Food Chemistry

Narrative Summary

In *Food Chemistry*, students explore basic concepts related to food and nutrition. They set up their own classroom laboratory and perform physical and chemical tests to identify the presence of starch, glucose, fats, and proteins in common foods. Some of the tests are relatively simple and produce "yes-or-no" results; others require multiple steps. Still other tests, such as the glucose test, produce results that require interpretation. Through readings, students discover how proteins, fats, and carbohydrates, as well as vitamins, are related to good health. They also learn how to interpret food labels. In a final challenge, students apply their knowledge and skills to analyze the nutritional components of a marshmallow.

Science Content

This physical science unit allows students to explore chemistry in a familiar context. The unit emphasizes the transfer of energy in biological systems and the nutrition of common foods. Students have opportunities to gather, organize, and interpret data throughout this unit. They discover that scientific inquiry can provide useful information about nutrients and foods. Through making predictions, conducting tests, analyzing results, and discussing findings with classmates, students become engaged in processes that encourage problem solving and foster the understanding that scientific conclusions must be justified by evidence. Reading selections about vitamins reveal both their importance in nutrition and in the history of health and science.

Assessment

Lesson 1 serves as a pre-unit assessment. By brainstorming what they know and want to know about foods and discussing foods they eat for specific meals, students begin to consider the relationship of nutrition to health. In the post-unit assessment, the class revisits these questions, providing the teacher with two sets of comparable data that indicate students' growth in knowledge and skills. Lesson 16 is an embedded assessment in which students apply the testing techniques they have learned in the unit to determine the nutritional value of a marshmallow. Additional assessments at the close of the unit include a student self-assessment, a performance-based assessment in which students identify mystery foods using tests from the unit, and an activity in which students read and interpret sample food labels.

Goals for *Food Chemistry*

In this unit, students investigate the basic nutrients found in a variety of common foods. From their experiences, they are introduced to the following concepts, skills, and attitudes.

Concepts

- Foods contain starches, sugars, fats, and/or proteins.
- Specific chemical and physical tests can be used to determine whether a food contains starches, sugars (in this unit, glucose), fats, or proteins.
- Iodine can be used to test for starches, test strips for glucose, brown paper for fats, and Coomassie blue for proteins.
- Varying amounts of starches, sugars (in this unit, glucose), fats, and proteins are found in foods.
- Starches and sugars are carbohydrates.
- Glucose is one kind of sugar.
- Carbohydrates, fats, proteins, water, vitamins, and minerals are nutrients.
- Nutrients are essential to human health.

Skills

- Learning to perform four chemical and physical tests to identify the presence or absence of nutrients in foods.
- Predicting the nutrient content of foods.
- Conducting independent research on nutrients.
- Observing, recording, and organizing test results.
- Interpreting a range of test results to draw conclusions about the kinds and amounts of nutrients in foods.
- Developing laboratory techniques to avoid contamination of the test samples.
- Communicating results in writing and through discussion.
- Reflecting on experiences in writing and through discussion.
- Applying previously learned concepts and skills to solve a problem.

Attitudes

- Developing an interest in investigating the nutritional content of food.
- Recognizing the importance of repeating tests to validate results.
- Recognizing that nutritional information can be used to make informed decisions about the foods we eat.

GRADE 5

Food Chemistry

Fundamental Concepts and Principles Addressed (5–8)

Science as Inquiry

Abilities necessary to do scientific inquiry

- Identify questions that can be answered through scientific investigations.
- Design and conduct a scientific investigation.
- Use appropriate tools and techniques to gather, analyze, and interpret data.
- Develop descriptions, explanations, predictions, and models using evidence.
- Think critically and logically to make the relationships between evidence and explanations.
- Recognize and analyze alternative explanations and predictions.
- Communicate scientific procedures and explanations.

Understandings about scientific inquiry

- Different kinds of questions suggest different kinds of scientific investigations.
- Current scientific knowledge and understanding guide scientific investigations.
- Technology used to gather data enhances accuracy and allows scientists to analyze and quantify results of investigations.
- Scientific explanations emphasize evidence, have logically consistent arguments, and use scientific principles, models, and theories.
- Science advances through legitimate skepticism.
- Scientific investigations sometimes result in new ideas and phenomena for study, generate new methods or procedures for an investigation, or develop new technologies to improve the collection of data.

Physical Science

Properties and changes of properties in matter

- A substance has characteristic properties, such as solubility.
- Substances react chemically in characteristic ways with other substances.

Science and Technology

Understandings about science and technology

- Many different people in different cultures have made and continue to make contributions to science and technology.
- Science and technology are reciprocal. Science helps drive technology, as it addresses questions that demand more sophisticated instruments and provides principles for better instrumentation and technique. Technology is essential to science, because it provides instruments and techniques that enable observations of objects and phenomena that are otherwise unobservable due to factors such as quantity. Technology also provides tools for investigations, inquiry, and analysis.

Science in Personal and Social Perspectives

Personal health

- Regular exercise is important to the maintenance and improvement of health. The benefits of physical fitness include maintaining healthy weight, having energy and strength for routine activities, good muscle tone, bone strength, strong heart/lung systems, and improved mental health.
- Food provides energy and nutrients for growth and development. Nutrition requirements vary with body weight, age, sex, activity, and body functioning.

