



Secondary Course Outline

Forest Lake Area Schools

Course name: Food Chemistry

Grade(s): 10-12

Course description:

This hands-on course will apply scientific concepts and procedures to the food science industry through a variety of laboratory activities and experiments focused on the principles of chemistry. Students will understand how the properties of food products and nutrients are related to atomic structures, elements, chemical bonding, molecular structures and formulas, and concentrations. Students will study a variety of chemical reactions that occur in food products and processing. Students will also understand the relationships between energy, motion of molecules, and states of matter in the development and improvement of food products, processing, and packaging. This course may be used to meet the CHEMISTRY A graduation credit requirement

Graduation standard(s) information: (alignment with Minnesota Academic Standards or national standards)

State Standards:

This course meets the following Minnesota Academic Standards: Science 9-12 standards

Strand	Sub-Strand	Standard
1. Nature of Science & Engineering	1. The Practice of Science	<ul style="list-style-type: none">● 1. Science is a way of knowing about the natural world and is characterized by empirical criteria, logical argument and skeptical review.
	3. Interactions Among Science, Technology, Engineering, Mathematics, and Society	<ul style="list-style-type: none">● 1. Natural and designed systems are made up of components that act within a system and interact with other systems.● 3. Science and engineering operate in the context of society and both influence and are influenced by this context.● 4. Science, technology, engineering and mathematics rely on each other to enhance knowledge and understanding.● 5. Developments in chemistry affect society and societal concerns affect the field of chemistry.● 6. Physical and mathematical models are used to describe physical systems.
2. Physical Science	1. Matter	<ul style="list-style-type: none">● 1. The periodic table illustrates how patterns in the physical and chemical properties of elements are related to atomic structure.● 2. Chemical and physical properties of matter result from the ability of atoms to form bonds.● 3. Chemical reactions describe a chemical change in which one or more reactants are transformed into one or more products.● 4. The structure of the atom determines chemical properties of elements.● 5. Chemical reactions involve the rearrangement of atoms as chemical bonds are broken and formed through transferring or sharing of electrons and the absorption or release of energy.

National AFNR Standards:

This course is aligned with the following performance indicators within the National Agriculture, Food, and Natural Resources Career Cluster Content Standards (National Council for Agricultural Education, 2009):

	Performance Indicator
FPP.01.01	Evaluate the significance and implications of changes and trends in the food products and processing industry.
FPP.02.03	Apply safety and sanitation procedures in the handling, processing and storing of food products.
FPP.03.01	Apply principles of science to food processing to provide a safe, wholesome & nutritious food supply.
FPP.04.03	Process, preserve, package and present food and food products for sale and distribution.
CS.01.01	Exhibit the skills and competencies needed to achieve a desired result
CS.07.04	Assess workplace safety.
CS.08.01	Evaluate and select the appropriate tool to perform a given task.
CS.08.02	Use appropriate protective equipment and handle AFNR tools and equipment to demonstrate safe and proper use of the tools and equipment.
CS.09.03	Use technology to demonstrate the ability to network and interface with technology.

Web Sites

- Institute of Food Technologists <http://www.ift.org>
- Science and our food supply <http://www.foodsafety.gov/~fsg/teach.htm>
- The Science Behind our Food <http://www.uga.edu/discover/sbof/index.htm>
- US FDA Food Labeling and Nutrition <http://vm.cfsan.fda.gov/label.htm>
- US FDA Center for Food Safety and Applied Nutrition <http://www.cfsan.fda.gov/list.htm>
- FoodSafety.gov <http://www.foodsafety.gov>
- USDA Food Safety and Inspection Service <http://www.fsis.usda.gov>
- Center for Disease Control. <http://www.cdc.gov/foodsafety>
- Food Science at Discovery.com http://school.discovery.com/foodscience/science_resources.html
- Penn State Food Science Resources http://www.foodscience.psu.edu/outreach/fun_food_science.html
- University of Nebraska – Lincoln Food Science Labs <http://scimath.unl.edu/labs/food.htm>
- Clemson University Food Science Labs <http://www.clemson.edu/foodscience/teachers.htm>

Learner outcomes:

Students will:

1. Understand and apply the foundation skills and concepts of food science
2. Understand the relationship between molecules and characteristics of food
3. Understand that elements are put together in unique ways to create food with unique properties
4. Understand the structure of the atoms that make up food
5. Understand the relationship between an element's location on the periodic table and its properties
6. Understand how chemical bonds are formed and their relationships to properties of food
7. Understand the chemical and physical properties of compounds found in food
8. Understand chemical equations and the types of chemical reactions
9. Understand the relationships between reactants and products in chemical reactions
10. Understand the relationship between the movement of molecules and the properties of matter

Course content: (Write this in outline format.)

