Unit 01: Chemistry of Food

Content Area: **Template**
Course(s):
Time Period: **Full Year**
Length: **FY**
Status: **Published**

Standards Alignment

New Jersey Student Learning Standards

Practice 1. Asking questions (for science) and defining problems (for engineering)
Asking questions and defining problems in 9–12 builds on K–8 experiences and progresses to formulating, refining, and evaluating empirically testable questions and design problems using models and simulations.

Ask questions that arise from careful observation of phenomena, or unexpected results, to clarify and/or seek additional information.

Ask questions that arise from examining models or a theory, to clarify and/or seek additional information and relationships.

Ask questions to clarify and refine a model, an explanation, or an engineering problem.

Ask and/or evaluate questions that challenge the premise(s) of an argument, the interpretation of a data set, or the suitability of a design.

Define a design problem that involves the development of a process or system with interacting components and criteria and constraints that may include social, technical, and/or environmental considerations.

Practice 4. Analyzing and interpreting data
Analyzing data in 9–12 builds on K–8 experiences and progresses to introducing more detailed statistical analysis, the comparison of data sets for consistency, and the use of models to generate and analyze data.

Consider limitations of data analysis (e.g., measurement error, sample selection) when analyzing and interpreting data.

Practice 7. Engaging in argument from evidence
Engaging in argument from evidence in 9–12 builds on K–8 experiences and progresses to using appropriate and sufficient evidence and scientific reasoning to defend and critique claims and explanations about the natural and designed world(s). Arguments may also come from current scientific or historical episodes in science.

Compare and evaluate competing arguments or design solutions in light of currently accepted explanations, new evidence, limitations (e.g., trade-offs), constraints, and ethical issues.

Evaluate the claims, evidence, and/or reasoning behind currently accepted explanations or solutions to determine the merits of arguments.

Respectfully provide and/or receive critiques on scientific arguments by probing reasoning and evidence, challenging ideas and conclusions, responding thoughtfully to diverse perspectives, and determining additional information required to resolve contradictions.

Practice 8. Obtaining, evaluating, and communicating information
Obtaining, evaluating, and communicating information in 9–12 builds on K–8 experiences and progresses to evaluating the validity and reliability of the claims, methods, and designs.

Critically read scientific literature adapted for classroom use to determine the central ideas or conclusions and/or to obtain scientific and/or technical information to summarize complex evidence, concepts, processes, or information

presented in a text by paraphrasing them in simpler but still accurate terms.

Compare, integrate and evaluate sources of information presented in different media or formats (e.g., visually, quantitatively) as well as in words in order to address a scientific question or solve a problem.

Gather, read, and evaluate scientific and/or technical information from multiple authoritative sources, assessing the evidence and usefulness of each source.

SCI.HS-LS1	From Molecules to Organisms: Structures and Processes
SCI.HS-LS1-2	Develop and use a model to illustrate the hierarchical organization of interacting systems that provide specific functions within multicellular organisms.
SCI.HS-LS1-5	Use a model to illustrate how photosynthesis transforms light energy into stored chemical energy.
SCI.HS-LS1-6	Construct and revise an explanation based on evidence for how carbon, hydrogen, and oxygen from sugar molecules may combine with other elements to form amino acids and/or other large carbon-based molecules.
SCI.HS-LS1-7	Use a model to illustrate that cellular respiration is a chemical process whereby the bonds of food molecules and oxygen molecules are broken and the bonds in new compounds are formed resulting in a net transfer of energy.
SCI.HS-LS2	Ecosystems: Interactions, Energy, and Dynamics
SCI.HS-LS2-3	Construct and revise an explanation based on evidence for the cycling of matter and flow of energy in aerobic and anaerobic conditions.
SCI.HS-LS2-4	Use mathematical representations to support claims for the cycling of matter and flow of energy among organisms in an ecosystem.
HPE.2.1.12	All students will acquire health promotion concepts and skills to support a healthy, active lifestyle.
HPE.2.1.12.A	Personal Growth and Development
HPE.2.1.12.A.1	Analyze the role of personal responsibility in maintaining and enhancing personal, family, community, and global wellness.
HPE.2.1.12.A.2	Debate the social and ethical implications of the availability and use of technology and medical advances to support wellness.
HPE.2.1.12.B	Nutrition
HPE.2.1.12.B.1	Determine the relationship of nutrition and physical activity to weight loss, weight gain, and weight maintenance.
HPE.2.1.12.B.2	Compare and contrast the dietary trends and eating habits of adolescents and young adults in the United States and other countries.
HPE.2.1.12.B.3	Analyze the unique contributions of each nutrient class (fats, carbohydrates, protein, water, vitamins, and minerals) to one’s health.

