assessments have application in a broad range of education, community development, staff development, and human resource settings where there is a need to document or validate competency achievement. Pre-PAC assessments are designed for use with secondary and post-secondary students and programs, pre-professionals working in early employment positions, and employers conducting staff development and training for pre-professionals. Further, the assessment and certification can be used to:

- document exit-level achievement in rigorous secondary programs and lower division post-secondary courses;
- satisfy accountability reporting mandates required by federal Perkins IV legislation as well as state and local policies;
- facilitate seamless articulation, placement, and credit-by exam within post-secondary institutions;
- validate competencies required for employment at the pre-professional and/or paraprofessional level; and
- provide an industry-recognized, pre-professional level certification.

Careers

The Food Science Fundamentals assessment/certification address competencies and a skill set necessary for success as a pre-professional in a career with a substantial focus on food science. It will facilitate employment in early career ladder positions and promote continuing education at the post-secondary level in career areas involving:

- food science,
- food safety,
- food quality,
- food technology, or
- food preservation and packaging.

In accordance with those career areas, the assessment is aligned with the following National Career Clusters:



The Career Clusters Icons are being used with permission of the:



States' Career Clusters Initiative, 2010, www.careerclusters.org

Assessment Specifications

The assessment specifications provided in this section of the bulletin are intended to provide test candidates with a comprehensive overview of the domains and competencies that are covered on the assessment.

Format

A large bank of high quality, valid test items have been developed for each Pre-PAC assessment. Each test administered is a unique combination of 80, four-option multiple choice items randomly selected from the item bank. Each of the items has only one (1) correct response. Of the 80 items presented on the assessment, 70 are scored and 10 are non-scored (used for piloting and research purposes).

The online testing software presents the items in five to seven groups or “blocks” corresponding to the domain areas identified on the assessment competency list. Testing is conducted under the supervision of proctors using PC or MAC computers in approved local schools and employment sites. During the assessment administration, it is possible to navigate forward and backward between items within a block of items. As items are viewed, they can be answered, skipped, or flagged for later review prior to submitting the item block. The testing software restricts access to other computer functions while the test is open. Local test administrators and proctors are authorized to make testing accommodations formally specified in Individual Education Plans for those with special needs.

In addition to each item being associated with a domain and competency, the items are also designed to assess appropriate cognitive levels necessary for competent practice. Specifically, some items assess at the lower level, some at the middle levels, and some at higher order levels. The items included on each test proportionally represent three cognitive difficulty levels:

- Level 1- 40%;
- Level 2 – 30%; and
- Level 3 – 30%.

Original Bloom’s Taxonomy	Revised Bloom’s Taxonomy	Pre-PAC Cognitive Complexity Level
<u>Knowledge</u> Defines, describes, identifies, labels, lists, matches, names, reads, records, selects, states, views	<u>Remember</u> Recognize, retrieve, identify, recall	1
<u>Comprehension</u> Classifies, describes, discusses, lists, matches, names, reads, records, selects, states, views	<u>Understand</u> Interpret, clarify, translate, illustrate, categorize, classify, conclude, predict, summarize, infer, compare, explain	

<u>Application</u> Assesses, determines, develops, discovers, establishes, informs, predicts, projects, provides, relates, shows, uses	<u>Apply</u> Execute, carry out, use, implement	2
<u>Analysis</u> Breaks down, correlates, differentiates, illustrates, infers, points out, recognizes	<u>Analyze</u> Differentiate, select, focus, organize, outline, attribute, determine point of view	
<u>Synthesis</u> Communicates, compares, contrasts, creates, designs, expresses, formulates, plans, reorganizes, reinforces, substitutes	<u>Evaluate</u> Check, coordinate, detect, monitor, test, critique, judge	3
<u>Evaluation</u> Appraises, compares & contrasts, concludes, criticizes, decides, defends, interprets, judges, justifies, supports	<u>Create</u> Generating, hypothesizing, planning, designing, producing, constructing	

Scoring

Once the assessment is submitted, results will be available immediately to the test candidate. The results provide an overall percentage score, a breakdown of scores corresponding to the domain levels on the competency list, and the indication whether pre-professional certification has been achieved. Based on the rigor and difficulty level of the assessment, the national cut score for pre-professional certification eligibility is established annually by AAFCS. Individuals who complete the assessment and earn the cut-score for certification are granted a time-limited pre-professional certification (3 years).

