

**Course Title: Chemistry of Food**

<b>Unit: 1</b>	<b>Evaluation of Chemical and Physical Changes of Food</b>
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<b>Content Standard(s) and Depth of Knowledge Level(s):</b>	<p>Students will:</p> <ol style="list-style-type: none"> <li>1. Apply sensory and objective methods to the evaluation of chemical and physical changes in food.</li> </ol>
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<b>Learning Objective(s) and Depth of Knowledge Level(s):</b>	<p>Students will:</p> <ol style="list-style-type: none"> <li>1. Compare reasons for evaluating food products subjectively and objectively.</li> <li>2. List physical, psychological, cultural and environmental influences on food likes and dislikes.</li> <li>3. Explain how taste and aroma combine to give food their flavors.</li> <li>4. Conduct a taste test panel.</li> </ol>
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<b>Essential Question(s):</b>	<p>How is sensory evaluation used to judge the appearance, flavor, and texture of food products?          What is the role of a taste test panel in the assessment of new food products for consumers?</p>
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<b>Content Knowledge</b>	<b>Suggested Instructional Activities Rigor &amp; Relevance Framework (Quadrant)</b>	<b>Suggested Materials, Equipment and Technology Resources</b>
<p>I. Evaluation of Chemical and Physical Changes of Food</p> <p style="padding-left: 40px;">A. Sensory and Objective Methods</p>	<p><b>PowerPoint Presentation:</b>            Chemical and Physical Changes in Food (lemon on apple)</p> <p><b>Field Trip:</b>            Virtual tour or field trip, students visit a foods lab like Southern Living to see how recipes are tried and tested.</p> <p><b>Laboratory Experience:</b>            Students determine the basic principles of sensory analysis.</p> <ul style="list-style-type: none"> <li>• Taste Test Panel</li> </ul>	<p>PowerPoint Presentation            CTX            Teacher Notes            Lead Questions</p> <p>Arrangements for Field Trip            Permission Slips</p> <p>Guidelines for Lab            Rubric            Equipment            Supplies</p>

	<ul style="list-style-type: none"> <li>• Analyze Taste, Flavor and Texture.</li> <li>• Explain the Five Flavor Profiles</li> <li>• Describe the Sense of Smell Using Olfactory Cells</li> </ul>	
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<b>Unit Assessment:</b>	Participation in Lecture, Field Trip, Research for an Experiment, Lab Experiment and Analysis from Taste Test Panel, and Presentation of Experiment Using Results from Taste Test Panel, Class Participation, and Rubric
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<b>Unit/Course CTSO Activity:</b>	FCCLA Project: Develop a low fat recipe version of an existing recipe used in the lunchroom. Post nutrient differences in the modified recipe for students to compare when choosing the item in the lunchroom.
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<b>Unit/Course Culminating Product:</b>	Students design a relevant food experiment that modifies one ingredient from an established recipe. A taste test panel is used for the evaluation of the product. A universal evaluation form is used by the panel. Observations from field trip to taste testing session helps students design taste test panel.
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<b>Course/Program Credential(s):</b> <input type="checkbox"/> Credential <input type="checkbox"/> Certificate <input type="checkbox"/> Postsecondary Degree <input checked="" type="checkbox"/> University Degree <input checked="" type="checkbox"/> Other: ServSafe AAFCS Pre-Professional Assessment – Nutrition and Science
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**Course Title: Chemistry of Food**

<b>Unit: 2</b>	<b>Science Relationships</b>
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<b>Content Standard(s) and Depth of Knowledge Level(s):</b>	Students will: 2. Compare interrelationships among food science, nutrition and other sciences.
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<b>Learning Objective(s) and Depth of Knowledge Level(s):</b>	Students will: 1. Determine the roles and functions of individuals engaged in food science, dietetics, and nutrition careers. 2. Describe the role of science in the development of new food products. Examples: chemistry, organic chemistry and microbiology
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<b>Essential Question(s):</b>	What are specific roles of professionals who work in the food science industry? How does knowledge of chemistry and microbiology interrelate with a food scientist? What are the interrelationships among food science, nutrition and other sciences?
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<b>Content Knowledge</b>	<b>Suggested Instructional Activities Rigor &amp; Relevance Framework (Quadrant)</b>	<b>Suggested Materials, Equipment and Technology Resources</b>
II. Science Relationships A. Interrelationships Among Food Science, Nutrition, and Other Sciences	<b>PowerPoint Presentation:</b> Scientific Properties, Functions and Forms of Foods  <b>Research and Presentations:</b> <ul style="list-style-type: none"> <li>• Food Science</li> <li>• Nutrition</li> <li>• Chemistry</li> <li>• Microbiology                             <ul style="list-style-type: none"> <li>- Find out the job duties, education requirements, salary, locations, how all fields relate, and job</li> </ul> </li> </ul>	PowerPoint Presentation LCD Projector Computer Lead Questions  Computers Internet Web sites References Multimedia Products Guidelines for Research and Presentation Rubric Lead Questions

	<p>advancements. Have students report out.</p> <ul style="list-style-type: none"> <li>- Describe the connection between food science and future careers.</li> <li>- Research and describe the history of food science and contributions of food scientists.</li> <li>- Evaluate the impact of research on scientific thought, society, and the environment.</li> </ul>	
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<b>Unit Assessment:</b>	Research and Presentation Reports
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<b>Unit/Course CTSO Activity:</b>	FCCLA adviser will invite microbiologist, food chemist to a chapter meeting to share job descriptions and daily work routines that include food chemistry.
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<b>Unit/Course Culminating Product:</b>	Students prepare an oral presentation developed from brainstorming exercise to define the interrelationships among food science, chemistry and microbiology.
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<p><b>Course/Program Credential(s):</b>   <input type="checkbox"/> Credential   <input type="checkbox"/> Certificate   <input type="checkbox"/> Postsecondary Degree   <input checked="" type="checkbox"/> University Degree</p> <p><input checked="" type="checkbox"/> Other: ServSafe AAFCS Pre-Professional Assessments - Nutrition and Food Science</p>
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## Course Title: Chemistry of Food

