RCACC Culinary Arts and Food
Science Learning Outcomes for the CRC® and CCS® Exams
(Revised February 2016)

CULINARY ARTS

Note: 90% of CCS® exam questions and 10% of CRC® exam questions come from CULINARY ARTS. In addition to these learning outcomes, please reference the most recent editions of *Elementary Food Science* (Ernest R. Vieira), *Essentials of Food Science* (Vickie A. Vaclavik and Elizabeth W. Christian) and *On Cooking: a Textbook of Culinary Fundamentals* (Sarah R. Labensky, Alan M. Hause), *Culinology: The Intersection of Culinary Art and Food Science* (Research Chefs Association.)

~ APPLICATIONS ~

Knowledge of Allergens

1) List at the top 8 commonly recognized food allergens as listed by the FDA. [Note: "On Cooking" does not separately list fin fish or tree nuts.]
2) Discuss why knowledge of allergens is critical.
3) Name several grains that can be eaten by someone who cannot consume gluten and explain why they can be tolerated.

Knowledge of Carbohydrates (Part I)

Carbohydrates (including vegetables, fruits, cereals, grains)

1) Characterize the benefits which the two essential nutrients found in carbohydrates provide the body.
2) List the components that make up a carbohydrate.
3) Define difference between simple and complex carbohydrates and list examples.
4) Explain why dietary fiber is a unique carbohydrate.
5) Outline difference between two types of dietary fiber.

Vegetables

1) Detail the characteristics of the nine categories of vegetables.
2) Explain why some fruits are often labeled as vegetables.
3) Define the term vegetable.
4) Identify vegetables from either visual or verbal illustrations.
5) Apply appropriate prep/cooking/holding/presentation options when presented with a list of vegetables.
6) Define the Scoville Heat Unit.
7) Recognize purchasing and storage requirements for vegetables, both fresh and preserved.
8) Explain how acid/alkali reactions affect vegetables.
9) Recognize basic cooking methods.

Knowledge of Carbohydrates (Part II)

Potatoes, Grains and Pasta

1) Recognize commonly used potato varieties.
2) Recognize basic cooking methods.
3) State purchasing and storage requirements for potatoes and pasta.
4) Label a botanical illustration of a kernel of grain.
5) List methods for grinding grains.
6) Indicate temperature safety requirements when using grains or potatoes in food service.
7) Identify various cuts of pasta.
8) Describe best methods to prepare pasta, both fresh and frozen.
9) Explain steps required to produce fresh pasta.

Knowledge of Carbohydrates (Part III)

Fruits

1) Identify a variety of fruits.
2) Discuss requirements for purchasing/storing fresh fruits.
3) Recognize basic cooking methods.
4) List options for prep/presentation of various fruits.
5) Detail ripening stages/requirements of fruits, including the effect on the sensory properties of the fruit.
6) State which parts of a specified fruit are edible.
7) Explain the terms "hybrid," "heirloom" and "variety."
8) List the nutritional benefits of fruits.
9) Explain the term "acidulation" as it applies to fruits.
10) List benefits of various processing methods (canned, frozen, preserved, dried).
11) Explain how storage temperatures affect fruit respiration rate.

Knowledge of Nutrition Trends

1) Identify food nutrition trends that affect food service.
2) Discuss consumer concerns as related to the nutritional content of various foods.
3) List six categories of nutrients.
4) Describe interplay of various nutrients as it relates to function.
5) Explain the different parts of a nutritional label.

Knowledge of Dairy Products (Part I)

Milk and Milk Products (concentrated milk products, cream, cultured dairy products, butter, margarine)

1) Differentiate attributes of various concentrated milk products.
2) State safe storage requirements for different dairy products.
3) Contrast butter and margarine, both in composition and application in cooking.
4) List a variety of mammals that produce milk used for human consumption.

Processing Techniques
1) Discuss the various processing techniques for milk.
2) Explain the steps needed to produce most common cultured dairy products.
3) Describe the characteristics of a variety of butters.

Cheeses (Fresh or Unripened, Soft, Semi-soft, Firm, Hard, Processed)
1) Identify various cheeses.
2) Describe production process for fresh, soft, semi-soft, firm, hard and processed cheese.
3) State which types of cheese fit various culinary applications.
4) Recognize cheese terminology appearing on labels.
5) Describe requirements for storing cheeses.

Knowledge of Dairy Products (Part II)
Egg Products/Substitutes
1) Identify the parts of an egg.
2) Explain purchase, safe storage and handling requirements for eggs.
3) Describe differences between eggs from various fowl.
4) List steps required to whip egg whites.
5) Define nutritional content of eggs.
6) List reasons for using egg substitutes.
7) Indicate specific properties of two types of egg substitutes.
8) Recognize basic cooking methods.