Scores can be used to demonstrate an individual's learning and competency, pinpoint weaknesses or gaps in performance, improve programs and curriculum, and demonstrate accountability to various stakeholders. Through articulation agreements, scores may be used as the basis for advanced placement and/or credit-by-exam by post secondary institutions. Thus, state and local entities have latitude for independently establishing passing or qualifying scores for other purposes.

Assessment At A Glance

The specific content being assessed by the items on the assessment follows the test specifications outlined in this section of the bulletin. Please note the number of items on the assessment in each domain.

Domain	Weighting	Number of Items
1. Careers	10%	7
2. Food Protection	16.5%	11
3. Nutritional Composition of Foods	16.5%	12
4. Food Processing, Preservation, & Packaging	24%	17
5. Product Development	16.5%	11
6. Food Technology	16.5%	12

Content Outline for Domains and Competencies

The following outline provides an overview of the content addressed within the domains and competencies. The outline is provided as a tool to be used for guidance in preparations for the assessment and is not intended to be totally inclusive. The numbered concepts listed under each competency are meant to be representative rather than prescriptive.

Domain 1: Careers

Competency 1A: Define the study of food science.

- 1.A.1 Definition and scope of food science
- 1.A.2 Related fields of study
- 1.A.3 Important historical developments in food science
- 1.A.4 Professional organizations, such as Institute of Food Technologists

Competency 1B: Understand the various careers in food science and list the educational requirements.

- 1.B.1 Jobs/careers that require a bachelors degree in food science
- 1.B.2 Jobs/careers in food science that do not require a bachelors degree
- 1.B.3 Food production and manufacturing

Competency 1C: Explain the roles, functions, and skills of individuals engaged in food science careers.

- 1.C.1 Food scientists
- 1.C.2 Food distributors
- 1.C.3 Research food scientist
- 1.C.4 Food technologist
- 1.C.5 Analytical problem solving skills
- 1.C.6 Percentage of U.S. workforce in food production (2%)

Domain 2: Food Protection

Competency 2A: Analyze factors that contribute to food borne illnesses.

- 2.A.1 Escherichia coli, Clostridium perfringens, Staphylococcus aureus, Listeria monocytogenes, Clostridium botulinum, Campylobacter jejuni, Salmonella
- 2.A.2 Norwalk virus, Hepatitis
- 2.A.3 Meat and dairy products
- 2.A.4 Danger zone (40-140°F)
- 2.A.5 Pathogens, microbes, ServSafe
- 2.A.6 Food intoxication versus food infection
- 2.A.7 Safe holding temperature(s) for food
- 2.A.8 Conditions necessary for food pathogen growth (i.e., Phat Tom)

Competency 2B: Analyze food safety and sanitation programs, including Hazard Analysis Critical Control Point (HACCP).

- 2.B.1 The Food Code
- 2.B.2 HACCP
- 2.B.3 Good manufacturing practices (GMPs)

Competency 2C: Evaluate industry standards for documenting and investigating food borne illnesses.

- 2.C.1 Thermal death curve (also known as Thermal Death Time – TDT)
- 2.C.2 Sterilization
- 2.C.3 Standard operating procedures (SOPs)
- 2.C.4 Sanitation standard operating procedures (SSOPs)
- 2.C.5 Critical Control Points (CCPs) and documentation procedures
- 2.C.6 Procedures and information needed to trace source of contaminant

Competency 2D: Identify government agencies and laws in the United States that regulate the safety of the food supply.

- 2.D.1 Government agencies, such as FDA, FAO, USDA, WHO, NIFA, CDC
- 2.D.2 Federal laws including, the Delaney Clause, the Nutrition Labeling and Education Act of 1990, and the Federal Meat Inspection Act of 1906
- 2.D.3 GRAS list

Domain 3: Nutritional Composition of Foods

Competency 3A: Discuss the functionality of carbohydrates in food preparation and preservation.

- 3.A.1 Properties of simple sugars
- 3.A.2 Retrogradation
- 3.A.3 Functions of complex carbohydrates in foods
- 3.A.4 Caramelization

Competency 3B: Discuss the functionality of lipids in food preparation and preservation.

- 3.B.1 Properties of fat and as a heating medium for food
- 3.B.2 Rancidity

Competency 3C: Discuss the functionality of proteins in food preparation and preservation.

- 3.C.1 Properties of proteins in foods, including enzymes and gluten
- 3.C.2 Enzymatic browning

Competency 3D: Discuss the functionality of vitamins, minerals, and phytochemicals, and the impacts by food preparation and preservation on their quality/integrity.