Integration of Career Readiness, Life Literacies and Key Skills

CRP.K-12.CRP1	Act as a responsible and contributing citizen and employee.
CRP.K-12.CRP2	Apply appropriate academic and technical skills.
CRP.K-12.CRP3	Attend to personal health and financial well-being.
CRP.K-12.CRP4	Communicate clearly and effectively and with reason.
CRP.K-12.CRP5	Consider the environmental, social and economic impacts of decisions.

CRP.K-12.CRP6	Demonstrate creativity and innovation.
CRP.K-12.CRP7	Employ valid and reliable research strategies.
CRP.K-12.CRP8	Utilize critical thinking to make sense of problems and persevere in solving them.
CRP.K-12.CRP9	Model integrity, ethical leadership and effective management.
CRP.K-12.CRP10	Plan education and career paths aligned to personal goals.
CRP.K-12.CRP11	Use technology to enhance productivity.
CRP.K-12.CRP12	Work productively in teams while using cultural global competence.

Technology / Integration of Computer Science and Design Thinking

TECH.8.1.12	Educational Technology: All students will use digital tools to access, manage, evaluate, and synthesize information in order to solve problems individually and collaborate and to create and communicate knowledge.
TECH.8.1.12.A	Technology Operations and Concepts: Students demonstrate a sound understanding of technology concepts, systems and operations.
TECH.8.1.12.A.2	Produce and edit a multi-page digital document for a commercial or professional audience and present it to peers and/or professionals in that related area for review.

Interdisciplinary Connections: NJSLS for ELA, Social Studies, Science and/or Math Section

	Key Ideas and Details
LA.K-12.NJSLSA.R1	Read closely to determine what the text says explicitly and to make logical inferences and relevant connections from it; cite specific textual evidence when writing or speaking to support conclusions drawn from the text.
LA.K-12.NJSLSA.R2	Determine central ideas or themes of a text and analyze their development; summarize the key supporting details and ideas.
LA.K-12.NJSLSA.R3	Analyze how and why individuals, events, and ideas develop and interact over the course of a text.
	Integration of Knowledge and Ideas
LA.K-12.NJSLSA.R7	Integrate and evaluate content presented in diverse media and formats, including visually and quantitatively, as well as in words.
LA.RI.11-12	Reading Informational Text
LA.RI.11-12.1	Accurately cite strong and thorough textual evidence, (e.g., via discussion, written response, etc.), to support analysis of what the text says explicitly as well as inferentially, including determining where the text leaves matters uncertain.
LA.K-12.NJSLSA.W	Writing
LA.RI.11-12.2	Determine two or more central ideas of a text, and analyze their development and how they interact to provide a complex analysis; provide an objective summary of the text.
	Text Types and Purposes
LA.RI.11-12.3	Analyze a complex set of ideas or sequence of events and explain how specific individuals, ideas, or events interact and develop over the course of the text.
LA.K-12.NJSLSA.W1	Write arguments to support claims in an analysis of substantive topics or texts, using valid reasoning and relevant and sufficient evidence.

LA.K-12.NJSLSA.W2	Write informative/explanatory texts to examine and convey complex ideas and information clearly and accurately through the effective selection, organization, and analysis of content.
LA.RI.11-12.7	Integrate and evaluate multiple sources of information presented in different media or formats (e.g., visually, quantitatively) as well as in words in order to address a question or solve a problem.
LA.K-12.NJSLSA.W9	Draw evidence from literary or informational texts to support analysis, reflection, and research.
LA.W.11-12.1	Write arguments to support claims in an analysis of substantive topics or texts, using valid reasoning and relevant and sufficient evidence.
LA.W.11-12.1.C	Use transitions (e.g., words, phrases, clauses) to link the major sections of the text, create cohesion, and clarify the relationships between claim(s) and reasons, between reasons and evidence, and between claim(s) and counterclaims.
LA.W.11-12.1.E	Provide a concluding paragraph or section that supports the argument presented (e.g., articulating implications or the significance of the topic).
LA.W.11-12.2	Write informative/explanatory texts to examine and convey complex ideas, concepts, and information clearly and accurately through the effective selection, organization, and analysis of content.
LA.W.11-12.2.A	Introduce a topic; organize complex ideas, concepts, and information so that each new element builds on that which precedes it to create a unified whole; include formatting (e.g., headings), graphics (e.g., figures, tables), and multimedia when useful to aiding comprehension.
LA.W.11-12.2.B	Develop the topic thoroughly by selecting the most significant and relevant facts, extended definitions, concrete details, quotations, or other information and examples appropriate to the audience's knowledge of the topic.
LA.W.11-12.2.F	Provide a concluding paragraph or section that supports the argument presented (e.g., articulating implications or the significance of the topic).
LA.W.11-12.9	Draw evidence from literary or informational texts to support analysis, reflection, and research.

