

Correlation of *Principles of Food Science* to Pre-PAC Domains and Competencies for *Food Science Fundamentals*

The American Association of Family and Consumer Sciences (AAFCS) in collaboration with AAFCS members and business, industry, and education leaders developed the *Pre-Professional Assessment and Certification (Pre-PAC) Program*. AAFCS administers these standards-based assessments for pre-professionals in family and consumer sciences career areas. The background sources used in developing these assessments include the National Standards for Family and Consumer Sciences Education, the Career Clusters initiative, and input from business and industry leaders.

The following chart correlates the domains and competencies of the *Food Science Fundamentals* Pre-PAC assessment with the content of *Principles of Food Science*. For each competency, the chart lists the chapter number(s) that identify the content location, and also the unit numbers and Special Topics titles. (*Note*: Because students may learn content that addresses these competencies through one or more courses, the chart also identifies other Goodheart-Willcox textbooks that support the competencies.)

After studying the content of this text, students will be able to achieve the following competencies:

Domain 1: Careers		
Competency 1A Define the study of food science.		Text Concepts (Related Text Components)
1.A.1	Definition and scope of food science	Ch. 1
1.A.2	Related fields of study	Ch. 25
1.A.3	Important historical developments in food science	Ch. 1, 7, 15, 17, 19, 20

1.A.4	Professional organizations, such as Institute of Food Technologists	Ch. 25
Competency 1B Understand the various careers in food science and list the educational requirements.		Text Concepts (Related Text Components)
1.B.1	Jobs/careers that require a bachelors degree in food science	Unit 1, 2, 3, and 6 openers; Ch. 25
1.B.2	Jobs/careers in food science that do not require a bachelors degree	Unit 4 opener, Ch. 25
1.B.3	Food production and manufacturing	Ch. 25
Competency 1C Explain the roles, functions, and skills of individuals engaged in food science careers.		Text Concepts (Related Text Components)
1.C.1	Food scientists	Ch. 1, Unit 2 opener
1.C.2	Food distributors	Ch. 25
1.C.3	Research food scientist	Unit 2 opener, Ch. 25
1.C.4	Food technologist	Ch. 25
1.C.5	Analytical problem solving skills	Ch. 2 and 3; Special Topics–Career Success
1.C.6	Percentage of U.S. workforce in food production (2%)	Ch. 25
Domain 2: Food Protection		
Competency 2A Analyze factors that contribute to food borne illnesses.		Text Concepts (Related Text Components)
2.A.1	Escherichia coli, Clostridium perfringens, Staphylococcus aureus, Listeria monocytogenes, Clostridium botulinum, Campylobacter jejuni, Salmonella	Ch. 6, 18
2.A.2	Norwalk virus, Hepatitis	Ch. 18
2.A.3	Meat and dairy products	Ch. 18
2.A.4	Danger zone (40-140°F)	Ch. 18 (addresses this

		USDA range and also FDA's Food Code range of 41-135° F)
2.A.5	Pathogens, microbes, ServSafe	Ch. 17, 18; Special Topics–Career Success
2.A.6	Food intoxication versus food infection	Ch. 18
2.A.7	Safe holding temperature(s) for food	Ch. 18
2.A.8	Conditions necessary for food pathogen growth (i.e., Phat Tom)	Ch. 17
Competency 2B Analyze food safety and sanitation programs, including Hazard Analysis Critical Control Point (HACCP)		Text Concepts (Related Text Components)
2.B.1	The Food Code	Ch. 1, 18
2.B.2	HACCP	Ch 1, 18
2.B.3	Good manufacturing practices (GMPs)	Ch. 7, 11, 16
Competency 2C Evaluate industry standards for documenting and investigating food borne illnesses.		Text Concepts (Related Text Components) To address more of the concepts covered by this competency, see the G-W texts <i>Nutrition & Wellness for Life</i> and <i>The Culinary Professional</i>
2.C.1	Thermal death curve (also known as Thermal Death Time TDT)	Ch. 19
2.C.2	Sterilization	Ch. 19
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	Ch. 18
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.		Text Concepts (Related Text Components)
2.D.1	Government agencies, such as FDA, FAO, USDA, WHO, NIFA, CDC	Ch. 1, 16, 18 (NIFA isn't covered)
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	Ch. 1, 6
2.D.3	GRAS list	Ch. 16
Domain 3: Nutritional Composition of Foods		
Competency 3A Discuss the functionality of carbohydrates in food preparation and preservation.		Text Concepts (Related Text Components)
3.A.1	Properties of simple sugars	Ch. 8
3.A.2	Retrogradation	Ch. 9
3.A.3	Functions of complex carbohydrates in foods	Ch. 9
3.A.4	Caramelization	Ch. 8
Competency 3B Discuss the functionality of lipids in food preparation and preservation.		Text Concepts (Related Text Components)
3.B.1	Properties of fat and as a heating medium for food	Ch. 10
3.B.2	Rancidity	Ch. 10
Competency 3C Discuss the functionality of proteins in food preparation and preservation.		Text Concepts (Related Text Components)
3.C.1	Properties of proteins in foods, including enzymes and gluten	Ch. 12