Knowledge of Fats & Oils
Hydrogenation, Saturation, Refining, Rendering of Fats
1) Define rendering as it applies to fats.
2) Describe the chemistry principles behind hydrogenation of fats.
3) Describe the following terms used to classify fats: saturated, monounsaturated, polyunsaturated, and trans.
4) Discuss how dietary fats may affect the heart.

Processing, Quality, Functionality
1) List appropriate cooking oils used in basic cooking methods.
2) Define the following terms: melt, smoke and flash points.
3) Match various fats to their melt, smoke and flash points.
4) Explain the following: sautéing, stir frying, deep frying and pan frying.
5) State safety requirements when cooking with oils.
6) Briefly explain what happens when fats break down.
7) Explain the changes to viscosity and opacity when oils transition from refrigeration to room temperature
8) State considerations regarding cost and flavor of oils in culinary usage.
9) Explain sensory results of "rancidity."
10) Define labeling terminology for blended oils.
11) Explain how hydrogenation can affect the various physical properties of oil.

Knowledge of General Nutrition (Part I)
Enrichment (esp. grain products)
1) List the two vitamins often used to enrich dairy products.

Essential Nutrients (Carbohydrates, Lipids, Proteins, Vitamins, Minerals, Water, & Phytochemicals)
1) Define: calorie, carbohydrate, lipids and protein.
2) Calculate fat, carbohydrate and protein calories.
3) Name three energy components of essential nutrients.
4) Specify the function, source and technique for nutrient retention of the various vitamins.
5) Specify the function and source of various minerals.
6) Describe the body's need and use of water.
7) Explain the value of phytochemicals as related to disease prevention and the healthy maintenance of the human body.
8) Define the terms flavonoids and antioxidants.

Knowledge of General Nutrition (Part II)
Healthful Eating (health recommendations, ingredient substitutions and alternatives)
1) Define "ingredient substitution" as related to diet.
2) Explain the difference between ingredient "substitution" and "alternative."
3) Apply the terms "reduce," "replace" and "eliminate" when modifying recipe ingredients for nutritional needs.
4) Describe appropriate use of the various sugar, salt and fat substitutes available in the marketplace.

Nutritional Labeling (consumer concerns about nutrition)
1) Describe how nutrient requirements are established.
2) Interpret nutritional labels on packaging.

Knowledge of Proteins (Part I)
Meat (Beef, Veal, Lamb, Pork, Game)
1) Match cuts of meat to the various animal sources.
2) Recognize basic cooking methods for meat.
3) Review the composition of different cuts of meat.
4) Describe the benefits of marination in preparation of meats.

5) Describe common methods for smoking meats.

Meat Composition & Butchering (primal, sub primal, fabricated cuts)
1) Identify structure and muscle composition of various meats.
2) Describe the primal, sub-primal and fabricated cuts of meat.
3) Describe various aging methods for meat. 4) Recognize purchasing/storage requirements for meats.
5) State safe serving temperatures for all meats.
6) Explain the Maillard reaction.

Poultry (Chicken, Duck, Goose, Guinea, Pigeon, Turkey, Game)
1) Identify the various classes of poultry.
2) Recognize various cooking methods for poultry.
3) Describe how poultry age affects the choice of cooking method.
4) Describe the benefits of marinating in preparation of poultry and game.

Identification & Butchering
1) Identify structure and muscle composition of poultry and game.
2) Label the various cuts of poultry/game. 3) Recognize purchasing/storage requirements for poultry and game.
4) List various procedures to prepare poultry and game for cooking.
5) Recognize various cooking methods for poultry and game.
6) List safe serving temperatures for all poultry and game.

Liver, Gizzards, Hearts, Neck, and Foie Gras
1) Identify various organ meats. 2) Recognize various cooking methods for organ meats.

Knowledge of Proteins (Part II)

Fish and Shellfish
1) Identify shellfish, fish, mollusk and crustacean categories.
2) Recognize proper purchasing, storage and food safety requirements for shellfish, fish, mollusks and crustaceans.
3) State nutritional aspects of various shellfish, fish, mollusks and crustaceans.
4) Recognize various cooking methods for various shellfish, fish, mollusks and crustaceans.

Identification & Fabrication
1) Describe common fabrication methods for shellfish and fish.

Knowledge of Proteins (Part III)

Plant Proteins (including legumes, soy/soy products, meat analogs, nuts, seeds, nutritional yeast)
1) Explain the range of vegetarian diets.
2) Discuss various motivations for supporting a vegetarian diet.
3) Substitute plant proteins for animal proteins to create balanced diet plan.
4) Describe properties of soybean-based proteins.
5) Recognize cooking methods for soybean-based proteins.
6) Describe the relationship of plant materials and flavorings/herbs & spices to create analogous foods.
7) List vegetarian substitutes for dairy/meat products.
8) Identify a variety of nuts.

