Student’s Name ___________ FOOD SCIENCE AG 550

**Directions:** Evaluate the trainee using the rating scale below and check the appropriate number to indicate the degree of competency achieve. The numerical rating of 3,2,1 and 0 are not intended to represent the traditional school grading system of A, B, C, D and F. The descriptions associated with each of the numbers focus on level of student performance for each of the tasks listed below.

**Rating Scale:**
- **0** – No exposure – no information nor practice provided during training program, complete training required.
- **1** – Exposure only – general information provided with no practice time, close supervision needed and additional training required.
- **2** – Moderately Skilled – has performed independently during training program, limited additional training may be required.
- **3** – Skilled – can perform independently with no additional training.

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Instructor Signature __________________ Date ____________

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### 01.0 Introduction

The student will be able to:

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<td>01.01</td>
<td>Define the scope of food science and food technology</td>
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<td>01.02</td>
<td>Distinguish between food science and nutrition</td>
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<td>01.03</td>
<td>List the dimensions of food science</td>
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<td>01.04</td>
<td>Describe the historical development of the food industry</td>
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<td>List the seven major classes of food components</td>
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<td>01.06</td>
<td>Discuss the ways in which experiments in food science are carried out</td>
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<td>01.07</td>
<td>Describe the importance of teamwork in the food processing industry</td>
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<td>01.08</td>
<td>Describe the major research focus areas in food science and technology today</td>
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### 02.0 Food Categories and Composition

The student will be able to:

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<td>02.01</td>
<td>Name the food categories used in the food industry and those in the Food Guide Pyramid</td>
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<td>02.02</td>
<td>Explain the information in food composition tables</td>
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<td>02.03</td>
<td>Define the concept of bioavailability</td>
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<td>02.04</td>
<td>Define technical terms related to food composition and processing, including degrees Brix, leavening, sucrose inversion, comminuted mean emulsion, trimethylamine, isoelectric pH, and sugar crystallization</td>
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<td>02.05</td>
<td>Explain the concept of nutrient density</td>
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<td>02.06</td>
<td>Describe the structure of muscle tissue</td>
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<td>02.07</td>
<td>Relate collagen content of meat to meat tenderness</td>
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<td>02.08</td>
<td>Explain how Standards of Identity for milk products relate to compositional differences</td>
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<td>02.09</td>
<td>Explain the difference in composition of crystalline and no crystalline confectionery</td>
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<td>02.10</td>
<td>Distinguish between the terms botanical, functional food, nutraceutical and phytochemical</td>
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03.0 Human Nutrition and Food
The student will be able to:

03.01 Define proper nutrition and describe ways to achieve it
03.02 Describe the Dietary Guidelines for Americans and the Food Guide Pyramid
03.03 Identify the nutrients considered essential for the human body
03.04 Explain how the digestion, absorption, and transport of the various nutrients are accomplished
03.05 Explain how to read a food label
03.06 Discuss the functions of the important nutrients in human nutrition
03.07 Calculate the energy value of any food
03.08 State the nutritional value of alternative sweeteners and fat replacers
03.09 Identify ergogenic substances and their functions
03.10 Discuss how to critically evaluate a weight-loss diet

04.0 Food Chemistry 1: Functional Groups and Properties, Water and Acids
The student will be able to:

04.01 Describe the use of chemical symbols, formulas and equations
04.02 Explain the types of importance of chemical bonds that occur in foods
04.03 List the fundamental classes of chemical reactions in food
04.04 Explain the significance of food enzymatic reactions
04.05 Define oxidation, reduction, oxidizing agent, and reducing agent
04.06 List the major functional groups occurring in food molecules
04.07 Describe the chemical and functional properties of water
04.08 Describe the chemical and functional properties of food acids
04.09 Explain food acidity in terms of pH and titratable acidity
04.10 Distinguish features of food systems such as emulsions, foams, gels and solutions