3.C.2	Enzymatic browning	Ch. 12
Competency 3D Discuss the functionality of vitamins, minerals, and phytochemicals, and the impacts by food preparation and preservation on their quality/integrity.		Text Concepts (Related Text Components)
3.D.1	Structures of basic vitamin molecule	Ch. 13
3.D.2	Sources and functions of vitamins, minerals, and phytochemicals including antioxidants, flavonoids, anthocyanins	Ch. 13, 14, 16
3.D.3	Impact of sunlight, pH, precipitation, heat	Ch. 13, 14
Competency 3E Discuss the functionality of water activity and pH in food preparation and preservation.		Text Concepts (Related Text Components)
3.E.1	Measures of pH	Ch. 6
3.E.2	Calculate molarity	Ch. 6, 7
3.E.3	Define base, acid, free water, and water activity	Ch 6, 7
3.E.4	Relation between water activity and shelf life	Ch. 7
Competency 3F Apply basic concepts of human nutrition.		Text Concepts (Related Text Components) To address more of the concepts covered by this competency, see the G-W text <i>Nutrition & Wellness for Life</i>
3.F.1	Most ideal energy source(s)	Ch. 9, 10, 11, 13, 14
3.F.2	Diabetes	Ch. 9
3.F.3	Function of fat in the human body	Ch. 10
3.F.4	Water-soluble and fat-soluble vitamins	Ch. 13

3.F.5	Nutrient interactions in the body, such as potassium and sodium balancing fluids	Ch. 13
3.F.6	Roles of soluble and insoluble fibers	Ch. 9 (insoluble fibers only)
Domain 4: Food Processing, Preservation, & Packaging		
Competency 4A		Text Concepts (Related Text Components)
4.A.1	Common antioxidants, emulsifiers, humectants, tenderizers, food analogs, bulking agent (polydextrose)	Ch. 8, 10, 11, 12, 15, 16
4.A.2	Advantages and disadvantages of polyols, xylitol, food analogs, monosodium glutamate	Ch. 8, 15, 16
4.A.3	Food additives that need warning labels	Ch. 16
Competency 4B Discuss units of operation in food preparation and preservation, including thermal energy.		Text Concepts (Related Text Components)
4.B.1	Effect of microwaves on food molecules	Ch. 5
4.B.2	Heat transfer (conduction, convection, radiation)	Ch. 5
4.B.3	Latent heat, energy, solubility and heat, solute and freezing points of a solution	Ch. 4, 5, 8, 22
4.B.4	Percentage of calories from nutrients (fat, carbohydrates, protein)	Ch. 5
Competency 4C Evaluate procedures that affect product quality performance.		Text Concepts (Related Text Components) To address more of the concepts covered by this competency, see the G-W text <i>The Culinary Professional</i>
4.C.1	Oxidation and reduction	Ch. 11
4.C.2	Recipe standardization	—
4.C.3	Quality assurance procedures	Ch. 25
4.C.4	Food additives and roles in enhancing product quality	Ch. 16

4.C.5	Quality and preservation methods (including heating and freezing)	Ch. 19
4.C.6	Sorting by quality and appropriate end use of produce (grading)	Ch. 23
4.C.7	Measuring for viscosity	Ch. 9
Competency 4D Examine the principles of fermentation.		Text Concepts (Related Text Components)
4.D.1	Foods that are the result of bacterial, mold, and acetic acid fermentation	Ch. 17
4.D.2	Preservation through fermentation	Ch. 17
4.D.3	Milk fermentation	Ch. 17
4.D.4	Mixed cultures	Ch. 17
Competency 4E Implement food preparation, production, and testing systems.		Text Concepts (Related Text Components)
4.E.1	Calculate mass percentages of a solution	Ch. 22
4.E.2	Role of culling, centrifuging, osmosis, evaporation, sedimentation	Ch. 5, 23 (Culling isn't covered)
4.E.3	Solutes, colloids, emulsion, gelatinization	Ch. 4, 9, 10, 22
4.E.4	Opacity, syneresis, translucency, viscosity	Ch. 9
Competency 4F Analyze packaging materials with regards to types, functions, and environmental factors.		Text Concepts (Related Text Components)
4.F.1	Function of packaging	Ch. 21
4.F.2	Permeable plastics, aseptic, modified atmosphere packaging (MAP), reduced oxygen packaging (ROP), copolymer, thermoplastic, laminates, aluminum foil, glass	Ch. 21
4.F.3	Primary, secondary, tertiary, and quaternary package components	Ch. 21 (Tertiary and quaternary components aren't covered)

