

Science and Technology for Children™

THIRD-GRADE UNITS

Grade	Life, Earth, and Physical Sciences and Technology			
1	Organisms	Weather	Solids and Liquids	Comparing and Measuring
2	The Life Cycle of Butterflies	Soils	Changes	Balancing and Weighing
3	Plant Growth and Development	Rocks and Minerals	Chemical Tests	Sound
4	Animal Studies	Land and Water	Electric Circuits	Motion and Design
5	Microworlds	Ecosystems	Food Chemistry	Floating and Sinking
6	Experiments with Plants	Measuring Time	Magnets and Motors	The Technology of Paper

Third-Grade STC™ Units and the NSES (K–4)

National Science Education Standards for Grades K–4	Plant Growth and Development	Rocks and Minerals	Chemical Tests	Sound
Science as Inquiry				
Abilities necessary to do scientific inquiry	●	●	●	●
Understandings about scientific inquiry	●	●	●	●
Physical Science				
Properties of objects and materials		●	●	●
Position and motion of objects				●
Light, heat, electricity, and magnetism		●	●	
Life Science				
Characteristics of organisms	●			●
Life cycles of organisms	●			
Organisms and environments	●			●
Earth and Space Science				
Properties of earth materials	●	●	●	
Objects in the sky				
Changes in earth and sky		●		
Science and Technology				
Abilities of technological design	●			●
Understandings about science and technology	●	●	●	●
Abilities to distinguish between natural objects and objects made by humans	●	●	●	
Science in Personal and Social Perspectives				
Personal health			●	●
Characteristics and changes in populations				
Types of resources		●	●	
Changes in environments		●		
Science and technology in local challenges	●			●
History and Nature of Science				
Science as a human endeavor	●	●	●	●
Unifying Concepts and Processes				
Systems, order, and organization	●	●	●	●
Evidence, models, and explanation	●	●	●	●
Constancy, change, and measurement	●	●	●	●
Evolution and equilibrium		●		
Form and function	●	●		●

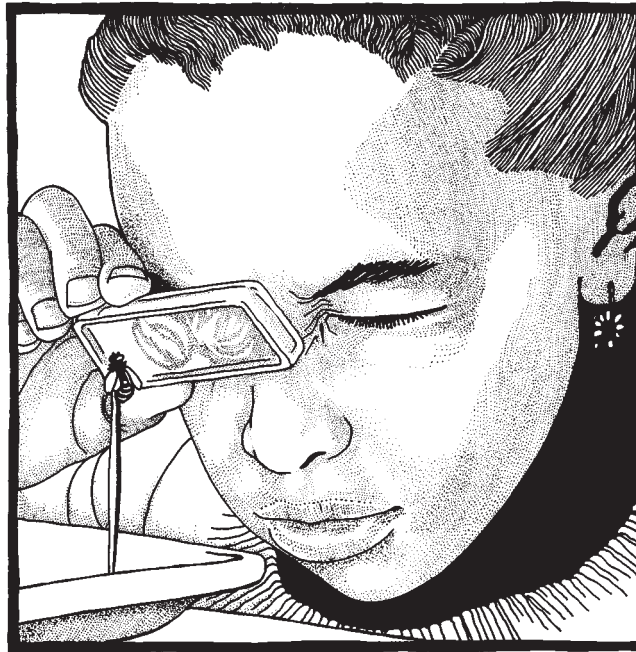
Plant Growth and Development

Narrative Summary

In this unit, students have the opportunity to observe each stage in the life cycle of a simple plant. Working with Wisconsin Fast Plants™ (*Brassica rapa*), which germinate, mature, and go to seed within a 40-day period, students plant seeds and watch the seedlings emerge. Later, they thin and transplant seedlings. As they watch their plants grow, students learn that plants need nutrients from the soil, as well as water and light, to thrive. As the unit expands to focus on the interdependence of living things, students cross-pollinate the flowers with dried honeybees. Finally, they harvest mature seeds and determine seed yields. These experiences deepen students' understanding of the characteristics of living organisms and their relationship with and dependence on their environment.

Science Content

Plant life cycles, resource needs of organisms, and environmental changes are investigated with Wisconsin Fast Plants™. Each student keeps a laboratory notebook to record the many changes, from seed to flower, of these plants. Students translate their findings and measurements into graphs. Measurement in standard units and comparisons between different groups are key to interpreting cause-and-effect relationships. Using the processes



of technological design, students design and build models of the *Brassica* plant and a bee. Students communicate their designs in a class presentation and demonstrate their knowledge of the science concepts learned in the unit.