Unit: 3 Chemistry

**Content  
Standard(s) and  
Depth of  
Knowledge  
Level(s):**

Students will:

3. Differentiate among pure substances, mixtures, elements, and compounds.
  - Distinguishing between intensive and extensive properties of matter
  - Contrasting properties of metals, nonmetals, and metalloids
  - Distinguishing between homogeneous and heterogeneous forms of matter
4. Describe the structure of carbon chains, branched chains, and rings.
  - Describing the impact of unsaturated, saturated, and supersaturated solutions for sugar crystallization
5. Use the periodic table to identify periodic trends, including atomic radii, ionization energy, electronegativity, and energy levels.
  - Utilizing electron configurations Lewis dot structures, and orbital notations to write chemical formulas
  - Calculating the number of protons, neutrons, and electrons in a isotope
  - Utilizing benchmark discoveries to describe the historical development of atomic structure, including proelectric effect, absorption, and emission spectra of elements  
Examples: Thomson's cathode ray, Rutherford's gold foil, Millikan's oil drop, and Bohr's bright line spectra experiments
6. Describe solubility in terms of energy changes associated with the solution process.
  - Using solubility curves to interpret saturation levels
  - Explaining the conductivity of electrolytic solutions
  - Describing acids and bases in terms of strength, concentration, pH, and neutralization reaction  
Example: pH in food preparation
  - Describing factors that affect the rate of solution
  - Solving problems involving molarity, including solution preparation and dilution
7. Use the kinetic theory to explain states of matter, phase changes, solubility, and chemical reactions.  
Example: Describing how water at 25 degrees Celsius remains in the liquid state because of the strong attraction between water molecules while kinetic energy allows the sliding of molecules past one another
8. Solve stoichiometric problems involving relationships among the number of particles, moles, and masses of reactants and products in a chemical reaction.
  - Predicting ionic and covalent bond types and products given known reactants
  - Assigning oxidation numbers for individual atoms of monatomic and polyatomic ions
  - Identifying the nomenclature of ionic compounds, binary compounds, and acids
  - Classifying chemical reactions as composition, decomposition, single replacement, or double replacement
  - Determining the empirical or molecular formula for a compound using percent composition data
9. Explain the behavior of ideal gases in terms of pressure, volume, temperature, and number of particles using Charles's law, Boyle's law, Gay-Lussac's law, the combined gas law, and the ideal gas law.

	<p>10. Distinguish among endothermic and exothermic physical and chemical changes.</p> <p>Example: endothermic physical—phase change from ice to water  endothermic chemical—reaction between citric acid solution and backing soda  exothermic physical—phase change from water vapor to water  exothermic chemical—formation of water from combustion of hydrogen and oxygen</p> <ul style="list-style-type: none"> <li>• Describing the impact of water in cooking vegetables</li> <li>• Calculating temperature change by using specific heat</li> </ul> <p>Example: explaining heat conduction and convection, radiation, and induction in the preparation of a variety of food products</p> <ul style="list-style-type: none"> <li>• Using Le Chatelier’s principle to explain changes in physical and chemical equilibrium</li> </ul> <p>11. Distinguish between chemical and nuclear reactions.</p> <ul style="list-style-type: none"> <li>• Identifying atomic and subatomic particles, including mesons, quarks, tachyons, and baryons</li> <li>• Calculating the half-life of selective radioactive isotopes</li> <li>• Identifying types of radiation and their properties</li> <li>• Contrasting fission and fusion</li> <li>• Describing carbon-14 decay as a dating method</li> </ul>
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<p><b>Learning Objective(s) and Depth of Knowledge Level(s):</b></p>	<p>Students will:</p> <ol style="list-style-type: none"> <li>1. Differentiate the classifications of matter.</li> <li>2. Investigate the relationship between matter and foods.</li> <li>3. Apply quantitative relationships among pressure, volume, temperature and number of particles in ideal gases.</li> <li>4. Determine the relationships among substances, mixtures and whole foods.</li> <li>5. Differentiate between physical and chemical properties.</li> <li>6. Apply sensory and objective methods to the evaluation of chemical and physical changes in food.</li> <li>7. Evaluate the impact of enzymatic activity on the quality, usability and safety of foods.</li> <li>8. Use the periodic table for specific purposes.</li> <li>9. Demonstrate knowledge of functional properties of the chemicals that compose food.</li> <li>10. Describe the preparation and properties of solutions.</li> <li>12. Investigate how properties of matter affect the characteristics of food.</li> <li>13. Relate factors to the role of solutes and solvents in food preparation.</li> <li>14. Summarize how the properties, phase changes and uses of water impact its use in food.</li> <li>15. Demonstrate the impact of unsaturated, saturated and supersaturated solutions on sugar crystallization.</li> <li>16. Apply rules of nomenclature and formula writing.</li> <li>17. Demonstrate the effects of chemical and biological leavening agents in a variety of food products.</li> <li>18. Describe the positive and negative impacts of microorganisms in foods.</li> <li>19. Compare characteristics of isotopes of the same elements.</li> <li>20. Use the periodic table to determine the number of protons, electrons, and neutrons in isotopes of elements.</li> <li>21. Summarize the benchmark discoveries in the historical development of the atomic theory.</li> </ol>
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22. Understand the nature and interactions of acids and bases.
23. Analyze the properties of acids, bases and salts.
24. Determine the importance of pH in food preparation and maintenance of high quality.
25. Analyze factors affecting reactions rates in relation to the kinetic theory.
26. Solve for unknown quantities by manipulating variables simultaneously.
27. Compare and contrast bond types.
28. Demonstrate knowledge of functional properties of the chemicals that compose food.
29. Explain physical and chemical changes in foods and endothermic and exothermic energy changes.
30. Investigate the relationship between matter and foods.
31. Assess the impact of technology on the study of food.