Unit	Days	Topics	Chapters
1- Introduction to Food Science	6	<ul style="list-style-type: none"> Curriculum; Expectations; Lab Equipment, Procedures, & Safety Food science overview; history; features; trends careers Measurements; accuracy, precision, significant figures, conversions, variables, data, error, evidence 	PFS 1 PFS25 NAC 1
2 - Sensory Evaluation & Nutrition	5	<ul style="list-style-type: none"> Sensory evaluation techniques; taste panels; triangle tests Relationship between flavor, aromas and molecular structures 6 classes of nutrients, food ingredients, percent composition 	PFS 3
3- Matter & Elements	10	<ul style="list-style-type: none"> classification of matter; elements, compounds, & mixtures; atoms, element, & periodic table; moles molecules & ionic compounds; chemical formula; formula mass 	NAC 3
4 - Atomic Structure	9	<ul style="list-style-type: none"> atomic structure (protons, neutrons, electrons); atomic number & mass; electrical charge and ions electron cloud, orbitals, energy levels, electron configuration; orbitals & periodic table; spectroscopy 	NAC 5
5-Periodic Table & Elements	9	<ul style="list-style-type: none"> periodic table; essential elements & food; periodic trends (radii, electronegativity, and ionization energy); orbitals and radii element groups; valence electrons, energy levels, Lewis dot 	NAC 6
6-Chemical Bonds	12	<ul style="list-style-type: none"> bonds types; covalent bonds (polar & nonpolar); ionic bonds; electronegativity; polarity valence electrons; octet rule; valence & ion formation; ionic formulas; covalent bonds; unpaired electrons (free radicals and antioxidants) Lewis dot and molecular models; isomers; double and triple bonds; molecular geometry; molecular shape of water; bond types in fats 	NAC 7
7 - Compounds & Molecules	10	<ul style="list-style-type: none"> ionic compounds; ionic structure & properties; polyatomic ions; ionic formulas and names molecular compounds (small, medium, large); empirical & chemical formulas; naming molecular formulas Primary food molecules carbohydrates, lipids, and proteins) Formula (molar) mass; percent composition; molecular formulas 	NAC8 PFS 8-11
8 - Chemical Reactions	12	<ul style="list-style-type: none"> chemical equations; reactants vs. products; conservation of mass; reading equations; coefficients vs. subscripts; balanced vs. unbalanced balancing equations rules (start with elements in fewest compounds; then elements in most; end with pure elements) types of reactions; synthesis; decomposition; single replacement; double replacement; precipitate; polymerization; combustion exo- vs. endo-thermic; energy profile; energy barrier 	NAC10 PFS 5

9 - Water & Solutions	12	<ul style="list-style-type: none"> • solvent, solute, & solutions; water molecule & hydrogen bonding; distilled vs. tap water; reactions in (aq) solutions <ul style="list-style-type: none"> • concentration (g/L, % mass, molarity); saturation & equilibrium; • factors affecting solubility; preparing solutions <ul style="list-style-type: none"> • factors affecting (aq) reaction rates; exo - vs. endo-thermic; • density, freezing, & boiling; colligative properties; electrolytes • PFS (dehydration, colloidal dispersions and suspensions) 	NAC-9 PFS 7 PFS 22
10- Review, Final and Lab Clean up	5		

Required Curriculum Materials: (This section should contain information regarding textbooks, technology integration, films, videos and various resources used in teaching the course. Please note whether items already exist in-district or will need to be purchased. Any additional notes that are useful to teachers should be included.)

Textbooks - Would need to be purchased

- Primary Text: A Natural Approach to Chemistry, 2010, Hsu, Chaniotakis, Carlisle, and Damelin, Lab-Aids. (NAC)
- Secondary Text: Principles of Food Science, 2013, 4 rd edition, Janet D. Ward, Goodheart/ Willcox. (PFS)

Texas Chemistry Review: Atomic Structure and Nuclear Chemisty Kit \$795

Other Supplies:

Blenders

Microwave

Gram Scales

Dehydrators

Beakers

Mixing Bowls

Mixing Spoons

Electric Griddle