05.0 Food Chemistry 2: Carbohydrates, Lipids, Proteins
The student will be able to:

05.01 Identify important food sugars, the chemical reactions they participate in, and their functional properties
05.02 Describe the structure and functional properties of food polysaccharides including pectin, starch and vegetable gums
05.03 Distinguish between the classes of lipid molecules and the chemical differences of fatty acids
05.04 State the important functional properties of food lipids, including aeration, crystallization, heat transfer and mouth feel
05.05 Describe the structure of food proteins and list their functional properties
05.06 Explain the relationship between isoelectric point and protein and functionality
05.07 Describe composition of the casein micelle and the functional role of the alpha-, beta-, and kappa-casein polypeptides in the micelle

06.0 Food Chemistry 2: Color, Flavor and Texture
The student will be able to:

06.01 Identify important food sugars, the chemical reactions they participate in, and their functional properties
06.02 Describe the structure and functional properties of food polysaccharides including pectin, starch and vegetable gums
06.03 Distinguish between the classes of lipid molecules and the chemical differences of fatty acids
06.04 State the important functional properties of food lipids, including aeration, crystallization, heat transfer and mouth feel
06.05 Describe the structure of food proteins and list their functional properties
06.06 Explain the relationship between isoelectric point and protein and functionality
06.07 Describe composition of the casein micelle and the functional role of the alpha-, beta-, and kappa-casein polypeptides in the micelle
07.0 Food Additives, Food Laws and Dietary Supplements

The student will be able to:

07.01 State the legal definition of a food additive
07.02 Explain the purpose for the various types of food additives
07.03 Summarize the history of food law in the United States
07.04 Discuss milestones in food law during the last five decades of the twentieth century
07.05 Define the distinction between the FDA and the USDA
07.06 Describe the approval process for food additives
07.07 Explain the importance of the NLEA
07.08 Describe the impact of the DSHEA regulation
07.09 Explain how regulatory efforts have addressed functional foods, GM foods, and organic foods

08.0 Understanding Food Processing and Preservations: Animal Products

The student will be able to:

08.01 Explain reasons why foods are processed, including maintain their freshness, nutritional value, and to extend shelf life
08.02 List the unit operations and discuss how they serve as underlying principles to guide the processing of the wide variety of foods
08.03 Describe the importance of heat transfer and how it occurs through conductive, convective and radiant energy transfer mechanisms
08.04 Provide examples of chemical antimicrobial agents, such as acidulates, short chain fatty acids, and sulfur dioxide
08.05 Distinguish pasteurization and blanching as examples of mild heat processes from sterilization, a more severe heat treatment
08.06 Define D value, the 12D concept, and TDT, and explain how each provides different information relative to thermal processing and food safety
08.07 Provide a general flowchart to indicate the steps required to process milk, yogurt, ice cream and cheese
08.08 Describe how egg processing involves separation, mixing, pasteurization, and drying operations
08.09 Explain the steps in meat, poultry, and fish processing that are directly related to preservation and those that are not
08.10 Explain irradiation processing and its potential to improve food safety by destroying pathogenic microorganisms

09.0 Understanding Fat, Sugar, Beverage, and Plant Product Processing

The student will be able to:

09.01 Provide several examples of tests that assess fat and oil quality
09.02 Explain the difference between interesterification and fractionation
09.03 List the sequence of steps required to produce refined sugar from sugarcane
09.04 Differentiate wet from dry milling
09.05 Discuss the key processing aspects of bread, pasta and snack food
09.06 Explain what is meant by minimally processed fruits and vegetables
09.07 Discuss the effects of pickling, canning, dehydration, and freezing on fruits and vegetables
09.08 Outline the basic approaches to produce soy isolated and concentrates
09.09 Describe the method in which cocoa butter is converted into chocolate
09.10 Assess the potential for protein hydrolysates to act as functional ingredients