**Essential Question(s):**

What are the similarities of food science to basic concepts of chemistry?

Content Knowledge	Suggested Instructional Activities Rigor & Relevance Framework (Quadrant)	Suggested Materials, Equipment and Technology Resources
<p>III. Chemistry</p> <ol style="list-style-type: none"> <li>A. Pure Substances</li> <li>B. Mixtures</li> <li>C. Elements</li> <li>D. Compounds</li> </ol>	<p><b>PowerPoint Presentation:</b></p> <ul style="list-style-type: none"> <li>• Pure Substances</li> <li>• Mixtures</li> <li>• Elements</li> <li>• Compounds</li> </ul> <p><b>Lab:</b> <b>Pure Substances and Compounds</b> Understanding water as a pure substance and Compounds such as salt (NaCl); compare pure substances in makeup of different salts and salt substitutes (lab).</p> <p><b>Lab:</b> <b>Mixtures and Elements</b> Understanding elements by using minerals in the body: major and trace minerals Students learn how minerals and elements function and identify sources for the body.</p> <p><b>Lab:</b> Iron skillet example and lab for source of Iron (Fe)</p>	<p>PowerPoint Presentation Computer CTX</p> <p>Guidelines for Lab Rubric Safety Glasses Food Laboratory w/ Experiments Lab Manual Food and Equipment for Experiments</p> <p>Guidelines for Lab Rubric Safety Glasses Food Laboratory w/ Experiments Lab Manual Food and Equipment for Experiments</p> <p>Guidelines for Lab Rubric Safety Glasses</p>





<p>G. Forms of Matter</p> <ol style="list-style-type: none"> <li>1. Homogeneous</li> <li>2. Heterogeneous</li> </ol> <p>H. Carbon Chains, Branched Chains, and Rings</p> <p>I. Sugar Crystallization</p> <ol style="list-style-type: none"> <li>1. Impact of unsaturated solutions</li> <li>2. Saturated solutions</li> <li>3. Supersaturated solutions</li> </ol>	<p><b>Teacher Talk:</b> Safety of Kitchen Equipment</p> <p><b>Kitchen Equipment Activity:</b> Students identify kitchen equipment.</p> <p><b>Labs:</b></p> <ul style="list-style-type: none"> <li>• Cooking Time with Different Metal Pots</li> <li>• Mercury in Thermometers</li> </ul> <p><b>PowerPoint Presentation:</b> Forms of Matter</p> <ul style="list-style-type: none"> <li>• Homogeneous</li> <li>• Heterogeneous</li> </ul> <p><i>See Activities for Mixtures</i></p> <p><b>PowerPoint Presentation:</b> Carbon Chains, Branched Chains, and Rings</p> <p><b>Teacher Talk:</b> Understanding the structures of macronutrients (carbohydrates, fats, proteins) Structures of sucrose, maltose, lactose, fructose, saturated fats, unsaturated fats, monounsaturated fats, polyunsaturated fats, and amino acids.</p> <p>Students cook recipe at home incorporating the food item that was researched.</p> <p><b>PowerPoint Presentation:</b> Sugar Crystallization</p>	<p>Lead Questions Safety Handouts</p> <p>Guidelines for Activity Kitchen Equipment</p> <p>Guidelines for Lab Rubric Safety Glasses Food Laboratory w/ Experiments Lab Manual Food and Equipment for Experiments</p> <p>PowerPoint Presentation Computer CTX Lead Questions</p> <p>PowerPoint Presentation Computer CTX Lead Questions</p> <p>Lead Questions</p> <p>PowerPoint Presentation Computer CTX Lead Questions</p>
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<p>J. Periodic Table to Identify Periodic Trends</p> <p>K. Writing Chemical Formulas</p> <ol style="list-style-type: none"> <li>1. Electron configurations Lewis dot structures</li> <li>2. Orbital notations</li> </ol> <p>L. Isotope</p> <ol style="list-style-type: none"> <li>1. Calculating number of protons</li> <li>2. Calculating number of neutrons</li> <li>3. Calculating number of electrons</li> </ol> <p>M. Historical development of atomic structure</p> <ol style="list-style-type: none"> <li>1. Proelectric effort</li> <li>2. Absorption</li> <li>3. Emersion spectra of elements <ol style="list-style-type: none"> <li>a. Thomson's cathode ray</li> <li>b. Rutherford's gold foil</li> <li>c. Millikan's oil drop</li> <li>d. Bohr's bright line spectra experiments</li> </ol> </li> </ol> <p>N. Energy Changes Associated with the Solution Process</p> <ol style="list-style-type: none"> <li>1. Solubility curves to interpret saturation levels</li> </ol>	<p><b>Lab:</b>  Sugar Crystallization and interfering agents in peanut brittle, candies, fudge, lollipops; Sweetness of different carbohydrates; Breads, Fiber in foods; Custards; Coagulation/denaturization of Eggs; gelatin; foams; gluten development; Emulsification; Cooking with oils; or any cooking lab with macronutrients.</p> <p><b>PowerPoint Presentation:</b></p> <ul style="list-style-type: none"> <li>• Periodic table</li> <li>• Writing chemical formulas</li> <li>• Isotope</li> <li>• Historical development of atomic structure</li> </ul> <p><b>Guided Practice:</b>  Understanding all topics through lecture, videos, project-based learning, and labs using the elements found in foods.</p> <p><b>Research Presentation:</b>  Students research elements found in the body and foods. They create a technological presentation and food related structure for showing electron configuration, orbital structures, subatomic particles, etc.</p> <p><b>Research Activity:</b>  Group research and presentation on benchmark discoveries and how they relate to food.</p> <p><b>PowerPoint Presentation:</b>  Energy Changes Associated with the Solution Process</p>	<p>Guidelines for Lab  Rubric  Safety Glasses  Food Laboratory w/ Experiments  Lab Manual  Food and Equipment for Experiments</p> <p>Power Point Presentation  Computer  CTX</p> <p>Lead Questions</p> <p>Lead Questions</p> <p>Guidelines for Activity  Computers  Internet  Web sites  Lead Questions</p> <p>PowerPoint Presentation  Computer  CTX  Lead Questions</p>
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2. Conductivity of electrolytic solutions