Knowledge of Flavor Building in the Kitchen (Part I)

Top, Mid, Base Notes and construction of flavor systems
1) Explain the psychology of taste and smell in humans.
2) Discuss factors affecting perception of flavors.
3) Match type of aroma/flavor with listing of foods with such characteristics.
4) Explain the concept of top, mid and base notes.
5) Describe what other factors can affect flavors.

Basic Tastes (sweet, salty, bitter, sour, and Umami)
1) Recognize what can be added/subtracted from a basic taste profile (sweet, salty, etc.) to enhance perception of taste.
2) Define the basic taste sensations by describing how they are derived, how to enhance them, and how tastes are perceived in various foods.

Flavor Perception
1) Discuss what human factors compromise perception of taste.
2) Describe what environmental factors affect perception of taste.
3) Describe the physiology of how humans experience taste and smell.

Knowledge of Flavor Building in the Kitchen (Part II)

Oil and Spice Extracts
1) Recognize a variety of herbs, spices, oils, vinegars, wines and other flavorings.
2) State proper storage conditions for flavoring agents.
3) Know the properties of culinary salts available.
4) Describe the taste profiles of culinary oils. 5) Explain the difference between emulsions and extracts.
6) Recognize the source of essential oils
7) Recognize proper storage for essential oils, extracts, etc.

Wine, Beers, Liquors
1) Define the following terms: beer, wine, brandies, liquors and liqueurs.
2) Explain the wine making process.
3) Describe the difference between sparkling and fortified wines.
4) Discuss grape varietals.
5) Recognize labeling requirements for imported wines of various regions.
6) Describe process for evaluating wines.
7) List some guidelines to assist customers to match wine and beer with food.
8) State challenges possible when using wine as a flavoring.
9) Describe characteristics of different types of beer.
10) Identify the basic categories of liquors.
11) Characterize the distillation process of major liquors.

~ CULINARY ARTS & MANAGEMENT ~

Knowledge of Culinary Kitchen Fundamentals

1) Identify the chef stations of the kitchen brigade and their responsibilities.
2) Describe how the modern kitchen brigade differs from the classic brigade system.
3) Describe the various work sections and their stations in the modern kitchen.
4) Define the term "Mise en Place" and be able to name examples.

Knowledge of Culinary Uses and Applications of Products

1) Identify which cooking methods are suited for specific foods.
2) Classify the following reaction temperatures for different types of fat: melting point, smoke point and flash point.

Knowledge of Kitchen Tools and Equipment

Knives
1) Identify the parts of a knife and various knife shapes.
2) Describe knife sharpening techniques and equipment.

Measuring and Portioning Equipment
1) Recognize measuring and portioning equipment and describe its uses.
2) List measuring utensils (spoons, cups, scales)
3) Discuss conversions between different measuring equipment (i.e., volume to weight).
4) Identify standard portion scoop capacities.

Common Cookware, Processing Equipment and Heavy Equipment
1) Identify common cookware, processing equipment, heavy equipment, and buffet equipment.
2) Describe materials used in cookware and the advantages/disadvantages of each.
3) Describe the factors that should be considered when selecting tools & equipment.
4) Describe new technology cooking: silicon bake-ware, induction.

Safety Equipment
1) Identify the following safety equipment elements, how they work and why they are necessary in the kitchen: fire extinguishers, ventilation, first aid and protective gear.

Knowledge of Principles of Cooking (Part I)

Heat Transfer
1) Describe the following principles of heat transfer: conduction, convection and radiation.

Effects of Heat
1) Explain the following effects of heat: coagulation, gelatinization, caramelization and browning.

Dry Heat Cooking: broiling, grilling, roasting, sautéing, stir-frying, pan frying, deep frying
1) Describe each dry heat cooking procedure.
2) Recognize the related terminology and explain when each technique would be used.
3) State which type of equipment would typically be used for each procedure.
4) Define Poêléing and basting.
5) Describe what carryover cooking is and why it is important.
6) Recognize the various methods of deep frying.
7) Describe the safety hazards of cooking with hot oil, including the role of acreolin.
8) Explain factors that can damage fryer fats and name indicators that the fat needs to be changed.

Knowledge of Principles of Cooking (Part II)

Moist Heat Cooking: poaching, simmering, boiling, steaming
1) Describe each moist heat cooking procedure.
2) Recognize the related terminology and explain when each technique would be used.
3) State which type of equipment would typically be used for each procedure.
4) Recognize and explain the differences associated with liquid temperature and liquid condition, and how each affects the following moist heat cooking techniques: poaching, simmering, boiling and steaming.

Combination Cooking: braising, stewing

1) Describe each combination cooking procedure.
2) Recognize the related terminology and explain when each technique would be used.
3) State which type of equipment would typically be used for each procedure.