- 3.D.1 Structures of basic vitamin molecule
- 3.D.2 Sources and functions of vitamins, minerals, and phytochemicals including antioxidants, flavonoids, anthocyanins
- 3.D.3 Impact of sunlight, pH, precipitation, heat

Competency 3E: Discuss the functionality of water activity and pH in food preparation and preservation.

- 3.E.1 Measures of pH
- 3.E.2 Calculate molarity
- 3.E.3 Define base, acid, free water, and water activity
- 3.E.4 Relation between water activity and shelf life

Competency 3F: Apply basic concepts of human nutrition.

- 3.F.1 Most ideal energy source(s)
- 3.F.2 Diabetes
- 3.F.3 Function of fat in the human body
- 3.F.4 Water-soluble and fat-soluble vitamins
- 3.F.5 Nutrient interactions in the body, such as potassium and sodium balancing fluids
- 3.F.6 Roles of soluble and insoluble fibers

Domain 4: Food Processing, Preservation, & Packaging

Competency 4A: Discuss the reasons for the use of food additives in processed food products.

- 4.A.1 Common antioxidants, emulsifiers, humectants, tenderizers, food analogs, bulking agent (polydextrose)
- 4.A.2 Advantages and disadvantages of polyols, xylitol, food analogs, monosodium glutamate
- 4.A.3 Food additives that need warning labels

Competency 4B: Discuss units of operation in food preparation and preservation, including thermal energy.

- 4.B.1 Effect of microwaves on food molecules
- 4.B.2 Heat transfer (conduction, convection, radiation)
- 4.B.3 Latent heat, energy, solubility and heat, solute and freezing points of a solution
- 4.B.4 Percentage of calories from nutrients (fat, carbohydrates, protein)

Competency 4C: Evaluate procedures that affect product quality performance.

- 4.C.1 Oxidation and reduction
- 4.C.2 Recipe standardization
- 4.C.3 Quality assurance procedures
- 4.C.4 Food additives and roles in enhancing product quality
- 4.C.5 Quality and preservation methods (including heating and freezing)
- 4.C.6 Sorting by quality and appropriate end use of produce (grading)
- 4.C.7 Measuring for viscosity

Competency 4D: Examine the principles of fermentation.

- 4.D.1 Foods that are the result of bacterial, mold, and acetic acid fermentation
- 4.D.2 Preservation through fermentation
- 4.D.3 Milk fermentation
- 4.D.4 Mixed cultures

Competency 4E: Implement food preparation, production, and testing systems.

- 4.E.1 Calculate mass percentages of a solution
- 4.E.2 Role of culling, centrifuging, osmosis, evaporation, sedimentation
- 4.E.3 Solutes, colloids, emulsion, gelatinization
- 4.E.4 Opacity, syneresis, translucency, viscosity

Competency 4F: Analyze packaging materials with regards to types, functions, and environmental factors.

- 4.F.1 Function of packaging
- 4.F.2 Permeable plastics, aseptic, modified atmosphere packaging (MAP), reduced oxygen packaging (ROP), copolymer, thermoplastic, laminates, aluminum foil, glass

- 4.F.3 Primary, secondary, tertiary, and quaternary package components
- 4.F.4 Commercial canning methods, cold pack methods
- 4.F.5 Methods to control environmental factors such as humidity

Domain 5: Product Development

Competency 5A: Describe the role of science and food science management in the development of new food products.

- 5.A.1 Scientific method and problem solving
- 5.A.2 Variable, control, experiment
- 5.A.3 Steps in new food product development

Competency 5B: Discuss the basic chemistry concepts and the food science applications.

- 5.B.1 Ionization, base, acid, buffer, molecules, reactions, polarity, free radical, electron, polymer, radiolytic compound
- 5.B.2 Bonds: hydrogen, covalent, ionic
- 5.B.3 Mass, volume, weight, density, area, pressure, temperature
- 5.B.4 Sources of acidity (i.e., carbon dioxide, etc.)
- 5.B.5 Substitutes for baking powder (i.e., cream of tartar and baking soda)

Competency 5C: Prepare food products for presentation and assessment.

- 5.C.1 Factors that effect flavor intensity
- 5.C.2 Sensory lab protocol (i.e., mouth rinsing between sampling, etc.)
- 5.C.3 Influence of volatile substances on flavor and how to control
- 5.C.4 Basic tastes (i.e., bitter, sweet, salty)
- 5.C.5 Flavor (combination of taste and aroma)

Competency 5D: Explain the purpose of sensory evaluation panels and how to conduct a sensory panel using appropriate controls.