**Lab:**

Understanding Solubility through Tea

- Solubility Curves to Chart Results
- Molarity of Tea Solutions
- Factors Affecting Saturation

**Teacher Talk:**

The teacher discusses the muscle and nerve functions of body as related to electrolytes found in foods and drinks.

**Lab:**

Investigate Food Labels of Sports Drinks

**PowerPoint Presentation:**

Acids and Bases

**Teacher Talk:**

The teacher discusses the properties of acids and bases in food items such as citrus juices, vinegars, sodas, baking ingredients, vinegars for pickling, etc.

**Labs:**

- Red Cabbage as an Acid Base Indicator
- pH and Chemical Leavening in Muffins

**Lab:**

Safety in Cleaning Products

Guidelines for Lab

Rubric

Safety Glasses

Food Laboratory w/ Experiments

Lab Manual

Food and Equipment for Experiments

Lead Questions

Guidelines for Lab

Rubric

Safety Glasses

Food Laboratory w/ Experiments

Lab Manual

Food and Equipment for Experiments

PowerPoint Presentation

Computer

CTX

Lead Questions

Guidelines for Lab

Rubric

Safety Glasses

Food Laboratory w/ Experiments

Lab Manual

Food and Equipment for Experiments

Guidelines for Lab

Rubric

Safety Glasses

Food Laboratory w/ Experiments

Lab Manual

3. Acids and Bases

a. Strength

b. Concentration

c. pH

d. Neutralization reactions

1. pH food preparation

<p>O. Factors Affecting the Rate of Solution</p> <p>P. Solving Problems Involving Molarity</p> <ol style="list-style-type: none"> <li>1. Solution preparation</li> <li>2. Dilution</li> </ol> <p>Q. Kinetic Theory</p> <ol style="list-style-type: none"> <li>1. States of matter</li> <li>2. Phase changes</li> <li>3. Solubility</li> <li>4. Chemical reactions</li> </ol>	<p><b>Teacher Talk:</b> Teacher discusses acids and bases used in the body Example: Hydrochloric acid in stomach.</p> <p><b>PowerPoint Presentation:</b> Factors Affecting the Rate of Solution</p> <p><i>See Tea Lab above.</i></p> <p><b>PowerPoint Presentation:</b> Solving Problems Involving Molarity</p> <ul style="list-style-type: none"> <li>• Solution Preparation</li> <li>• Dilution</li> </ul> <p><i>See Tea Lab above.</i></p> <p><b>PowerPoint Presentation:</b> Kinetic Theory</p> <p><b>Teacher Talk:</b> Understanding kinetic theory using lectures, videos, labs, and more.</p> <p><b>Labs:</b></p> <ul style="list-style-type: none"> <li>• Microwave Oven</li> <li>• Fruit Juice Popsicle and Water Properties of Freezing, also do a Cola demo</li> <li>• Kilocalories in Food and Food Conversion to Energy, burning a walnut</li> <li>• Combine with Gas Laws in Yeast Bread Lab</li> <li>• Non-Newtonian Fluid with Food Products (such as 2 parts cornstarch and 1 part liquid)</li> </ul>	<p>Food and Equipment for Experiments Lead Questions</p> <p>Lead Questions</p> <p>PowerPoint Presentation Computer CTX Lead Questions</p> <p>PowerPoint Presentation Computer CTX Lead Questions</p> <p>PowerPoint Presentation Computer CTX Lead Questions</p> <p>Lead Questions</p> <p>Guidelines for Lab Rubric Safety Glasses Food Laboratory w/ Experiments Lab Manual Food and Equipment for Experiments</p>
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<p>R. Stoichiometric Problems</p> <ol style="list-style-type: none"> <li>1. Relationships among the number of particles, moles, and masses of reactants</li> <li>2. Relationships among products in a chemical reaction</li> </ol>	<p><b>PowerPoint Presentation:</b> Stoichiometric Problems</p> <p><b>Teacher Talk:</b> The teacher discusses problem solving using reactions found in body</p> <p>Digestion and Absorption of Sugars in the Body Example: <math>C_{12}H_{22}O_{11} + 12O_2 \rightarrow 12CO_2 + 11H_2O</math></p>	<p>PowerPoint Presentation Computer CTX Lead Questions Lead Questions</p>
<p>S. Ionic and Covalent Bond Types</p>	<p><b>Teacher Talk:</b> Also can use Photosynthesis and Respiration Equations</p>	<p>Lead Questions</p>
<p>T. Oxidation Number</p> <ol style="list-style-type: none"> <li>1. Monatomic ions</li> <li>2. Polyatomic ions</li> </ol>	<p><b>PowerPoint Presentation:</b> Oxidation Number Understanding Bonding and Reactions (through lectures, videos, and worksheets)</p> <p><b>Labs:</b> Predict how food products will perform and observe how food preparation relates to chemical structure of food ingredients Examples:</p> <ul style="list-style-type: none"> <li>• Why/how Na combines with Cl to form salt, K and Cl, and salt substitutes Lab suggestion flavors of salts and substitutes based on chemical makeup.</li> <li>• Baking Soda compound (<math>H_2CO_3</math>) will leaven breads.</li> </ul> <p><b>Household Cleaning Products Activity:</b> Students search household cleaning products for common compounds and acids, name and identify of chemicals found in kitchen Example: NaOH-Sodium Hydroxide in cleaners</p>	<p>PowerPoint Presentation Computer CTX Lead Questions</p> <p>Guidelines for Lab Rubric Safety Glasses Food Laboratory w/ Experiments Lab Manual Food and Equipment for Experiments</p> <p>Guidelines for Activity Household Cleaning Products</p>
<p>U. Chemical Reactions</p> <ol style="list-style-type: none"> <li>1. Composition</li> <li>2. Decomposition</li> </ol>	<p><b>PowerPoint Presentation:</b> Determining the Empirical or Molecular Formula for a Compound using Percent Composition Data</p>	<p>PowerPoint Presentation Computer CTX</p>