Knowledge of Principles of Cooking (Part III)

Breading/Batters

1) Identify the types of breading and batters and how they are used.
2) Explain how to make bread crumbs and the standard breading procedure, including associated safety concerns.
3) Define "meal" as it relates to the breading/battering process.

Blanching and Parboiling

1) Define blanching, parboiling and par cooking and describe why they are important.

Ice Baths

1) Explain the purposes of using an ice bath. 2) Identify the process of shocking and why it is used.

Knowledge of Regional & World Cuisines

1) Identify typical flavoring ingredients and cooking methods that are fundamental to various world cuisines.
2) Define the following: global cuisine, national cuisine, regional cuisine, and ethnic cuisine.

Knowledge of Traditional Stocks, Sauces & Soups (Part I)

Stocks

1) Identify stock terminology: white, brown, fish, fumet, court bouillon and fond.
2) Identify the ratios of the following stock components: bones, mirepoix, seasonings and water.
3) Identify the components and uses of various bones and how they relate to making stock.
4) Identify the steps in making the various types of stocks.
5) Describe the method for safely cooling and handling stocks.
6) Explain the following key terms associated with stock making: sweat, deglaze, degrease, caramelize, matignon, remouillage, nage and glaze.
7) Describe how to troubleshoot common problems in stock making.

Knowledge of Traditional Stocks, Sauces & Soups (Part II)

Sauces

1) List the mother / leading sauces, their ingredients.
2) Recognize how small/compound sauces are created
3) Define the following contemporary sauces: purees, salsas, relish, compound butters, coulis, vegetable juice sauces, flavored oils and pan sauces.
4) Describe the process to make a mother sauce.
5) Define "gastrique", "clarify" and the various types of butter sauces.
6) Recognize the following sauce thickening agents, their purpose and benefits or disadvantages: roux, cornstarch, arrowroot, beurre manié, liaison, emulsification, tempering and slurry.
7) Describe the proportions of roux to liquid for light, medium and heavy sauces.
8) Describe the process for holding emulsified butter sauces, and state the proper, related temperatures.
9) Recognize the following sauce finishing techniques: reduction, straining and monté au beurre.
10) Describe the following sauce qualities and typical uses: Béchamel, Velouté, Espagnole, Tomato, Hollandaise, butter sauces, pan gravy, coulis, salsa/relish and flavored oils.
11) Discuss how to troubleshoot common problems in sauce making.

Knowledge of Traditional Stocks, Sauces & Soups (Part III)

Soups

1) Identify the classifications of soups and their components: clear, consommé, cream, puree, bisques, chowders and cold soups. 2) Describe the method used to produce the various types of soups.
3) Discuss the types of thickening agents used for the various types of soups.
4) Understand the function of soup garnishes and the appropriate garnish for each type of soup.
5) Describe the classic garnishes of classic consommés.

Knowledge of Baking & Pastry (Part I)

Ingredient Composition & Structure

1) Describe the composition of wheat kernels.
2) Describe the process of milling flour.
3) Describe the difference between soft and hard flours.
4) Explain the process of aging or bleaching flour.
5) Explain and describe gluten and its function in baked goods.
6) Describe different protein contents of flour and the different usages of each.
7) List and describe the different usages of sugars as they relate to baked goods.
8) List and describe the usages of liquid sweeteners and their functions in baked goods.
9) Describe different cooked sugar syrup stages, their make-up and usages.
10) Describe and list the different fats used in baking.

11) Describe the difference between powdered gelatin and sheet gelatin. Why and how each is used.
12) Describe the difference between extracts and emulsions.

Ingredient Functionality
1) Describe the composition and different usages of baking powder and baking soda.
2) Recognize commonly used acids used in conjunction with baking soda.
3) List the function of sugars and or other sweeteners on baked goods.
4) List and describe the functions of fats in baked goods.
5) Describe the composition of eggs.
6) Describe proper storage of eggs.
7) Describe and list common methods of determining the quality of eggs.
8) Describe how salt affects baked products. 9) List different types of leavening agents.

Knowledge of Baking & Pastry (Part II)

Mixing Methods
1) Define the mixing methods and applications: biscuit, muffin, creaming, beating, blending, cutting, folding, kneading, sifting, stirring and whipping.

Applications
1) Describe the function of fermentation.
2) Describe the proper temperatures when using yeasts.
3) List and describe different types of yeasts.
4) List and describe the 10 stages of production for yeast breads.
5) Identify and explain the procedure for preparing rolled-in dough.
6) Describe and list the differences between lean and rich doughs.
7) Describe the difference between flaky and mealy doughs.
8) Describe the process of blind baking.
9) Describe various pie fillings such as cream, fruit, custard and chiffon.
10) Describe common methods of making meringues such as common, Swiss and Italian.
11) Describe various types of cookies such as drop, icebox, bar, cut-out, rolled, pressed and wafer.
12) Describe how formula ingredients, size, shape and baking affect the texture of cookies.
13) Describe how formula ingredients, mixing method affect the texture of cakes.
14) Describe various types of cakes such as high-ratio, genoise, angel, chiffon and butter cakes.
15) Describe how altitude affects cakes and how to adjust formulas.
16) Describe methods for determining when cakes are done.
17) List and describe various types of frosting such as butter-cream, foam, fudge, fondant, glaze, royal icing, and ganache.
18) Describe the difference between a stirred custard and a baked custard.
19) List the classifications of pastry dough and describe characteristics after baking.