Integration of Diversity, Equity and Inclusion; Climate Change; Informational and Media LiteracyNew Section

see Crosswalks

21st Century Life and Careers

Stage I: Desired Results

Transfer/Overview/Rationale

Transfer / Overview / Rationale

Unit Rationale

The purpose of this unit…

The purpose of this unit is to understand the components of food on a molecular level and analyze the effect of chemical processes that take place in food.

Meaning

Essential Questions

Essential Questions

- What is food composed of on a molecular level?
- Why does food contain energy and what process does our body use to convert that energy into a usable form?
- What methods are used to counter the decomposition of food?
- In what ways can chemical processes affect or alter food?

Enduring Understanding/Indicators of Understanding

Enduring Understanding/Indicators of Understanding

Students will understand that:

- Carbohydrates, lipids (or fats) and proteins are the main macromolecules that make up food.
- Photosynthesis is the process that allows plants to transform the sun into energy, and cellular respiration is the process that our bodies use to turn that food into a usable form of energy
- The principles underlying food chemistry create the methods that make it possible to harvest, preserve, distribute, store and prepare foods for human consumption.
- The chemical processes that take place inside food determine its nutritional value, taste, texture and freshness.

Acquisition (Student Learning Objectives)

Knowledge

Knowledge

Students will know…

- Carbon, hydrogen, nitrogen and oxygen are the four most frequently occurring elements that are found in the molecules that make up food
- The three most common groups of molecules found in food are carbohydrates, proteins and lipids essential for proper body functioning
- Carbohydrates are our bodies main energy source because they provide glucose; They can be classified as simple or complex
- Simple carbs contain one or two sugars while complex carbs contain three or more
- Fats belong to a large group known as lipids. Lipids include fats, oils and waxes
- Fats can be classified as saturated, unsaturated or trans fat
- Unsaturated fats can either be monounsaturated or polyunsaturated
- Trans fats are unsaturated fats that have been processed and as a result, behave like saturated fats
- Protein is a macronutrient that is essential to building muscle mass, which is important for metabolism
- People can produce some amino acids, but must get others from food. The nine amino acids that humans cannot produce on our own are called essential amino acids
- Proteins function as building blocks for bones, muscles, cartilage, skin, and blood. They are also building blocks for enzymes, hormones, and vitamins
- B vitamins found in protein serve a variety of functions in the body. They help the body release energy, play a vital role in the function of the nervous system, aid in the formation of red blood cells, and help build tissues. Iron found in protein is used to carry oxygen in the blood
- Photosynthesis is the process by which plants use the suns energy to create their own food
- Cellular respiration is the process by which all cellular organisms transform food into a usable form of energy called ATP
- Aerobic respiration is a form of cellular respiration that requires the presence of oxygen. It produces a total of 36 ATP's
- Anaerobic respiration, also known as fermentation, is when organisms create energy from food without the use of oxygen. It produces a total of 2 ATP's
- Fermentation is the process of using microorganisms, such as bacteria or yeast, to convert carbohydrates to alcohol or organic acids under anaerobic conditions.
- 2 types of fermentation are lactic acid and alcoholic
- Healthy bacteria are added to food and metabolize some of the natural sugars, forming lactic acid. Lactic acid prevents the growth of other harmful bacteria. In this way, the fermentation process preserves the food, and adds interesting flavors and textures.
- Fermented foods increase the range of healthy bacteria in the gut. Having a wide spectrum of healthy types of bacteria has recently been associated with a host of possible benefits-including weight control and reduced blood sugar.
- The earliest record of fermentation dates back as far as 6000 B.C. in the Fertile Crescent—and nearly every civilization since has included at least one fermented food in its culinary heritage.
- Examples of fermented foods include yogurt, cottage cheese, pickles and sauerkraut, beer, wine, chocolate and bread
- Lactose, an enzyme present in milk, converts to lactic acid during bacterial fermentation, which causes the milk to thicken and also gives yogurt its characteristic tartness.
- Food preservation prevents the growth of microorganisms, or other microorganisms, as well as slowing the oxidation of fats that cause rancidity. Spoiled food can cause sickness or even death
- Food Preservation techniques include drying, smoking, canning, freezing, vacuum sealing, salting, addition of sugar, lye, jellying, potting, jugging, burial in the ground, controlled atmosphere, addition of microorganisms, high pressure and pasteurization
- Every food we eat is made up of chemical compounds that determine flavor, color, texture and nutrient value
- An additive includes any substance used in the production, processing, treatment, packaging, transportation or