<p>3. Single replacement 4. Double replacement</p>	<p><b>Teacher Talk:</b> Understanding chemical reactions using metabolism and anabolic and catabolic reactions in the body Example: Decomposition of sugars from foods into ATP, composition of ATP from glycogen and fats stored in the body.</p> <p><b>PowerPoint Presentation:</b> Behavior of Ideal Gases</p>	<p>Lead Questions</p> <p>PowerPoint Presentation Computer CTX Lead Questions</p>
<p>V. Determining the Empirical or Molecular Formula for a Compound using Percent Composition Data</p>	<p><b>Teacher Talk:</b> Understanding formulas using lecture, worksheet, and the Baker's Formula used in culinary baking.</p>	<p>Lead Questions</p>
<p>W. Behavior of Ideal Gases</p> <ol style="list-style-type: none"> <li>1. Pressure</li> <li>2. Volume</li> <li>3. Temperature</li> <li>4. Number of Particles <ol style="list-style-type: none"> <li>a. Charles's law</li> <li>b. Boyle's law</li> <li>c. Gay-Lussac's Law</li> <li>d. Combined gas law</li> <li>e. Ideal gas law</li> </ol> </li> </ol>	<p><b>Labs:</b></p> <ul style="list-style-type: none"> <li>• Yeast Breads and Carbonated Beverages for Gay-Lussac's law</li> <li>• Pressure Cookers for Boyle's law</li> <li>• Making jelly and sealing cans Charles's law</li> <li>• Hot Air Balloon Party Crafts for combined gas law</li> </ul>	<p>Guidelines for Lab Rubric Safety Glasses Food Laboratory w/ Experiments Lab Manual Food and Equipment for Experiments</p>
<p>X. Endothermic and Exothermic Physical and Chemical Changes</p>	<p><b>PowerPoint Presentation:</b> Endothermic and Exothermic Physical and Chemical Changes</p> <p>Changes in food items in the kitchen:</p> <p><b>Labs:</b></p> <ul style="list-style-type: none"> <li>• Homemade Ice Cream</li> <li>• Sodium Hydroxide demo/lab of drain cleaners</li> <li>• Recondensation of Hot Foods on Container Lids</li> </ul>	<p>PowerPoint Presentation Computer CTX</p> <p>Guidelines for Labs Rubric Safety Glasses Food Laboratory w/ Experiments Lab Manual Food and Equipment for Experiments</p>

<p>1. Impact of water in cooking vegetables</p>	<ul style="list-style-type: none"> <li>• Digestion of Foods to Keep Body Warmth and Maintain Homeostasis</li> <li>• Grill Lab with Charcoal Heat</li> </ul> <p><b>PowerPoint Presentation:</b> Impact of Water in Cooking Vegetables</p> <p><b>Teacher Talk:</b> Understand process of boiling versus steaming, Example: boiling vegetables leads to nutrient loss, steaming retains nutrients and does not destroy the structures of foods. Time involving both boiling and steaming.</p> <p><b>Lab:</b></p> <ul style="list-style-type: none"> <li>• Boiling and steaming labs</li> <li>• Taste tests of boiled water vs. fountain and faucet waters.</li> </ul>	<p>PowerPoint Presentation Computer CTX Lead Questions</p> <p>Lead Questions</p> <p>Guidelines for Lab Rubric Safety Glasses Food Laboratory w/ Experiments Lab Manual Food and Equipment for Experiments</p>
<p>2. Calculating temperature change by using specific heat</p>	<p><b>PowerPoint Presentation:</b> Calculating Temperature Change by Using Specific Heat</p> <p><b>Teacher Talk:</b> Understand using cooking mediums: the cooking mediums heat to temperatures at different rates without decomposing. Example: water, oils, butter, margarine</p> <p><b>Labs:</b></p> <ul style="list-style-type: none"> <li>• Experimental Frying Lab</li> <li>• Fats in Dropped Cookies Lab</li> </ul>	<p>PowerPoint Presentation Computer CTX Lead Questions</p> <p>Lead Questions</p> <p>Guidelines for Lab Rubric Safety Glasses Food Laboratory w/ Experiments Lab Manual Food and Equipment for Experiments</p>