Formula Calculations-Baker's %
1) Recognize and be able to apply Baker's percent.

Knowledge of Product Presentation

1) Explain the following aspects of food preparation for proper plate presentation: cutting and molding.
2) Indicate how to properly choose plates for presenting food with regard to sizes and shapes, and colors and patterns.
3) Recognize how to arrange food on plates for the best presentation with regard to shapes, colors, textures and arrangements. 4) Explain how to decorate plates through dusting, herbs/greens and sauces.

Knowledge of Ingredient Sourcing

Internal management
1) Define FIFO.
2) Explain the issues that can control/affect food costs.
3) Define parstock.

Storage
1) Describe storage procedures for the various ingredients in the kitchen.

Knowledge of Recipe Development and Formula Ratios

Recipe Yield
1) Calculate recipe yield.
2) Explain how to convert portion size.
3) Define common abbreviations for measurements and common equivalents.
4) Describe how to calculate recipe cost, unit cost, food cost percent and selling price. 5) Define conversion factor, A.P. (as purchased), E.P. (edible portion), overhead costs and inventory.

Standardized recipes
1) Recognize the difference between the definitions for "recipe" and "standardized recipe."

Knowledge of Weight & Measurement Conversions

1) Describe the difference of weight versus volume.
2) Explain how to convert from Celsius to Fahrenheit and from Fahrenheit to Celsius degrees.

3) Explain how to convert from the US and metric measurement systems.
4) Discuss the process of using a balance scale.

~ MICROBIOLOGY, FOOD SAFETY, QUALITY ASSURANCE & REGULATIONS ~

Knowledge of Food Chemistry and Microbiology

1) Describe different types of bacteria.
2) Define putrefactives and explain how "pathogenic" and "reproduction time phases" relate to the term.
3) List and describe different types of intoxications and infections.
4) Describe viruses and their forms, and how they differ from bacteria.

Knowledge of Food Safety and Sanitation (Part I)

Contaminants: Biological, Chemical, Physical
1) Describe terms biological hazard, chemical hazard and physical hazard.
2) List and describe the names, forms, common sources and prevention of different types of bacterial illnesses.
3) Describe and list several types of potentially hazardous foods.
4) Identify chemical contaminants.
5) Describe how to prevent chemical contamination.
6) Describe common pest management programs.

Knowledge of Food Safety and Sanitation (Part II)

Knowledge of HACCP
1) Define HACCP.
2) List and describe HACCP systems.
3) Explain "HACCP flow" as it relates to recipes.
4) List and describe the following different aspects of the "time and temperature" principle: a. Danger zone b. "Hot Foods Hot/Cold Foods Cold" c. Temperature in order to kill bacteria d. Lag and log phase e. Thawing foods f. Reheating or cooling foods g. Recommended internal temperatures of final cooked stage h. pH and its affects i. Aerobic atmosphere j. Anaerobic atmosphere k. Facultative atmosphere

Preventing Food Borne Illness
1) Describe cross contamination and state its causes and effects.
2) Describe proper hand washing procedures.
3) Describe the difference between "clean" and "sanitary" and how they relate to ware washing.
4) Describe and list "safe worker practices" related to working in a kitchen.
5) Define parasites and describe how the following parasites affect people and food: Trichinosis, Anisakiasis and Cyclospora.

Knowledge of Government Food Regulations
1) List the criteria for food to be labeled organic or to display the USDA organic seal.
2) Identify the U.S. government agency responsible for general nutrition guidelines.
3) Identify various acronyms (USDA, FDA, etc) for the various federal government groups responsible for health recommendations/food safety guidelines
4) Name the federal agency which regulates authorized health claims (e.g. low fat, lean, good source).
5) Indicate specific requirements for a vegetable to be labeled "organic.
6) Differentiate the various federal health organizations that publish recommended dietary needs.
7) Describe the need for USDA pasteurization guidelines for eggs.
8) List the enrichment nutrients, permissible by USDA standards, to be added to flour.
9) Define the acronyms EAR, RDA, UL and AL as they relate to nutrition.
10) Define NSF and the standards requirements
11) Describe the US grading system for the following food items: fresh fruits, milk, eggs, meat and poultry.

