Unit 1: Introduction to Food Science

Content Area: **Science**
Course(s):
Time Period: **MP1**
Length: **18 days**
Status: **Published**

NJSLS - Science

9-12.HS-PS1-2	Construct and revise an explanation for the outcome of a simple chemical reaction based on the outermost electron states of atoms, trends in the periodic table, and knowledge of the patterns of chemical properties.
9-12.HS-PS1-4	Develop a model to illustrate that the release or absorption of energy from a chemical reaction system depends upon the changes in total bond energy.
9-12.HS-PS1-5	Apply scientific principles and evidence to provide an explanation about the effects of changing the temperature or concentration of the reacting particles on the rate at which a reaction occurs.
9-12.HS-PS3-1	Create a computational model to calculate the change in the energy of one component in a system when the change in energy of the other component(s) and energy flows in and out of the system are known.
9-12.HS-PS3-3	Design, build, and refine a device that works within given constraints to convert one form of energy into another form of energy.
9-12.HS-PS3-4	Plan and conduct an investigation to provide evidence that the transfer of thermal energy when two components of different temperature are combined within a closed system results in a more uniform energy distribution among the components in the system (second law of thermodynamics).
9-12.HS-PS2-6	Communicate scientific and technical information about why the molecular-level structure is important in the functioning of designed materials.

Science and Engineering Practices

Developing and Using Models

Develop a model based on evidence to illustrate the relationships between systems or between components of a system. (HS-PS1-4)

Constructing Explanations and Designing Solutions

Apply scientific principles and evidence to provide an explanation of phenomena and solve design problems, taking into account possible unanticipated effects. (HS-PS1-5)

Construct and revise an explanation based on valid and reliable evidence obtained from a variety of sources (including students' own investigations, models, theories, simulations, and peer review) and the assumption that theories and laws that describe the natural world operate today as they did in the past and will continue to do so in the future. (HS-PS1-2)

Design, evaluate, and/or refine a solution to a complex real-world problem, based on scientific knowledge, student-generated sources of evidence, prioritized criteria, and tradeoff considerations. (HS-PS3-3)

Obtaining, Evaluating, and Communicating information

Communicate scientific and technical information (e.g. about the process of development and the design and performance of a proposed process or system) in multiple formats (including orally, graphically, textually, and mathematically). (HS-PS2-6)

Planning and Carrying Out Invesgaons

Plan and conduct an invasion individually and collaboratively to produce data to serve as the basis for evidence, and in the design: decide on types, how much, and accuracy of data needed to produce reliable measurements and consider limitations on the precision of the data (e.g., number of trials, cost, risk, me), and refine the design accordingly. (HS-PS3-4)

Using Mathematics and Computational Thinking

Create a computational model or simulation of a phenomenon, designed device, process, or system. (HS-PS3-1)

Disciplinary Core Ideas

PS1.A: Structure and Properties of Matter

The periodic table orders elements horizontally by the number of protons in the atom's nucleus and places those with similar chemical properties in columns. The repeating patterns of this table reflect patterns of outer electron states. (HS-PS1-2)

A stable molecule has less energy than the same set of atoms separated; one must provide at least this energy in order to take the molecule apart. (HS-PS1-4)

PS1.B: Chemical Reactions

Chemical processes, their rates, and whether or not energy is stored or released can be understood in terms of the collisions of molecules and rearrangements of atoms into new molecules, with consequent changes in the sum of all bond energies in the set of molecules that are matched by changes in kinetic energy. (HS-PS1-4),(HS-PS1-5)

The fact that atoms are conserved, together with knowledge of the chemical properties of the elements involved, can be used to describe and predict chemical reactions. (HS-PS1-2)

PS2.B: Types of Interactions

Aracon and repulsion between electric charges at the atomic scale explain the structure, properties, and transformations of matter, as well as the contact forces between material objects. (HS-PS2-6)