storage of food.
- All food additives are carefully regulated by federal authorities and various international organizations to ensure that foods are safe to eat and are accurately labeled.
- Additives in food help to maintain and/or improve safety and freshness, improve or maintain nutritional value and improve taste, texture and appearance
- Direct food additives are those that are added to a food for a specific purpose in that food. For example, xanthan gum -- used in salad dressings, chocolate milk, bakery fillings, puddings and other foods to add texture -- is a direct additive. Most direct additives are identified on the ingredient label of foods.
- Indirect food additives are those that become part of the food in trace amounts due to its packaging, storage or other handling. For instance, minute amounts of packaging substances may find their way into foods during storage.
- A color additive is any dye, pigment or substance which when added or applied to a food, drug or cosmetic, or to the human body, is capable (alone or through reactions with other substances) of imparting color.
- Color additives are used in foods for many reasons: to offset color loss due to exposure to light, air, temperature extremes, moisture and storage conditions; to correct natural variations in color; to enhance colors that occur naturally; and 4) to provide color to colorless and "fun" foods.
- Federal regulations require evidence that each substance is safe at its intended level of use before it may be added to foods.
- Because of inherent limitations of science, FDA can never be *absolutely* certain of the absence of any risk from the use of any substance.
- Food manufacturers are required to list all ingredients in the food on the label. On a product label, the ingredients are listed in order of predominance, with the ingredients used in the greatest amount first, followed in descending order by those in smaller amounts.

Skills

Skills

Student will be skilled at …

- Analyze the functions of carbohydrates, proteins and fats and their role in a balanced diet
- Compare and contrast simple verses complex carbohydrates
- Compare and contrast saturated and unsaturated fats
- Evaluate the importance of healthy fats and distinguish between the healthy fats and unhealthy fats
- Examine the importance of proteins in the human body
- Infer how one must various sources of proteins in order for their bodies to produce all nine amino acids required for proper human body functioning
- Identify the various body functions require the consumption of proteins
- Analyze the relationship between photosynthesis and cellular respiration
- Trace the path of energy from the sun to the human body
- Compare and contrast between aerobic respiration and fermentation
- Identify the 2 types of fermentation and the role they play in food preparation and preservation
- Describe the history and importance of fermentation in the food industry
- Evaluate why food needs to be preserved
- Identify several food preservation techniques
- Analyze several methods in which food is chemically altered and the purpose for the alteration
- Explain what an additive is and why companies put them in food
- Distinguish between direct and indirect food additives
- Evaluate several reasons why color additives are used by food companies
- Identify pros and cons of food additives
- Determine the role the FDA plays in the food industry
- Analyze why the FDA cannot be 100% certain of any long term effects of some of the additives and preservatives used in food

Stage 3: Learning Plan

Resource and Mentor Texts

Resources and Mentor Texts

- **Powerpoint presentations**
- **Scienceworld Magazines**
- **Nutrition Magazines**
- **Recipe Magazines**
- **Articles related to topics**
- **Youtube videos**
- **Materials for labs**
- **Journals**
- **Website: https://foodcrumbles.com/food-science-bascis-6-weeks-part-2-food-chemistry/**

Formative Assessment Strategies

Formative Assessment Strategies

- Nutrition and Health Journals
- Graphic Organizers
- Quick Thoughts
- Exit Slips
- Kahoot
- Bingo
- White Board Participation
- Homework
- Teacher Check
- Thumbs up/thumbs down
- Create a Test/Take a Test
- Whole class questioning and answering
- Macromolecule quiz - carbohydrates, proteins and fats
- Cell Energy Quiz