FOOD SCIENCE

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~ APPLICATIONS ~

Knowledge of Allergens

1) Discuss the distinction between a food allergy and a food intolerance.
2) List the top 8 commonly recognized food allergens as listed by the FDA. [Note: On Cooking does not separately list fin fish or tree nuts.]
3) Recognize substances which can cause food intolerances and trigger reactions.

Knowledge of Carbohydrates

1) Identify important food sugars, the chemical reactions they participate in, and their functional properties.

2) Identify various sources of gums, their differences and functional properties in food processing.

Vegetables and Fruits
1) Botanically classify fruits vs. vegetables. 2) Describe different approaches to ripening commercial fruit.
3) Describe standard methods of storing, and processing for fruit and vegetables.

Knowledge of Commercial Flavorings
1) Define commercial flavor terms as they relate to applications.
2) State the significance of the Maillard reactions.
3) Explain the purpose of encapsulation with respect to the flavor industry.

Knowledge of Dairy & Milk Products
1) Explain how the Standards of Identity for milk products relate to compositional differences.
2) Name sources in milk and methods of limiting bacterial contamination.

Processing Techniques
1) Describe the manufacturing procedures in preparing ice cream.
2) Describe the processing of fluid milk to include pasteurization and different UHT processes.

Egg Products/Substitutes
1) Explain the process of pasteurization of egg product in the prevention of salmonellosis.
2) Describe how egg processing involves separation, mixing, pasteurization, cooling, freezing or drying.

Knowledge of Fats & Oils (Lipids)
1) State the important functional properties of food lipids, including aeration, crystallization, heat transfer, and mouth feel. 2) Identify the origin of fats and oils and examples in each source.

Hydrogenation, Saturation, Refining & Rendering
1) Distinguish between the classes of lipid molecules and the chemical differences of fatty acids.
2) Discuss the chemical reactions that lipids undergo and the functionality of these reactions.
3) Describe the chemical and physical tests used on fats and oils.
4) Identify the difference between cis and trans fat configuration.

Processing, Quality & Functionality
1) Discuss the basic production and refining methods for fats and oils.
2) Describe the functionality of lipids in emulsions.

Knowledge of Nutrition Trends and General Nutrition
1) Explain the concept of nutrient density.
2) Explain how the digestion, absorption and transport of the various nutrients are accomplished.
3) Explain the information in the food composition tables.
4) State the nutritional value of alternative sweeteners and fat replacers.
5) Explain how to read a food label.

Essential Nutrients
1) Explain difference between micro and macro nutrients
2) Define healthy nutrition and describe ways to achieve it.
3) Calculate the energy value of any food.
4) Define bioavailability and name factors that affect it.
5) Identify the nutrients considered essential for the human body.
6) Discuss the functions of the important nutrients in human nutrition.

Knowledge of Proteins
1) Describe the structure of food proteins and list their functional properties.
2) Describe the structure of muscle tissue. 3) Relate collagen content of meat to meat tenderness.
4) Describe the functional properties of protein (e.g. foaming and gelation, etc.)
5) Explain the chemical basis for red meat color.

Knowledge of Functional Ingredients
1) Recognize the potential for protein hydrolysates to act as functional ingredients. 2) Discuss the functional properties of common food additives, including acidulants, alkalies, buffers, etc.
3) Explain the function and benefits of food starches in food systems.

Colors
1) List the certified food colorants and examples of those exempt from certification. 2) Discuss the advantages and disadvantages of natural and artificial food colorants in product development.

Preservatives
1) State the legal definition of a food additive.
2) Explain the purpose of the various types of food additives.
3) Describe the purpose of chemical preservatives.
4) List and define the various chemicals used in food preservation.

Antioxidants
1) Explain antioxidants.
2) Discuss the functionality of antioxidants. 3) Classify various ingredients as natural or artificial antioxidants.

Leavening Agents
1) Describe chemical and biological leavening and their functionality in baked products.

Acidulants, Buffers & pH Adjusting Ingredients
1) Define: oxidation, reduction, oxidizing agent, reducing agent.
2) Describe related chemical and functional properties of water.
3) Describe related chemical and functional properties of food acids.
4) Distinguish features of food systems such as emulsions, foams, gels and solutions.
5) Explain food acidity in terms of pH and titratable acidity.
6) Explain how acidulants, buffers and pH adjusting ingredients affect food enzymatic reactions.

~ MICROBIOLOGY, FOOD SAFETY, QUALITY ASSURANCE & REGULATIONS ~

Knowledge of Food Chemistry and Microbiology (Part I)

Cell Basics
1) Identify the parts of both animal and plant cells.

Basic Chemical Matter
1) Define: elements, compounds, mixture, symbols and chemical bonds.
2) Identify the elements of the Periodic Table that are important to food science.
3) Explain chemical equations and their components (including reactants, products and symbols).
4) Define: solution, solvent, solute, homogeneous matter, food system, food colloids, emulsion, foam, gel and sol.