- 5.D.1 Appropriate sample descriptors for astringency, consistency, and texture
- 5.D.2 Sensory lab protocol (i.e., limiting the number of samples, etc.)
- 5.D.3 Universal evaluation, hedonic scale, duo-trio test, difference from control
- 5.D.4 Techniques to control variables in food sample (i.e., using colored light to mask slight color differences, etc.)

Competency 5E: Discuss factors affecting a person's food preference such as physical, psychological, cultural, and environmental influences.

- 5.E.1 Factors that reduce a person's ability to taste (i.e., age, having a cold, etc.)
- 5.E.2 Vegetarian, omnivore, demographics
- 5.E.3 Age related preferences in flavor (i.e., babies and young children prefer sweet, etc.)
- 5.E.4 Olfactory bulb (smell), umami, supertasters

Domain 6: Food Technology

Competency 6A: Describe the functions/operations and maintenance of test laboratory and related equipment and supplies.

- 6.A.1 Appropriate use and maintenance of equipment to weigh, measure (volume), and heat foods
- 6.A.2 Laboratory safety procedures
- 6.A.3 Cleaning procedures, hand washing
- 6.A.4 Considerations of the task for selecting appropriate equipment
- 6.A.5 Temperature scales: Celsius, Fahrenheit

Competency 6B: Conduct testing for safety of food products, utilizing up-to-date technology.

- 6.B.1 Significant figures and data reading
- 6.B.2 Use of equipment that requires estimating a measurement (i.e, meter stick, beaker)
- 6.B.3 Steps in accurately using a thermometer
- 6.B.4 Use of appropriate format to complete safety/lab reports
- 6.B.5 Role of governmental regulations, sample testing, and written reports
- 6.B.6 Instrumentation commonly used (i.e., hygrometer, etc.)

Competency 6C: Describe the benefits of various technological advances on the scientific study, processing, and preparation of food products.

- 6.C.1 Irradiation, microwave sterilization
- 6.C.2 Drum drying, freeze-drying, spray drying,
- 6.C.3 Biotechnology examples (i.e., drought-resistant plants, etc.)
- 6.C.4 Ultra-high temperature processing (UHT)

Competency 6D: Describe examples of emerging technologies that may impact careers in food science.

- 6.D.1 Genetically engineered foods and role of FDA, GMOs, Flavr Savr tomato
- 6.D.2 Impact of food science on the health of humans and safety of food
- 6.D.3 Recent/emerging technologies (i.e., use of nanoscale materials, etc.)
- 6.D.4 Trends in emerging technologies including ingredient innovations, packaging materials, and clean/green
- 6.D.5 Legal issues and waste

Sample Assessment Items

A series of sample test items is provided below. These items are not intended to serve as a study mechanism, but to familiarize candidates with the format, style, and structure of the items that can be expected on the assessments. Always choose the one best answer.

1. Rosa has just graduated from college with a bachelors degree, in a specialized area of food science. Which of the following jobs would **NOT** be appropriate for Rosa as a recent college graduate? (Domain 1, Competency B)
 - A. Sensory scientist
 - B. Product development
 - C. Flavorist
 - D. Food microbiologist
2. A report from the Center for Science in the Public Interest stated that the cause of a specific outbreak of foodborne illness was a food infection. Which of the following microorganisms can a cause of food infection? (Domain 2, Competency A)
 - A. Clostridium botulism
 - B. Hepatitis C
 - C. Staphylococcus aureus
 - D. Salmonella
3. Meat and poultry are inspected by the _____. (Domain 2, Competency D)
 - A. FSIS
 - B. APHIS
 - C. FDA
 - D. CDC
4. Sarah is comparing two recipes for corn starch pudding. Both recipes have almost the same ingredients and similar procedures, yet one recipe yields a much thicker product. Which of the following factors can reduce a starch's thickening ability? (Domain 3, Competency A)
 - A. Reducing the total salt content
 - B. Adding cream instead of whole milk
 - C. Adding an acid before it thickens
 - D. Reducing water or liquid content
5. Which of the following is **NOT** a pH control agent? (Domain 3, Competency E)
 - A. Acids
 - B. Buffers
 - C. Salts
 - D. Tocopherols
6. Which of the following conditions best promotes a longer shelf life of a food product? (Domain 3, Competency E)
 - A. Low pH and high water activity
 - B. Low pH and low water activity
 - C. High pH and high water activity
 - D. High pH and low water activity