Learning Activities/Unit of Study

Learning Activities/Unit of Study

- Nutrition and Health Portfolio - Students will build a nutrition and health portfolio throughout the entire school year. Students will continuously add information
- Ferment a pickle from a cucumber https://www.thespruceeats.com/methods-of-food-preservation-1328477
- Macromolecule Chart: Function of Macromolecules
- Cellular Energy Foldable
- Student Lab: Effects of carbon dioxide production and exercise
- Food Additives Lab
- Test for Carbohydrates Lab
- Movie: Food, Inc

  https://www.netflix.com/watch/70108783?trackId=13752289&tctx=1%2C0%2C6c0abfde2f929f224eb9c501d603a2bf90b14d45%3A21aa158cb5e3bff67ab69571b57743a1d5de4d51%2C%2C

Modifications and/or Accommodations

Suggested Modifications (ELL, Sp. Ed, Glfted, At-risk of Failure)

English Language Learners

Native language support: The teacher provides auditory or written content to students in their native language.

Adjusted Speech: The teacher changes speech patterns to increase student comprehension. This could include facing the students, paraphrasing, clearly indicating the most important ideas, and speaking more slowly.

Visuals: The teacher uses graphics, pictures, visuals, and manipulatives. This helps ELL students better understand and comprehend the subjects at hand.

Front-Loading Vocabulary: The teacher front loads vocabulary. This means providing students with a list of important vocabulary words they will need to know for a book, lesson, etc. prior to the lesson being taught. Including pictures to go with the vocabulary words is also very beneficial for the students.

Special Education Students

Chunking: The teacher presents information in a way that makes it easy for students to understand

and remember. Chunking is based on the presumption that our working memory is easily overloaded by excessive detail. The best way to deliver information is to organize it into meaningful units. Because students with special needs get overloaded easily, chunking is an effective strategy to use with them.

Checking for Understanding: It is important to constantly check for understanding, especially for students who have accommodations. Teachers want to make sure students understand the concepts being covered in a way that makes sense to them.

Extra time: The teacher provides students with special needs extra time to complete work or answer questions. It is important to give students enough time to process their thoughts.

Oral Reading: The teacher will read work orally to students. Class work such as tests and literature circles may need to be read aloud to the student.

Timers: The teacher will use timers as an instructional tool. The use of timers is beneficial for students who have trouble completing tasks. Timers can be helpful so the student is aware of how much time they have to complete an assignment.

Students with 504 Plans

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Gifted & Talented Strategies

Extensions/Enrichments: Teachers will provide gifted and talented students with extension/enrichment projects. Students will be challenged to further their understanding, to apply acquired knowledge, and/or to produce something in reference to acquired knowledge.

Modify/Change Activities: Teachers will monitor and modify activities to accommodate those students who need to be challenged further. Additional reading, problem-solving, writing, or project work is necessary for those students who are ready to move on at a rate more accelerated than their peers. In this way, G & T students are provided the same opportunity for support as special needs students.

Students at Risk of School Failure

Directions or Instructions: Make sure directions and/or instructions are given in limited numbers. Give directions/instructions verbally and in simple written format. Ask students to repeat the instructions or directions to ensure understanding occurs. Check back with the student to ensure he/she hasn't forgotten.

Peer Support: Peers can help build confidence in other students by assisting in peer learning. Many teachers use the 'ask 3 before me' approach. This is fine, however, a student at risk may have to have a specific student or two to ask. Set this up for the student so he/she knows who to ask for clarification before going to you.

Alternate or Modified Assignments: Always ask yourself, "How can I modify this assignment to ensure the students at risk are able to complete it?" Sometimes you'll simplify the task, reduce the length of the assignment or allow for a different mode of delivery. For instance, many students may hand something in, the at-risk student may jot notes and give you the information verbally. Or, it just may be that you will need to assign an alternate assignment.

Increase One to One Time: When other students are working, always touch base with your students at risk and find out if they're on track or needing some additional support. A few minutes here and there will go a long way to intervene as the need presents itself.

Contracts: It helps to have a working contract between you and your students at risk. This helps prioritize the tasks that need to be done and ensure completion happens. Each day write down what needs to be completed, as the tasks are done, provide a checkmark or happy face. The goal of using contracts is to eventually have the student come to you for completion sign-offs.

Hands On: As much as possible, think in concrete terms and provide hands-on tasks. This means a child doing math may require a calculator or counters. The child may need to tape record comprehension activities instead of writing them. A child may have to listen to a story being read instead of reading it him/herself.

Tests/Assessments: Tests can be done orally if need be. Break tests down in smaller increments by having a portion of the test in the morning, another portion after lunch and the final part the next day.

Seating: Seat students near a helping peer or with quick access to the teacher. Those with hearing or sight issues need to be close to the instruction which often means near the front.