Knowledge of Food Chemistry and Microbiology (Part II)

Enzymatic Reactions
1) Define enzymes.
2) Discuss the following enzymes: proteolytic, oxidizing, fat-splitting, and decomposing carbohydrates.
3) Discuss the application of emzymes in food processing.
4) Understand how enzymes can affect food products.
5) Explain how enzymes work, including the term “active site.”
6) Explain enzymatic hydrolysis.
7) Understand enzymatic fermentation, oxidation-reduction and polymerization.

Non Enzymatic Reactions
1) Define the following non-enzymatic terms: addition, oxidation-reduction, condensation and hydrolysis.

Functional Groups
1) Be able to define the following functional groups and recognize their chemical structures: alcohol, aldehyde, amino, carboxylic acid, ester, ketone, methyl, phosphate, sulfhydryl and ionic.

Knowledge of Food Chemistry and Microbiology (Part III)

Properties of Water
1) Explain the functional properties of water. 2) Recognize the molecular structure of water.
3) Explain why the structure of water affects its physical characteristics and electrostatic attraction.
4) Define the terms solubility, hydrophilic, hydration, amphiphilic, micelles and non-colvalent interactions, and explain why they are important to water.
5) Explain water activity and how moisture, free water, absorbed water and bound water are related to water activity.
6) Understand how to calculate water activity and relative humidity.
7) Explain how water can be a vehicle for heat transfer.
8) Define the terms platicizer, and Tg (glass transition temperature).

Knowledge of Food Safety and Sanitation (Part I)

Process Lethality
1) Define process lethality.
2) Describe how to determine a process time and a lethal process.
3) Define what a unit of lethality is.
4) Recognize the basic calculation of process lethality.

Thermal Death Curves
1) Discuss the concept of death curves.
2) Define D, F, Fo and z values.
3) Explain the importance of death curves in manufacturing.

Knowledge of Food Safety and Sanitation (Part II)

Contaminants
1) Define the terms: safety, hazard and risk. 2) Name an example of a biological, chemical, physical, or microbiological contaminant.

HACCP
1) Describe purpose of HACCP.
2) State the definition of HACCP.
3) List seven principals of HACCP.
4) Recognize a critical control point.

Food Borne Illness
1) Recognize difference between food infection vs. food intoxication.
2) List the four major food borne pathogenic microorganisms.
3) Identify foods associated with specific food borne pathogenic microorganisms.
4) Explain the six factors that affect microbial growth, including temperature, pH and water activity.
5) Discuss the sources that contribute to the microbial flora of foods.
6) Describe the microorganism associated with meats, seafood, fruit and vegetables and dairy products.
7) Explain how food spoilage occurs.
8) Discuss how microbial sampling can be used to verify food quality.
9) Discuss the following attributes of microbes: structure, shape, size, reproduction and motility.

Knowledge of Food Testing

Analytical
1) Explain water activity, pH, brix, moisture testing, and acid testing, as they are used to prevent bacteria outgrowth.

Organoleptic
1) Indicate signs of food spoilage.
2) Identify visual signs of pathogenic spoilage.

Micro Testing
1) Identify how microbiology labs test for pathogenic and spoilage bacteria.
2) Recognize sampling, cultures, and microscopic methods (TPC, APC, Coliform indicator organisms).

Knowledge of Government Food Regulations (Part I)

Governmental Agencies
1) Identify government agencies and their primary responsibilities.
2) Define what GMPs are and who publishes them.
3) Recognize Dept. of Commerce and which bureau it holds.

NLEA
1) Define what the NLEA law is.
2) Recognize parts of nutritional labeling (serving size, nutrients, reference values, conversion guide, % daily values).
3) Define what a nutrient "claim" is.
4) Define what a “health” claim is.

Labeling of Flavors
1) Describe the difference between natural, WONF (with other natural flavors), type, Natural and Artificial (N&A), and artificial.
2) Recognize the four classes of flavors: oil soluble, water soluble, water dispersible and water-oil soluble.

Knowledge of Government Food Regulations (Part II)

Code of Federal Regulations
1) Identify the Code of Federal Regulation. 2) Describe what Title 21 specficially covers. 3) Explain the Food, Drug and Cosmetic Act. 4) Identify other acts (Federal Poultry, Federal Trade, Infant Formula Act 1980, Nutritional Labeling and Education Act).

Grading and Inspection
1) Define the Federal Grade Standards of Quality and recognize who administers them.
2) Describe the difference between inspection and grading.
3) Recognize how consumers use these grades.
4) Differentiate between products that are inspected by USDA vs FDA.

Standard of Identity
1) Describe the Standard of Identity of dairy products, such as ice cream, yogurt, cheese, butter, whey, buttermilk and sour cream.

Knowledge of Government Food Regulations (Part III)

Allergen Regulations
1) List the top 8 commonly recognized food allergens as listed by the FDA. [Note: On Cooking does not separately list fin fish or tree nuts.]
2) Recognize the legal way to label an allergen on a food label.