<p>3. LeChatelier's Principle to explain changes in physical and chemical equilibrium</p>	<p><b>Teacher Talk:</b> Understand heat in controlled cooking process with water and foods ex.) water bath for custards</p> <p><b>Lab:</b> Custards with/without a water bath.</p> <p><b>Teacher Talk:</b> Understand cooking processes and heat transfer with various lab.</p> <p><b>PowerPoint Presentation:</b> LeChatelier's Principle to Explain Changes in Physical and Chemical Equilibrium</p> <p><b>Teacher Talk:</b> Understanding equilibriums with fruit ripening.</p> <p><b>Labs:</b></p> <ul style="list-style-type: none"> <li>• Avocadoes and tomatoes ripening in paper bags</li> <li>• Cake overflowing from pan (too much put into a pan, not enough room to rise)</li> <li>• Cake lab</li> </ul>	<p>Lead Questions</p> <p>Guidelines for Lab Rubric Safety Glasses Food Laboratory w/ Experiments Lab Manual Food and Equipment for Experiments</p> <p>Lead Questions</p> <p>PowerPoint Presentation Computer CTX Lead Questions</p> <p>Lead Questions</p> <p>Guidelines for Lab Rubric Safety Glasses Food Laboratory w/ Experiments Lab Manual Food and Equipment for Experiments</p>
<p>Y. Chemical and Nuclear Reactions 1. Atomic and subatomic particles</p> <ol style="list-style-type: none"> <li>a. Mesons</li> <li>b. Quarks</li> <li>c. Tachyons</li> <li>d. Baryons</li> </ol>	<p><b>PowerPoint Presentation:</b> Chemical and Nuclear Reactions</p> <p><b>Teacher Talk:</b> Understanding concepts of reactions using lectures, Project-based learning, videos, labs, and outside resources. Examples: Proteins in a boiled egg vs. raw egg</p>	<p>PowerPoint Presentation Computer CTX Lead Questions</p> <p>Lead Questions</p>



2. Calculate half-life of selective radioactive isotopes
3. Types of radiation and their properties

4. Fission and fusion

**PowerPoint Presentation:**  
Irradiation in Food Preservation

**Project-Based Learning:**  
Students research nutrition effects from irradiation of foods.

**Lab:**  
Simulation of Irradiating Foods

**PowerPoint Presentation:**

- Understanding atomic and subatomic particles of minerals needed in body.
- Types of radiation and their properties
- Calculating half-life of selective radioactive isotopes
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**Lab:**  
Marshmallows used as example of radioactive isotope

**Teacher Talk:**  
Understanding concepts through kitchen and gardening food items for classes. Fusion from sun gives plants growth. Fission used to power electrics in home.

**Project-Based Learning:**  
Students research how community derives its power sources.

PowerPoint Presentation  
Computer  
CTX  
Lead Questions

Guidelines for Activity  
Computers  
Internet  
Web sites  
References  
Rubric  
Safety Glasses  
Food Laboratory w/ Experiments  
Lab Manual  
Food and Equipment for Experiments

PowerPoint Presentation  
Lead Questions  
CTX  
Computer

Guidelines for Lab  
Rubric  
Safety Glasses  
Food Laboratory w/ Experiments  
Lab Manual  
Food and Equipment for Experiments

Lead Questions

Guidelines for Activity  
Computers  
Internet  
Web sites  
References

5. Carbon-14 decay as a dating method	<b>Teacher Talk:</b> Understand half-life and C-14 dating through mini lab.	Rubric  Lead Questions Guidelines for Lab
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<b>Unit Assessment:</b>	Participation in Discussion, Research Report, Lab Log, and Rubrics
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<b>Unit/Course CTSO Activity:</b>	Members sponsor assembly featuring a Health Department Environmentalist who identifies importance of safe and sanitary eating practices and how it relates to microbiology and food.
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<b>Unit/Course Culminating Product:</b>	Students will perform food experiments using a control and experimental group. The report of their findings will be written according to approved research design guidelines and present the information to the entire class.
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<b>Course/Program Credential(s):</b> <input checked="" type="checkbox"/> Credential <input type="checkbox"/> Certificate <input type="checkbox"/> Postsecondary Degree <input checked="" type="checkbox"/> University Degree <input checked="" type="checkbox"/> Other: ServSafe AAFCS Pre-Professional Assessments - Nutrition and Food Science
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**Course Title: Chemistry of Food**

<b>Unit: 4</b>	<b>Food Microbiology</b>
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<b>Content Standard(s) and Depth of Knowledge Level(s):</b>	Students will: 12. Describe the positive and negative impacts of microorganisms in food.
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<b>Learning Objective(s) and Depth of Knowledge Level(s):</b>	Students will: 1. Identify three main types of food contaminants. 2. Differentiate among the types of foodborne illnesses. 3. Name pathogens that cause foodborne illnesses. 4. Use food handling procedures that will help prevent the growth of illness-causing microbes.
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<b>Essential Question(s):</b>	What role do pathogens play in the incidence of foodborne illness?
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<b>Content Knowledge</b>	<b>Suggested Instructional Activities Rigor &amp; Relevance Framework (Quadrant)</b>	<b>Suggested Materials, Equipment and Technology Resources</b>
IV. Food Microbiology A. Evaluation of Positive and Negative Impacts of Microorganisms	<p><b>PowerPoint Presentation:</b> Food Safety and Microbiology</p> <p><b>Lab Experiments and Work Groups:</b></p> <ul style="list-style-type: none"> <li>• Investigate the important pathogens and spoilage microorganisms in foods and the conditions under which they will grow.</li> <li>• Examine the conditions under which the important pathogens are commonly inactivated, killed or made harmless in foods.</li> <li>• Utilize laboratory techniques to identify</li> </ul>	<p>PowerPoint Presentation Computer CTX Lead Questions</p> <p>Foods Laboratory w/Experiments Lab Logs Rubric References</p>