Assessment

Students begin the unit with a brainstorming session in which they share what they know and want to know about plants. Assessments in this session and Lesson 10 are

matched with a post-unit discussion that provides tools to help evaluate student progress in understanding the plant's life cycle and learning about the anatomy of the bee. Throughout the unit, student notebooks, graphs, and record sheets can be used for assessment and evaluation. Using the record chart provided, teachers can track each student's progress in the unit by evaluating student products and skills. A sequencing activity using life cycle cards and the evaluation of a student-generated illustration of a bee are among the additional assessments found at the close of the unit.

Goals for *Plant Growth and Development*

In this unit, students observe the life cycle of the *Brassica rapa* (Wisconsin Fast Plants™). Their experiences introduce them to the following concepts, skills, and attitudes.

Concepts

- Many plants follow a life cycle that begins with growth from a seed and proceeds through the production of seeds.
- Plants have distinct stages in their life cycle.
- To live and grow, plants need light, water, and nutrients from the soil.
- Flowering plants must be pollinated in order to produce seeds.
- Many plants are pollinated by bees.
- A flower's pollen sticks to a bee, but some rubs off when the bee feeds at other flowers.
- One seed produces one plant; one plant can produce many seeds.

Skills

- Planting and caring for the *Brassica rapa*.
- Observing, describing, and recording changes in plants.
- Comparing and discussing changes occurring in plants over time.
- Measuring and recording the growth of plants.
- Using graphs to display and compare growth patterns.
- Predicting future growth from observations and measurements.
- Reading to learn more about plants.
- Communicating results and reflecting on experiences through writing, drawing, and discussion.

Attitudes

- Developing an interest in studying the life cycle of plants.
- Developing sensitivity to the needs of plants.
- Developing an awareness of the interaction between plants and animals.



Plant Growth and Development

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 an 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.
- Scientists use different kinds of investigations, depending on the questions they are trying to answer.
- Simple instruments, such as magnifiers and rulers, provide more information than scientists obtain using only their senses.
- Scientists develop explanations using observations.
- Scientists make the results of their investigations public.
- Scientists review and ask questions about the results of other scientists' work.

Life Science

Characteristics of organisms

- Organisms have basic needs; plants require air, water, nutrients, and light. Organisms can survive only in environments in which their needs are met.
- Each plant has different structures that serve different functions in growth, survival, and reproduction.

Life cycles of organisms

- Plants have life cycles that include developing into adults, reproducing, and eventually dying.
- Plants closely resemble their parents.
- Many characteristics of an organism are inherited from the parents of the organism, but other characteristics result from interaction with the environment.

Organisms and their environments

- All animals depend on plants.
- An organism's patterns of behavior are related to the nature of that organism's environment. When the environment changes, some plants survive and reproduce, and others die.

Earth and Space Science

Properties of earth materials

- Earth materials, such as soil and water, are useful in growing plants.

Science and Technology

Abilities of technological design

- Identify a simple problem.
- Propose a solution.
- Implementing proposed solutions.
- Evaluate a product or design.
- Communicate a problem, design, and solution.

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.
- Scientists often work in teams with different individuals doing different things that contribute to the results.
- Tools help scientists make better observations, measurements, and equipment for investigations. They help scientists see, measure, and do things they could not otherwise see, measure, and do.

Abilities to distinguish between natural objects and objects made by humans

- Some objects occur in nature while others have been designed by people.
- Objects can be categorized into two groups, natural and designed.

Science in Personal and Social Perspectives

Science and technology in local challenges

- People continue inventing new ways of doing things, solving problems, and getting work done.

History and Nature of Science

Science as a human endeavor

- Many people choose science as a career and devote their 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

Rocks and Minerals

Narrative Summary

Students explore the differences and similarities between rocks and minerals by investigating samples of these earth materials, performing a series of tests similar to geologists' field tests, and reading about rocks and minerals and how they are used. The first lessons focus on rocks. The students then turn their attention to a set of 12 minerals and test them to identify properties such as streak color, luster, transparency, hardness, shape, and magnetism. After completing these observations, students compile them into their own "Minerals Field Guide." In a culminating activity, they are challenged to apply their knowledge and skills to identify new minerals. They then report on how rocks and minerals are used.