10.0 Food Microbiology and Fermentation

The student will be able to:

10.01 List the four types of foodborne microorganisms
10.02 Explain the six factors that affect microbial growth, including temperature, pH, and water activity
10.03 Discuss the sources that contribute to the microbial flora of foods
10.04 Describe the microorganisms associated with meats, seafood, fruits and vegetables, and dairy products
10.05 Explain how food spoilage occurs
10.06 Describe the microbial fermentation of milk products, meat products, fruit and vegetables, and cereal grains
10.07 Discuss how microbial sampling can be used to verify food quality
11.0 Food Safety

The student will be able to:

0 1 2 3

11.01 Describe what is meant by foodborne illness and the associated hazards
11.02 Explain how biological hazards cause disease
11.03 Identify the most common biological hazards responsible for foodborne disease
11.04 Describe the pathway of infection of several microorganisms and parasites
11.05 Identify commonly used sanitizers in the food industry
11.06 Identify the major contributing factors to foodborne illness
11.07 Explain what is meant by mad cow disease
11.08 Describe how a HACCP plan is structured
11.09 Critique risk assessment calculations associated with food biological hazards

12.0 Food Toxicology

The student will be able to:

0 1 2 3

12.01 List the three types of food toxicants, citing specific examples
12.02 Evaluate a dose-response curve
12.03 Explain the possibility of cyanide toxicity from eating certain vegetables
12.04 Describe the toxicity of domoic acid arising from shellfish consumption
12.05 Discuss the safety of herbal products
12.06 Explain the structure and mechanism of cholera toxin
12.07 Describe the problem of antibiotic resistance and how it relates to human health
12.08 Decide if growth promotants BST and DES are harmful and why
12.09 Explain how pesticides might be present in a fast food meal
12.10 Discuss the distinction between food allergy and food intolerance

13.0 Food Engineering

The student will be able to:

0 1 2 3

13.01 Define the broad scope of food engineering
13.02 List the thermal properties of foods
13.03 Explain the processes of heat transfer and mass transfer
13.04 Describe how materials science principles can be applied to foods
13.05 Explain the significance of the glass transition
13.06 Discuss the link between food microstructure and food quality
13.07 List the psychometric properties of air
13.08 State the importance of key rheological parameters
13.09 Explain the purpose of extrusion technology
13.10 List examples of food package types and the plastics used in their fabrication

14.0 Food Biotechnology

The student will be able to:

0 1 2 3

14.01 Define biotechnology, and food biotechnology
14.02 List the benefits provided by biotechnology in food production
14.03 Explain the basics of genetic engineering techniques
14.04 List the issues related to the regulatory aspects of biotechnology-derived foods
14.05 List and explain the three categories of equivalence used in determining the safety of biotechnology-derived foods
14.06 Give examples of biotechnology-derived plant and animal products
14.07 Give examples of biotechnology-derived food processing aids
14.08 Describe the use of biotechnology in food safety applications
14.09 Discuss the concerns associated with biotechnology-derived foods
15.0 Sensory Evaluation and Food Product Development
The student will be able to:
0123
15.01 Discuss the meaning and value of sensory evaluation
15.02 Summarize the key sensory parameters of importance in sensory work
15.03 Classify sensory methods as discrimination, descriptive and affective testing
15.04 Evaluate the need to obtain objective and subjective measurements in determining food quality
15.05 Explain the stages of product development
15.06 Assess the role of marketing in product development
15.07 Calculate the probability of success for a new food product
15.08 Define what is meant by a product’s life cycle

16.0 Milk
The student will be able to:
0123
16.01 Define the term “milk”
16.02 Describe quality control during the production of milk and milk products
16.03 Explain pasteurization and homogenization
16.04 Identify three methods of pasteurization
16.05 Describe the “solids” composition of milk
16.06 Discuss separation of butterfat and its uses
16.07 List four beverage milk products
16.08 Describe butter
16.09 Name five concentrated or dried dairy products
16.10 List the steps in cheese making
16.11 Identify three bacteria used to produce dairy products
16.12 Name five fermented dairy products
16.13 List the steps in making ice cream
16.14 Describe three USDA quality grade shields