7. Joshua is deciding which type of vanilla ice cream to purchase at the grocery store. One type contains natural vanilla flavoring from vanilla beans, and the other contains artificial vanilla flavoring. What is the main difference between the two types of ice cream? (Domain 4, Competency A)
- A. Cost
 - B. Nutritional value
 - C. Texture
 - D. Melt rate
8. For a chemically active food product, Alisha needs to identify an appropriate packaging material. Which packaging material is chemically inert? (Domain 4, Competency F)
- A. Aluminum
 - B. Glass
 - C. Paper
 - D. Steel
9. Ellen is a food scientist. She is conducting a test to measure the resistance to flow of a starch-thickened mixture. What is she measuring? (Domain 4, Competency C)
- A. Gelatinization
 - B. Retrogradation
 - C. Syneresis
 - D. Viscosity
10. Several trials of an experiment are run to check for _____. (Domain 5, Competency D)
- A. consistency, accuracy, and validity
 - B. cost, accuracy, and replicability
 - C. consistency, practice, and control
 - D. variables, control, and cost

Answer Key:

- | | |
|------|-------|
| 1. C | 6. B |
| 2. D | 7. A |
| 3. A | 8. B |
| 4. C | 9. D |
| 5. D | 10. A |

Suggested Preparation Techniques

The assessment measures two things: knowledge of the subject matter and ability to take an assessment. The first depends on the preparation, instruction, and experience gained in the selected content area. The second depends on self-confidence and experience with multiple-choice questions. It also depends upon the ability to recognize related information or solutions to problem situations.

In preparation for the assessments, test candidates should:

- Avoid situations that would trigger emotions such as worry, anger, depression, and lack of confidence right before the test day. These emotions interfere with memory and are sometimes called “memory thieves.”
- Follow the directions! If read too quickly, something important may be missed.
- Read each item very carefully and avoid jumping to conclusions based upon a quick skimming of the wording.
- See if they can answer the item before looking at the four (4) response options.
- Never think they have immediately spotted the correct response. “Back into” the correct response by first eliminating the incorrect choices.
- Answer each item. Look for clues in the item and even in the choices. If able to eliminate some options, the chances of selecting the correct answer are improved. Use the “flag” options to denote items to come back to within the item block.
- Read the “Candidate Guide to Assessments.” It is important to understand details about online testing and navigation.

Suggested Instructional Resources

The Pre-PAC Instructional Resource Directory provides a list of suggested resources providing content addressed within Pre-PAC assessments. Development panel members and instructors have identified resources that would be relevant and useful in addressing the domains and competencies within the assessment. Use of the references and resources do not guarantee successful completion of the assessment.

AAFCS does not endorse any external products (textbooks, curriculum, etc), vendors, consultants, or documentation that may be referenced in the Directory. While every effort will be made to ensure accuracy and reliability of content, AAFCS assumes no responsibility for errors or for use of the information provided. Additionally, AAFCS disclaims any and all liability for any claims or damages that may result from providing information contained on the site, including any Web sites maintained by third parties and linked to the Pre-PAC site. The responsibility for content rests with the organizations that provide the information. The inclusion of links from the site does not imply endorsement by AAFCS.

The Pre-PAC Instructional Resource Directory is available online at
<https://www.aafcs.org/credentialing-center/pre-pac/portfolio/food-science-fundamentals>

Acknowledgements

AAFCS has engaged the assistance of a broad range of esteemed scientists, educators, and other professionals in food science from across the nation to assist in identifying relevant industry standards and to develop the assessment instrument. Recognizing the value of a solid assessment tool in assuring effective preparation of individuals with appropriate and fundamental food science knowledge and skills, the following stakeholders participated on the development panel for the assessment and certification:

- Ellen Bradley, River City Food Group LLC, Portland, OR
- Bruce Ferree, California Natural Products, Lathrop, CA
- Beverley Hammond, Thermador, BSH Test Kitchens, LaFollette, TN
- Josie Landon, Heinz North America, Ontario, OR
- Tom Nack, General Mills, Golden Valley, MN
- Sarah Olhorst, Institute for Food Technologists, Washington, DC
- Michelle Perchonok, NASA Shuttle Food System and Advanced Food Technology, Houston, TX
- Larry Steenson, Danisco USA, Inc., New Century, KS
- Renee Boyer, Virginia Tech University, Blacksburg, VA
- Claudine Laing-Kean, Purdue University, West Lafayette, IN
- Kim Gayle Best-Smith, Cary High School, Cary, NC
- Susan Turgeson, Menomonie High School, Menomonie, WI