PS3.A: Definitions of Energy

Energy is a quantitive property of a system that depends on the moon and interactions of matter and radiation within that system. That there is a single quantity called energy is because a system's total energy is conserved, even as, within the system, energy is continually transferred from one object to another and between its various possible forms. (HS-PS3-1)

At the macroscopic scale, energy manifests itself in multiple ways, such as in motion, sound, light, and thermal energy. (HS-PS3-3)

PS3.B: Conservation of Energy and Energy Transfer

Conservation of energy means that the total change of energy in any system is always equal to the total energy transferred into or out of the system. (HS-PS3-1)

Energy cannot be created or destroyed, but it can be transported from one place to another and transferred between systems. (HS-PS3-1), (HS-PS3-4)

Mathematical expressions, which quantify how the stored energy in a system depends on its configuration (e.g. relative positions of charged particles, compression of a spring) and how kinetic energy depends on mass and speed, allow the concept of conservation of energy to be used to predict and describe system behavior. (HS-PS3-1)

The availability of energy limits what can occur in any system. (HS-PS3-1)

Uncontrolled systems always evolve toward more stable states—that is, toward more uniform energy distribution (e.g., water flows downhill, and objects hotter than their surrounding environment cool down).

(HS-PS3-4)

PS3.D: Energy in Chemical Processes

Although energy cannot be destroyed, it can be converted to less useful forms—for example, to thermal energy in the surrounding environment. (HS-PS3-3), (HS-PS3-4)

Crosscutting Concepts

Patterns

Different patterns may be observed at each of the scales at which a system is studied and can provide evidence for causality in explanations of phenomena. (HS-PS1-2),(HS-PS1-5)

Energy and Matter

Changes of energy and matter in a system can be described in terms of energy and matter flows into, out of, and within that system. (HS-PS1-4), (HS-PS3-3)

Structure and Function

Investigating or designing new systems or structures requires a detailed examination of the properties of different materials, the structures of different components, and the connections of components to reveal their function and/or solve a problem. (HS-PS2-6)

Systems and System Models

When investigating or describing a system, the boundaries and initial conditions of the system need to be defined and their inputs and outputs analyzed and described using models. (HS-PS3-4)

Models can be used to predict the behavior of a system, but these predictions have limited precision and reliability due to the assumptions and approximations inherent in models. (HS-PS3-1)

Influence of Science, Engineering, and Technology on Society and the Natural World

Modern civilization depends on major technological systems. Engineers continuously modify these technological systems by applying scientific knowledge and engineering design practices to increase benefits while decreasing costs and risks. (HS-PS3-3)

Scientific Knowledge Assumes an Order and Consistency in Natural Systems

Science assumes the universe is a vast single system in which basic laws are consistent. (HS-PS3-1)

Rationale and Transfer Goals

The purpose of this content topic is to explore and understand factors connecting food science to all other relevant sciences while providing the historical and scientific developments of foods in a global society. Serving as an introduction to Food Science, this unit will serve as a foundation for the topics to follow, tying in real-life examples in everyday foods and life. This content topic will provide opportunities for students to apply communication, leadership, management, and thinking skills to the study of Food Science. The students will be able to apply and recognize what physiological factors humans use in serving foods. Students will develop and investigate these physiological factors and the science of food marking. There will be an introduction to foodborne diseases and the effects of food processing on the microflora of foods, in which students can communicate scientific and technical information about why foodborne diseases spread. All topics will include the overarching theme of a STEM classroom.

Enduring Understandings

- Humans choose food based on several physiological factors, along with nutritional, cultural, psychological/sociological, and budgetary criteria.
- Food manufacturers use both sensory and objective methods to help sell food
- When people choose a particular food, they evaluate it based on sensory criteria
- Volatile molecules and the effects of temperature explain the intensity of odors of food
- The five basic types of taste (sweet, salty, sour, savory, and bier) are interpreted by the four major sections on the human tongue.
- Tastes, such as salty and sour, are related to the concentration of ions found in the food
- Tastes can interact affecting the net sensory interpretation of food.
- The texture is a combination of perceptions
- The human diet is related to some of the leading causes of death
- People get sick from food that has been contaminated by one of three types of hazards: biological, chemical, or physical.
- Foodborne biological hazards include bacteria, molds, viruses, and parasites.
- More than 90% of foodborne illness is bacterial.
- Bacteria found in food can exist independently, while viruses require a host.
- Chemical hazards are any chemical substances that are hazardous to health.