Risks and benefits

- Risk analysis considers the type of hazard and estimates the number of people that might be exposed and the number likely to suffer consequences. The results are used to determine the options for reducing or eliminating risks.
- Students should understand the risks associated with chemical hazards (food), biological hazards (viruses, bacteria), and with personal hazards (diet).
- Individuals can use a systematic approach to thinking critically about risks and benefits.
- Important personal and social decisions are made based on perceptions of benefits and risks.

Science and technology in society

- Science influences society through its knowledge and world view.
- Societal challenges often inspire questions for scientific research.
- Technology influences society through its products and processes. Technology influences the quality of life and the ways people act and interact.
- Science and technology have advanced through contributions of many different people, in different cultures, at different times in history.
- Scientists and engineers work in many different settings, including colleges and universities, businesses and industries, research institutes, and government agencies.
- Science cannot answer all questions and technology cannot solve all human problems or meet all human needs.

History and Nature of Science

Science as a human endeavor

- Women and men of various social and ethnic backgrounds—and with diverse interests, talents, qualities, and motivations—engage in the activities of science, engineering, and related fields such as the health professions.
- Science requires different abilities, depending on such factors as the field of study and type of inquiry.

Nature of science

- Scientists formulate and test their explanations of nature using observation and experiments.
- It is normal for scientists to differ with one another about the interpretation of the evidence.
- It is part of scientific inquiry to evaluate the results of scientific investigations, experiments, observations, and the explanations proposed by other scientists.

History of science

- Many individuals have contributed to the traditions of science.
- In historical perspective, science has been practiced by different individuals in different cultures.
- Tracing the history of science can show how difficult it was for scientific innovators to break through the accepted ideas of their time to reach the conclusions that we currently take for granted.

Unifying Concepts and Processes

Systems, order, and organization

Evidence, models, and explanation

Constancy, change, and measurement

Form and function

GRADE 5

Food Chemistry

Fundamental Concepts and Principles Addressed (K–4)

Science as Inquiry

Abilities necessary to do scientific inquiry

- Ask a question about objects, organisms, and events in the environment.
- Plan and conduct a simple investigation.
- Employ simple equipment and tools to gather data and extend the senses.
- Use data to construct a reasonable explanation.
- Communicate investigations and explanations.

Understandings about scientific inquiry

- Scientific investigations involve asking and answering a question and comparing the answer with what scientists already know about the world.
- Scientists use different kinds of investigations, depending on the questions they are trying to answer.
- Simple instruments, such as magnifiers, provide more information than scientists obtain using only their senses.
- Scientists develop explanations using observations (evidence) and what they already know about the world (scientific knowledge).
- Scientists make the results of their investigation public.
- Scientists review and ask questions about the results of other scientists' work.

Physical Science

Properties of objects and materials

- Objects have many observable properties, including size, shape, color, temperature, and the ability to react with other substances. Those properties can be measured using tools.
- Objects can be described by the properties of the materials from which they are made, and those properties can be used to separate or sort a group of objects or materials.

Life Science

Characteristics of organisms

- Organisms have basic needs, such as food and water.

Science and Technology

Understandings about science and technology

- People have always had questions about their world. Science is one way of answering questions and explaining the natural world.
- People have always had problems and invented tools and techniques (ways of doing something) to solve problems.
- Scientists and engineers often work in teams with different individuals doing different things that contribute to the results.
- Women and men of all ages, backgrounds, and groups engage in a variety of scientific and technological work.
- Tools help scientists make better observations, measurements, and equipment for investigations. They help scientists see, measure, and do things that they could not otherwise see, measure, and do.

Abilities to distinguish between natural objects and objects made by humans

- Some objects occur in nature; others have been designed and made by people to solve human problems and enhance the quality of life.

Science in Personal and Social Perspectives

Personal health

- Safety and security are basic needs of humans. Safety involves freedom from danger, risk, or injury. Student understandings include following safety rules for home and school, preventing neglect, and avoiding injury.
- Individuals have some responsibility for their own health.
- Nutrition is essential to health. Students should understand how the body uses food and how various foods contribute to health. Recommendations for good nutrition include eating a variety of foods, eating less sugar, and eating less fat.
- Students should understand that some substances, such as prescription drugs, can be beneficial, but that any substance can be harmful if used inappropriately.

Types of resources

- Resources are things we get from the living and nonliving environment to meet the needs and wants of a population.
- Some resources are basic materials and some are produced from basic resources, such as food.

Science and technology in local challenges

- People continue inventing new ways of doing things, solving problems, and getting work done.
- Science and technology have greatly influenced food quality.

History and Nature of Science

Science as a human endeavor

- Science and technology have been practiced by people for a long time.
- Men and women have made a variety of contributions throughout the history of science and technology.
- Although men and women using scientific inquiry have learned much about the objects, events, and phenomena in nature, much more remains to be understood.
- Many people choose science as a career and devote their entire lives to studying it. Many people derive great pleasure from doing science.

Unifying Concepts and Processes

Systems, order, and organization

Evidence, models, and explanation

Constancy, change, and measurement

Form and function