Chemistry of Food

Chemistry of Food is a one-credit, specialized area of study that provides an in-depth study of the application of science principles to scientific investigation of the production, processing, preparation, evaluation, and utilization of food. Students apply the scientific method to study scientific concepts and theories in the context of nutrition and foods. While achieving academic standards and competencies in the area of chemistry, biochemistry, biology, and some physics at the analysis, synthesis, and evaluation levels. Students develop critical-reasoning and mathematics and writing skills through a variety of higher-level learning strategies and laboratory experiments that require measuring, recording, graphing, and analyzing data; predicting and evaluating laboratory results; and writing laboratory reports. The course highlights nutrition concepts and explores the various relationships between food science and nutrition.

Career and technical student organizations are integral, cocurricular components of each career and technical education course. These organizations serve as a means to enhance classroom instruction while helping students develop leadership abilities, expand workplace-readiness skills, and broaden opportunities for personal and professional growth.

Evaluation of Chemical and Physical Changes of Food

Students will:

1. Apply sensory and objective methods to the evaluation of chemical and physical changes in food.

Science Relationships

2. Compare interrelationships among food science, nutrition, and other sciences.

Chemistry

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 an 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 reactions

        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.

10. Distinguish among endothermic and exothermic physical and chemical changes.
    Examples: endothermic physical—phase change from ice to water
    endothermic chemical—reaction between citric acid solution and baking soda
    exothermic physical—phase change from water vapor to water
    exothermic chemical—formation of water from combustion of hydrogen and oxygen
    - Describing the impact of water in cooking vegetables
    - Calculating temperature change by using specific heat
        Example: explaining heat conduction and convection, radiation, and induction in the preparation of a variety of food products
    - Using Le Châtelier's principle to explain changes in physical and chemical equilibrium

11. Distinguish between chemical and nuclear reactions.
    - Identifying atomic and subatomic particles, including mesons, quarks, tachyons, and baryons
    - Calculating the half-life of selective radioactive isotopes
    - Identifying types of radiation and their properties
    - Comparing fission and fusion
    - Describing carbon-14 decay as a dating method

Food Microbiology

12. Describe positive and negative impacts of microorganisms in food.
    - Examples: positive—yogurt, sauerkraut, bleu cheese, cheddar cheese, mayonnaise
      negative—food spoilage, food contamination, food-borne illnesses

Food Science

13. Describe the chemical makeup of major food nutrients.
    - Examples: carbohydrates, protein, fats, vitamins, minerals, water

14. Compare safe food-handling practices used in the food industry.
    - Describing the government's role in food safety
    - Analyzing the correct care and safe use of instruments, equipment, and chemicals

Food Preservation

15. Evaluate various food preservation techniques.

16. Evaluate the impact of using food additives in products.

Food Basics

17. Describe major nutrients, including functions and sources of each.

Technology and Careers

18. Assess the impact of technology on the food industry.
    - Example: supercritical carbon dioxide technology

19. Analyze career options and entrepreneurial opportunities in food science and technology.
    - Examples: food scientists, food technicians, microbiologists