Essential Questions

- What drives people to choose different types of food?
- How can basic research practices be used to investigate and study food science?
- Why do hot peppers taste hot?
- Why is the odor of something baking more intense than that of cold items such as ice cream?
- How was the food pyramid established and why is it ever changing?
- What are genetically modified organisms (GMOs), how are they made, and why do we need them?
- What is the difference between common marketplace foods and foods classified as “organic” What causes foodborne illnesses and how can they be prevented?
- Why are some molds all right on foods while others are not?
- What is the series of events that leads a bacterium, such as E.coli, to contaminate both hamburger meat and lettuce?
- How are chemical hazards introduced into human food sources and what steps are being taken to prevent this?
- Why do flavors differ in how quickly they are detected or how long they last?

Content - What will students know?

- The sensation of taste is a function controlled by the flow of dissolved food particles in saliva into gustatory cells found on the tongue, which relay the message to the brain.
- People choose foods that satisfy their senses of sight, smell, taste, touch, hearing, nutrient needs, cultural and religious beliefs, budget, and psychological factors.
- The three periods in the development of food.
- How food products and processing methods have changed due to the contributions of food scientists.
- The role of scientists in the development of new food products.

Skills - What will students be able to do?

- Provide an understanding of the chemical function and properties of major food components.
- Provide an understanding of the chemical interactions of food components and their effects on sensory and nutritional quality, functional properties, and safety of foods.
- Provide an understanding of the chemical basis of food preservation and the effects of processing and storage on food quality.
- Be Familiar with common analytical and experimental methods used in the study of the major food components.
- Examine the basis of food chemistry-related issues in food safety, regulation, and current events.
- Define food science and relate it to other science disciplines.
- Relate the role of science to the development of the food industry.

Activities - How will we teach the content and skills?

- Structure lessons around questions that are authentic, and relate to students' interests, social/family background, and knowledge of their community.
- Provide students with multiple choices for how they can represent their understanding.
- Provide opportunities for students to connect with people of similar backgrounds.
- Provide multiple grouping opportunities for students to share their ideas and to encourage work among various backgrounds and cultures.

Evidence/Assessments - How will we know what students have learned?

Labs: ○ Effects of Salt on Boiling Point

Nutritional Main Meals and Global Issues

Product Production and Presentation

Grocery Store Visit

Developing Data tables

Balancing Chewing Gum

Measuring volumes of irregularly shaped objects

Odor Recognition

Taste Test Panel

Imitation Apple Pie

UNIT Test

Quizzes

Food Science Benchmark #1

Spiraling for Mastery

Content or Skill for this Unit	Spiral Focus from Previous Unit	Instructional Activity

• Provide an understanding of the chemical function and properties of major food components. • Provide an understanding of the chemical interactions of food components and their effects on sensory and nutritional quality, functional properties, and safety of foods. • Provide an understanding of the chemical basis of food preservation and the effects of processing and storage on food quality.	• Foundations of chemical principles- Atomic structure, chemical compounds, and chemical reactions	• Converting Recipes • Sensory Evaluation Cryptogram • News Update Acvity • Vocabulary anagram

Key Resources

"Principles of Food Science 3rd Edition" Janet Ward

"Understanding Food- Principles and Preparation" Amy Brown

Career Readiness, Life Literacies, & Key Skills

Interdisciplinary Connections/Companion Standards

LA.RST.11-12.1	Accurately cite strong and thorough evidence from the text to support analysis of science and technical texts, attending to precise details for explanations or descriptions.
LA.WHST.11-12.2	Write informative/explanatory texts, including the narration of historical events, scientific procedures/experiments, or technical processes.