4.F.4	Commercial canning methods, cold pack methods	Ch. 19
4.F.5	Methods to control environmental factors such as humidity	Ch. 19
Domain 5: Product Development		
Competency 5A Describe the role of science and food science management in the development of new food products.		Text Concepts (Related Text Components)
5.A.1	Scientific method and problem solving	Ch. 2, 24
5.A.2	Variable, control, experiment	Ch. 24
5.A.3	Steps in new food product development	Ch. 24
Competency 5B Discuss the basic chemistry concepts and the food science applications.		Text Concepts (Related Text Components)
5.B.1	Ionization, base, acid, buffer, molecules, reactions, polarity, free radical, electron, polymer, radiolytic compound	Ch. 4, 6, 7, 9, 14, 16, 21
5.B.2	Bonds: hydrogen, covalent, ionic	Ch. 4, 7
5.B.3	Mass, volume, weight, density, area, pressure, temperature	Ch. 2, 7
5.B.4	Sources of acidity (i.e., carbon dioxide, etc.)	Ch. 6, 16
5.B.5	Substitutes for baking powder (i.e., cream of tartar and baking soda)	Ch. 6
Competency 5C Prepare food products for presentation and assessment.		Text Concepts (Related Text Components)
5.C.1	Factors that effect flavor intensity	Ch. 3
5.C.2	Sensory lab protocol (i.e., mouth rinsing between sampling, etc.)	Ch. 3
5.C.3	Influence of volatile substances on flavor and how to control	Ch. 3
5.C.4	Basic tastes (i.e., bitter, sweet, salty)	Ch. 3
5.C.5	Flavor (combination of taste and aroma)	Ch. 3

Competency 5D Explain the purpose of sensory evaluation panels and how to conduct a sensory panel using appropriate controls.		Text Concepts (Related Text Components)
5.D.1	Appropriate sample descriptors for astringency	Ch.3
5.D.2	Sensory lab protocol (i.e., limiting the number of samples, etc.)	Ch.3, 24
5.D.3	Universal evaluation, hedonic scale, duo-trio test, difference from control	Ch.3 (Duo-trio test isn't covered)
5.D.4	Techniques to control variables in food sample (i.e., using colored light to mask slight color differences, etc.)	Ch. 3
Competency 5E Discuss factors affecting a person's food preference such as physical, psychological, cultural, and environmental influences.		Text Concepts (Related Text Components)
5.E.1	Factors that reduce a person's ability to taste (i.e., age, having a cold, etc.)	Ch. 3, 15
5.E.2	Vegetarian, omnivore, demographics	Ch. 3
5.E.3	Age related preferences in flavor (i.e., babies and young children prefer sweet, etc.)	Ch. 3
5.E.4	Olfactory bulb (smell), umami, supertasters	Ch. 3
Domain 6: Food Technology		
Competency 6A Describe the functions/operations and maintenance of test laboratory and related equipment and supplies.		Text Concepts (Related Text Components)
6.A.1	Appropriate use and maintenance of equipment to weigh, measure (volume), and heat foods	Ch. 2
6.A.2	Laboratory safety procedures	Ch. 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24
6.A.3	Cleaning procedures, hand washing	Ch. 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24

6.A.4	Considerations of the task for selecting appropriate equipment	Ch. 2
6.A.5	Temperature scales: Celsius, Fahrenheit	Ch. 2, 5
Competency 6B Conduct testing for safety of food products, utilizing up-to-date technology.		Text Concepts (Related Text Components)
6.B.1	Significant figures and data reading	Ch. 2
6.B.2	Use of equipment that requires estimating a measurement (i.e, meter stick, beaker)	Ch. 2
6.B.3	Steps in accurately using a thermometer	Ch. 7
6.B.4	Use of appropriate format to complete safety/lab reports	Ch. 2
6.B.5	Role of governmental regulations, sample testing, and written reports	Ch. 1, 18
6.B.6	Instrumentation commonly used (i.e., hygrometer, etc.)	Ch. 2
Competency 6C Describe the benefits of various technological advances on the scientific study, processing, and preparation of food products.		Text Concepts (Related Text Components)
6.C.1	Irradiation, microwave sterilization	Ch 21 (irradiation only)
6.C.2	Drum drying, freeze-drying, spray drying,	Ch. 20
6.C.3	Biotechnology examples (i.e., drought-resistant plants, etc.)	Ch. 21
6.C.4	Ultra-high temperature processing (UHT)	Ch. 19
Competency 6D Describe examples of emerging technologies that may impact careers in food science.		Text Concepts (Related Text Components)
6.D.1	Genetically engineered foods and role of FDA, GMOs, Flavr Savr tomato	Ch. 21
6.D.2	Impact of food science on the health of humans and safety of food	Ch. 1, 2, 3, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24
6.D.3	Recent/emerging technologies (i.e., use of nanoscale materials, etc.)	Ch. 1, 21, 24, 25

6.D.4	Trends in emerging technologies including ingredient innovations, packaging materials, and clean/green	Ch. 16, 17, 18, 21, 24
6.D.5	Legal issues and waste	Ch. 7, 16, 21, 23, 25