	<p>microorganisms in foods.</p> <ul style="list-style-type: none"> <li>• Analyze the role and significance of microbial inactivation, adaptation and environmental factors (i.e. pH, temperature) on growth and response of microorganisms in various environments.</li> <li>• Determine the conditions, including sanitation practices, under which the important pathogens and spoilage microorganisms are commonly inactivated, killed or made harmless in foods.</li> </ul>	
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<b>Unit Assessment:</b>	Participation in Discussion, Research, Lab Experiments, and Work Groups
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<b>Unit/Course CTSO Activity:</b>	Students display scientific method procedures used in their experiments at a PTA/PTO meeting.
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<b>Unit/Course Culminating Product:</b>	Students research the positive and negative impact of selected foods and illustrate the correlation to microorganisms.
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<p><b>Course/Program Credential(s):</b> <input type="checkbox"/> Credential <input type="checkbox"/> Certificate <input type="checkbox"/> Postsecondary Degree <input checked="" type="checkbox"/> University Degree</p> <p><input checked="" type="checkbox"/> Other: ServSafe AAFCS Pre-Professional Assessments - Nutrition and Food Science</p>
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**Course Title: Chemistry of Food**

<b>Unit: 5</b>	<b>Food Science</b>
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<b>Content Standard(s) and Depth of Knowledge Level(s):</b>	<p>Students will:</p> <ol style="list-style-type: none"> <li>13. Describe the chemical makeup of the major food nutrients.</li> <li>14. Compare safe food-handling practices used in the food industry</li> </ol>
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<b>Learning Objective(s) and Depth of Knowledge Level(s):</b>	<p>Students will:</p> <ol style="list-style-type: none"> <li>1. Demonstrate knowledge of functional properties of the chemicals that compose food.</li> <li>2. Determine the main types of food contaminants.</li> <li>3. Differentiate among the types of foodborne illnesses.</li> <li>4. Use food handling procedures that will help prevent the growth of illness-causing microbes.</li> <li>5. Explain the seven steps in developing a HACCP system.</li> </ol>
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<b>Essential Question(s):</b>	<p>What chemical compounds can be identified in selected major food categories?          What procedures are followed in a HACCP system?</p>
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	<b>Suggested Instructional Activities Rigor &amp; Relevance Framework (Quadrant)</b>	<b>Suggested Materials, Equipment and Technology Resources</b>
<p>V. Food Science                      A. Chemical Makeup of Nutrients</p>	<p><b>PowerPoint Presentation:</b>                      Food Chemistry and Analysis</p> <p><b>Lab Experiments and Work Groups:</b></p> <ul style="list-style-type: none"> <li>• Understand the chemistry underlying the properties and reactions of various food components.</li> <li>• Manipulate the structure and properties of food components, including water, carbohydrates, protein, lipids, other nutrients and food additives.</li> <li>• Determine how food chemistry can control reactions in foods.</li> </ul>	<p>PowerPoint Presentation                      CTX                      Lead Questions</p> <p>Food Laboratory w/Experiments                      Lab Log                      Rubric                      References                      Guidelines for Labs</p>

<p>B. Safe Food Handling Practices</p>	<ul style="list-style-type: none"> <li>Investigate the major chemical reactions that limit shelf life of foods.</li> <li>Determine various methods for retaining nutrients and improving nutrient content in foods.</li> </ul> <p><b>Guest Speaker:</b> County Health Department representative discusses safe food-handling practices used in the food industry.</p> <p><b>Field Trip:</b> Students participate in a field trip to a HACCP facility.</p> <p><b>Brochure:</b> Students develop a brochure on the safe-food handling practices that are distributed in the community.</p>	<p>Arrangements for Guest Speaker Lead Questions County Health Department</p> <p>HACCP Facility Arrangements for Field Trip Permission Slip</p> <p>Guidelines for Activity Rubric Computers Internet Web sites References Art Supplies Lead Questions</p>
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<p><b>Unit Assessment:</b></p>	<p>Participation in Discussion, Research Report, Lab Log, Group Investigation Report, Group Project, Brochure, and Rubric</p>
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<p><b>Unit/Course CTSO Activity:</b></p>	<p>FCCLA members participate in a field trip to an approved HACCP facility.</p>
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<p><b>Unit/Course Culminating Product:</b></p>	<p>Students research and develop a project that identifies the chemical makeup of food nutrients. Students design a HACCP program for the school lunch program on campus. Brochure on Safe-Food Handling Practices</p>
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<p><b>Course/Program Credential(s):</b> <input checked="" type="checkbox"/> Credential <input type="checkbox"/> Certificate <input type="checkbox"/> Postsecondary Degree <input checked="" type="checkbox"/> University Degree  <input checked="" type="checkbox"/> Other: ServSafe  AAFCS Pre-Professional Assessments - Food and Science</p>
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**Course Title: Chemistry of Food**

<b>Unit: 6</b>	<b>Food Preservation</b>
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<b>Content Standard(s) and Depth of Knowledge Level(s):</b>	<p>Students will:</p> <ol style="list-style-type: none"> <li>15. Evaluate various food preservation techniques.</li> <li>16. Evaluate the impact of using food additives in products.</li> </ol>
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<b>Learning Objective(s) and Depth of Knowledge Level(s):</b>	<p>Students will:</p> <ol style="list-style-type: none"> <li>1. Compare various food preservation techniques.</li> <li>2. Analyze the main food additives used in food preservation.</li> </ol>
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<b>Essential Question(s):</b>	<p>Why are food additives used in food products?          What techniques are used to preserve food?</p>
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	<b>Suggested Instructional Activities Rigor &amp; Relevance Framework (Quadrant)</b>	<b>Suggested Materials, Equipment and Technology Resources</b>
VI. Food Preservation <ol style="list-style-type: none"> <li>A. Evaluate Various Food Preservation Techniques.</li>   <li>B. Evaluate the Impact of Using Food Additives in Products.</li> </ol>	<p><b>PowerPoint Presentation:</b>            Food Preservation Techniques</p> <p><b>Lab:</b>            Investigate the Major Chemicals that Preserve Shelf life of Foods</p> <p><b>10 + 2 Discussion:</b></p> <ul style="list-style-type: none"> <li>• Understand the principles involving food preservation via fermentation processes</li> <li>• Why add additives to foods?</li> </ul>	<p>PowerPoint Presentation            Computer            CTX            Lead Questions</p> <p>Guidelines for Lab            Rubric            Equipment            Supplies</p> <p>Lead Questions</p>