17.0 Meat, Poultry, and Eggs
The student will be able to:
0123
17.01 Describe the production of meat from cattle, pigs and poultry
17.02 Identify meat products from cattle, pigs and poultry
17.03 Discuss the general composition of meat and meat products
17.04 List five factors affecting meat tenderness
17.05 Describe the cooking of meat
17.06 Discuss the production of meat substitutes
17.07 Identify quality grading of meat
17.08 Describe egg production
17.09 Identify factors affecting egg quality
17.10 Discuss egg grading

18.0 Fish and Shellfish
The student will be able to:
0123
18.01 Identify three fish and three shellfish used for food
18.02 Describe aquaculture and processing
18.03 Discuss the composition of fish and shellfish
18.04 Identify three spoilage issues associated with fish
18.05 Describe two processes that ensure quality
18.06 List four factors that affect the grading of fish
18.07 List four fish products and by-products
18.08 Describe two methods for preserving fish
18.09 Explain the methods of inspection during processing
19.0  Cereal Grains, Legumes and Oilseeds
The student will be able to:

19.01 Diagram the general structures of a grain
19.02 Name three cereal grains
19.03 Describe the general composition of grains, legumes and oilseeds
19.04 Identify three properties of starch
19.05 List four factors that must be controlled when cooking starch
19.06 Discuss the milling of grains to flour
19.07 Identify five types of wheat flour
19.08 Explain the classes of wheat and grades of flour
19.09 Identify the type of flours other than wheat flour
19.10 List the steps in corn refining
19.11 Name four products derived from corn
19.12 Explain the processes that take place during baking
19.13 List four oilseeds and indicate the use of their products
19.14 Discuss the general use of legumes
19.15 Name four general categories of products from soybean extraction
19.16 Identify five food products of soybean extraction

20.0  Fruits and Vegetables
The student will be able to:

20.01 Identify the parts of a plant considered a vegetable or a fruit
20.02 Describe the nutrient composition of a fresh fruit or vegetable
20.03 Discuss the structure of a plant cell
20.04 Describe the plant tissues and their functions
20.05 Explain climacteric and nonclimacteric with examples
20.06 Name one pigment in fruits or vegetables and describe how it responds to heat of pH
20.07 List four factors affecting the texture that give fruits and vegetables their flavor
20.08 Name four general compounds that give fruits and vegetables their flavor
20.09 Identify the quality grades for fruits and vegetables
20.10 Describe how quality grade determines the use of a fruit or vegetable
20.11 List five factors considered during storage
20.12 Describe the processing of fruits
20.13 Discuss the processing of vegetables

21.0  Fats and Oils
The student will be able to:

21.01 Explain saturated and unsaturated, cis and trans in terms of fatty acids
21.02 Describe fatty acids
21.03 Discuss melting point and the structure of fatty acids
21.04 Identify six sources of fats and oils
21.05 List eight functions fats and oils serve in foods
21.06 Compare the extraction of fats or oils from animals to that of plants
21.07 Describe the process used on oils after extraction
21.08 List five processes in the refining and modifying of oils or fats after extraction
21.09 Discuss monoglycerides and diglycerides and their uses
21.10 Identify substances that may substitute for fat
21.11 Describe two tests conducted on fats and oils

22.0  Candy and Confectionery
The student will be able to:

22.01 Identify three crystalline and three noncrystalline candies
22.02 Describe the relationship between sugar concentration and the boiling point
22.03 Discuss common components of candies and confectionaries
22.04 Identify two ways to produce invert sugar
22.05 Explain caramelization in candymaking
22.06 Name four sugar-based sweeteners developed from cornstarch
22.07 Describe uses of high-fructose corn syrup
22.08 Describe cocoa
22.09 Explain conching
22.10 Describe modern candy and confectionery manufacturing
22.11 List four sugar alcohols and four high-intensity sweeteners
22.12 Discuss labeling information and requirements for candy
23.0 Beverages
The student will be able to:

0 1 2 3
23.01 Describe how carbonated nonalcoholic beverages are manufactured
23.02 List the steps in the production of beer
23.03 Compare the production of wine to vinegar
23.04 Indicate how fermentation plays a role in the production of coffee
23.05 Name six ways enzymes are used in the production of coffee
23.06 Discuss how two beverages meet the demand for a healthful drink
23.07 Identify the fastest growing segment of the beverage industry
23.08 Name five herbs used in beverages
23.09 Identify the plants that produce coffee and tea
23.10 Describe how to produce a coffee substitute
23.11 Compare tea to herbal teas

24.0 Environmental Concerns and Processing
The student will be able to:

0 1 2 3
24.01 Describe the properties and the requirements used in food processing
24.02 Describe the nutrient composition of a fresh fruit or vegetable
24.03 Discuss the structure of a plant cell
24.04 Describe the plant tissues and their functions
24.05 Explain climacteric and nonclimacteric with examples
24.06 Name one pigment in fruits or vegetables and describe how it responds to heat of pH
24.07 List four factors affecting the texture that give fruits and vegetables their flavor
24.08 Name four general compounds that give fruits and vegetables their flavor
24.09 Identify the quality grades for fruits and vegetables

25.0 Food Safety
The student will be able to:

0 1 2 3
25.01 List three categories of food safety
25.02 Name four factors contributing to the development of a foodborne disease
25.03 List four types of microorganisms that can cause foodborne illness
25.04 List five factors affecting microbial growth
25.05 Identify the microorganisms that provide an index of food sanitation
25.06 Discuss the role of sanitation and cleaning during processing in food safety
25.07 Identify the correct order of sanitizing or cleaning a food contact surface
25.08 Name three types of sanitization
25.09 Identify agencies involved in food safety regulation
25.10 Describe the role of HACCP in food safety

26.0 Regulation and Labeling
The student will be able to:

0 1 2 3
26.01 Identify the agencies and laws that regulate foods and labeling
26.02 Describe the functions of a quality assurance department
26.03 Discuss the history of food labels
26.04 Name two general categories of food exempt from food labels
26.05 List six components found on the nutritional panel
26.06 Describe the format of the nutritional panel
26.07 Discuss the use of DRVs
26.08 Identify when these words can be used: free, low, high, less, light, and more
26.09 List two health claim relationships that can be listed on a food package
27.0  **World Food Needs**
The student will be able to:

- 27.01 Discuss the effects of hunger and malnutrition
- 27.02 Describe the impact of hunger worldwide
- 27.03 Discuss possible causes of world hunger
- 27.04 List seven steps identified by the United Nations for elimination hunger
- 27.05 Explain the role of technology in eliminating hunger
- 27.06 Discuss the Plan of Action developed at the World Food Summit
- 27.07 Recognize agencies and organizations concerned with eliminating hunger

28.0  **Careers in Food Science**
The student will be able to:

- 28.01 List the basic skills and knowledge needed for successful employment and job advancement
- 28.02 Describe the thinking skills needed for the workplace of today
- 28.03 Identify the traits of an entrepreneur
- 28.04 List six occupational areas of the food industry
- 28.05 Identify the careers that require a science background
- 28.06 Describe the general duties of the occupations in six areas of the food industry
- 28.07 List six general competencies needed in the workplace
- 28.08 List eight guidelines for choosing a job
- 28.09 List ten guidelines for filling out an application form
- 28.10 Describe a letter of inquiry or application
- 28.11 List the elements of a resume or data sheet
- 28.12 Describe ten reasons an interview may fail