Organic Regulations
1) Identify who regulates the organic industry (USDA).
2) Recognize organic certification procedures.
3) Name laws related to organic manufacturing.
4) Differentiate between "made with organic ingredients" and "organic".
5) Define standards of organic products.

Knowledge of Product Shelf Life (Part I)

Determination of Food Safety and Quality
1) Define the term "Quality of Food."
2) Identify equipment used to measure sensory qualities (appearance, texture, and flavor).
3) Define a quality control department and its general functions.
4) Define TQC (total quality control).

Shelf Life Testing Procedures & Recommendations
1) Define "shelf life of a food" as it relates to safety and quality.
2) Identify what MAQ stands for.
3) Explain how one can determine shelf life of a product?
4) Recognize time/temperature indicator as it relates to quality and shelf life.

Knowledge of Product Shelf Life (Part II)

Packaging Technology
1) List some current packaging technologies.
2) List general requirements of a food package.
3) List types of "assaults" that packaging prevent against.
4) Recognize how product quality is protected by packaging and how it is protected from light, heat, chemicals, bugs, rodents and oxygen.
5) Discuss how packaging prolongs shelf life.
6) Define aseptic packaging.

Preservation Methods
1) List all the preservation method categories: thermal, drying, low temperature and food additives.
2) Indicate how each preservation method inhibits outgrowth of bacteria.
3) Explain difference between sterilization, commercially sterile, pasteurization, blanching, hot fill and the different types of microorganisms each inhibits.
4) Explain drying methods.
5) Explain low temperature methods.
6) Explain the function of the most common food additives for preservation.

Knowledge of Product Shelf Life (Part III)

Discoloration Due to Oxidation & Temperature Abuse
1) Describe negative effects of temperature, oxygen and light on food quality and shelf life over a period of time.

Flavor Loss Over Time
1) Identify factors that can contribute to flavor loss and the creation of off flavors.
2) Define oxidized flavor.
3) Identify a food additive that can help prevent flavor loss over time.

Yeast, Mold, Spoilage Prevention
1) Describe how yeast and mold contamination occur.
2) List food associated with specific types of mold/yeast/spoilage organisms.
3) Explain how to prevent food spoilage and extend shelf life.

Knowledge of Product Shelf Life (Part IV)

Dating Procedures
1) Recognize why products are "dated".
2) Explain what a date tag tells consumers. Distribution, Shipping & Storage
1) List environmental (extrinsic) factors that affect food quality/shelf life.
2) Explain how to protect food during distribution, shipping and storage.

Minimum Shelf Life & Minimum Aging
1) Define MAQ (minimum acceptable quality).
2) Recognize how soon a product's deterioration can be detected (this is what minimum shelf life requirements are based on).
3) Review how shelf life can also relate to time needed to obtain optimal quality.

~ PROCESSING, MANUFACTURING & ENGINEERING ~

Knowledge and Application of Heat Exchange / Heat Transfer

1) Discuss the reasoning for D-value.
2) Explain retort.
3) Review heat transfer and thermal processing techniques and be able to discuss the differences and application.
4) Identify the steps for heat transfer technologies and thermal processes e.g. convection, conduction, radiation and irradiation/microwave etc.
5) Describe IQF technology.
6) Describe sun drying, drum drying, spray drying, and freeze-drying techniques.

Knowledge of Packaging

1) Discuss packaging selection criteria for modified atmosphere packaging, vacuum packaging and aseptic packaging.
2) Review the most critical material properties of plastics and understand how and why to apply to packaging selection.
3) Discuss the barrier property differences between metal cans, flexible pouches, glass and edible films.

Knowledge of Weight & Measurement Conversions

1) Translate weight and volumetric measurements from US to metric.
2) Review formulation structure such as % weight, scale-up from batch to full-scale, converting to standardized recipe.
3) Describe the method or calculations for converting degrees F to degrees C.

Knowledge of Food Processing

1) Classify and describe different ways to process food.
2) Identify methods for drying and be able to discuss the process for each.
3) Explain the reasons for using a particular type of drying method.
4) Describe the effects of drying on food product and its quality.
5) Describe freezing methods and why you would use a particular method.
6) Identify the methods for preparing food for freezing.
7) Recognize the effects of freezing on food quality.
8) Explain the process and purpose of milk pasteurization.
9) Describe what an extruder is and the types of food products produced.
10) Identify the three tools to measure texture and control quality during processing.

~ FOOD PRODUCT DEVELOPMENT ~

Knowledge of Equipment & Selection

1) Review basic types of manufacturing equipment to produce a range of food products and explain differences and similarities.

Understanding of the Product Development Process

1) Define the stages of product development and recognize the key aspects of each stage.
2) Define the appropriate types of sensory tests required for each stage.