	<ul style="list-style-type: none"> <li>• What additives do you find in pre-prepared food?</li> </ul>	
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<b>Unit Assessment:</b>	Participation in Discussion and Lab Log
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<b>Unit/Course CTSO Activity:</b>	Guest Speaker at FCCLA meeting addresses food additives.
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<b>Unit/Course Culminating Product:</b>	Design a chart that contains the additives and ways to preserve foods
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<b>Course/Program Credential(s):</b>	<input checked="" type="checkbox"/> Credential <input type="checkbox"/> Certificate <input type="checkbox"/> Postsecondary Degree <input checked="" type="checkbox"/> University Degree <input checked="" type="checkbox"/> Other: ServSafe AAFCS Pre-Professional Assessments - Nutrition and Food Science
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**Course Title: Chemistry of Food**

<b>Unit: 7</b>	<b>Food Basics</b>
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<b>Content Standard(s) and Depth of Knowledge Level(s):</b>	Students will: 17. Describe the major nutrients, including functions and sources of each.
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<b>Learning Objective(s) and Depth of Knowledge Level(s):</b>	Students will: 1. Name the six classes of nutrients and name their primary functions in the body. 2. Determine the primary sources of food nutrients. 3. Describe the composition of food nutrients. 4. Determine the importance of sensory evaluation in food products.
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<b>Essential Question(s):</b>	How do the food choices impact the body? Why is it important to use senses to evaluate food?
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<b>Content Knowledge</b>	<b>Suggested Instructional Activities Rigor &amp; Relevance Framework (Quadrant)</b>	<b>Suggested Materials, Equipment and Technology Resources</b>
VII. Food Science A. Chemical Makeup of Food Nutrients 1. Carbohydrates 2. Proteins 3. Fats 4. Vitamins 5. Minerals 6. Water	<b>PowerPoint Presentation:</b> Sources, Functions and Roles of Nutrients in the Body  <b>Lab:</b> <ul style="list-style-type: none"> <li>Part 1: Display foods that are sources of the six nutrients. Students specify which foods are of which source.</li> <li>Part 2: Teams will research recipes that include one of the food items. Analyze the nutritional value of the recipe, based on ingredients. Make changes for a healthier recipe.</li> </ul>	PowerPoint Presentation Computer CTX  Guidelines for Lab Rubric Supplies Equipment References

<p>B. Sensory Evaluation of Food Products</p>	<ul style="list-style-type: none"> <li>Part 3: Prepare the healthy version of the recipe.</li> </ul> <p><b>Display Posters:</b> Students create a poster on the composition and functions of nutrients in the body. Share Out.</p> <p><b>Experiment:</b> Set up a blind tasting area, where students will evaluate certain brands of food based on mouth feel, taste, and smell.</p> <p><b>Agreement Circle:</b> Students evaluate answers from experiment.</p>	<p>Guidelines for Posters Rubric Art Supplies Poster Boards</p> <p>Guidelines for Experiment Equipment Supplies</p> <p>Lead Questions</p>
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<b>Unit Assessment:</b>	PowerPoint Presentation Notes, Lab Experiment, Poster, and Class Participation
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<b>Unit/Course CTSO Activity:</b>	FCCLA Alabama Children First Project – Students create a presentation to take to elementary school(s) teaching young children about good sources of the six nutrients. They take healthy snacks that demonstrate choosing food with good sources of each nutrient.
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<b>Unit/Course Culminating Product:</b>	Blind Tasting Experiment involving the School
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<p><b>Course/Program Credential(s):</b> <input checked="" type="checkbox"/> Credential <input type="checkbox"/> Certificate <input type="checkbox"/> Postsecondary Degree <input checked="" type="checkbox"/> University Degree</p> <p><input checked="" type="checkbox"/> Other: ServSafe AAFCS Pre-Professional Assessments - Nutrition and Food Science</p>
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	<p>Administrative Dietitians/Food Service Directors, CNP Directors discuss career options in the area of food science.</p> <p><b>College Directory:</b> Students design a student oriented directory of state colleges that offer programs in food science with eligibility requirements for entering the program. Share Out.</p> <p><b>Essay:</b> Students write an essay on a career opportunity in the food science field that they would like to pursue. They present their essay to the class.</p>	<p>Guidelines for Activity Computers Internet Web sites References Rubric Lead Questions</p> <p>Guidelines for Activity Computers Internet Web sites References Rubric Guidelines for Presentation Rubric for Presentation</p>
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<b>Unit Assessment:</b>	Participation in Discussion, Interview of Guest Speakers, Essay, Class Discussion, and Rubric
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<b>Unit/Course CTSO Activity:</b>	The FCCLA Chapter sponsors a field trip to a university to tour and identify programs available to pursue careers in food science.
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<b>Unit/Course Culminating Product:</b>	<p>Students design a student oriented directory of state colleges that offer programs in food science with eligibility requirements for entering freshman.</p> <p>Essay on Career Choice</p>
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<p><b>Course/Program Credential(s):</b> <input checked="" type="checkbox"/> Credential <input type="checkbox"/> Certificate <input type="checkbox"/> Postsecondary Degree <input checked="" type="checkbox"/> University Degree</p> <p><input checked="" type="checkbox"/> Other: ServSafe AAFCS Pre-Professional Assessments - Nutrition and Food Service</p>
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