Science Content

Students investigate the properties of earth materials using techniques similar to those of a geologist. As part of their investigations of rocks, they read about how rocks are changed by heat and pressure. Students then explore the color, transparency, crystal form, luster, hardness, and magnetism of a set of 12 minerals and, on the basis of these tests, identify the minerals by name. Through a variety of reading selections, the history and nature of science are explored in depth as students learn more about the origin of common rock and mineral names and the various uses of minerals over the centuries. Science in personal and social perspectives is addressed as students examine and report



on ways in which minerals and rocks are used as a resource.

Assessment

During brainstorming sessions in Lessons 1 and 5, students share what they know and want to know about rocks and minerals, respectively. Throughout the unit and following Lesson 16, students revisit their brainstorming lists to assess their prior thinking and address misconceptions, if needed. Problem solving and reasoning can be

assessed throughout this unit as students perform field tests to identify minerals. Students' observations, data collection, and recordkeeping also provide evidence of their understanding. In Lesson 15, students' investigations of three "mystery minerals" serve as an embedded assessment and allow the teacher to assess growth in concepts, skills, and attitudes developed throughout the unit. Additional assessments include a class presentation in which students share with visitors what they have learned in the unit, guidelines for conducting student/teacher conferences in which students share their knowledge of rocks and minerals, and a paper-and-pencil student self-assessment that helps students reflect on the unit.

Goals for *Rocks and Minerals*

In this unit, students investigate rocks and minerals. Through their experiences, students are introduced to the following concepts, skills, and attitudes.

Concepts

- Rocks are aggregates of minerals, and they may also contain organic matter.
- Different rocks have different properties.
- The properties of rocks reflect the way they were formed and the minerals in them.
- Each mineral is composed of only one substance, and that substance is the same in all samples of the mineral.
- Minerals differ in color, texture, smell, luster, transparency, hardness, shape, and reaction to magnets.
- The properties of rocks and minerals determine how they are used.

Skills

- Using senses to observe and describe rocks and minerals.
- Recording and discussing observations of rocks and minerals.
- Sorting minerals on the basis of similarities and differences in identified properties.
- Performing and interpreting results of the following tests on minerals: streak, transparency, luster, hardness, and magnetism.
- Recording and discussing results of tests on minerals.
- Reading for more information on minerals and rocks.
- Communicating observations and test results through writing and discussion.
- Reflecting on experiences through writing and discussion.
- Applying previously learned concepts and skills to solve a problem.

Attitudes

- Developing an interest in investigating rocks and minerals.
- Recognizing the importance of using multiple tests to create a profile of a mineral.
- Valuing scientific information that has been collected and verified over time.



Rocks and Minerals

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 an 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.
- 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 investigations 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, weight, shape, color, and the ability to react with other substances. These properties can be measured using tools.
- Objects are made of one or more materials. 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.

Light, heat, electricity, and magnetism

- Light travels in a straight line until it strikes an object.
- Magnets attract and repel each other and certain kinds of other materials.

Earth and Space Science

Properties of earth materials

- Earth materials include solid rocks and soils. The varied materials have different physical and chemical properties, which make them useful in different ways, for example, as building materials and as resources for fuel. Earth materials provide many of the resources that humans use.
- Fossils provide evidence about plants and animals that lived long ago and the nature of the environment at that time.

Changes in the earth and sky

- The surface of the earth changes. Some changes are due to slow processes, such as erosion and weathering, and some changes are due to rapid processes, such as landslides, volcanic eruption, and earthquakes.

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.

- 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.
- Objects can be categorized into two groups, natural and designed.

Science in Personal and Social Perspectives

Types of resources

- Resources are things that we get from the living and nonliving environment to meet the needs and wants of a population.
- Some resources are basic materials, such as air, water, and soil; some are produced from basic resources, such as food, fuel, and building materials.
- The supply of many resources is limited.

Changes in environments

- Some environmental changes occur slowly, and others occur rapidly.

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.
- 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

Evolution and equilibrium

Form and function

Chemical Tests

Narrative Summary

This unit introduces third-graders to the science of chemistry by challenging them to explore and determine the identity of five common household chemicals: sugar, alum, talc, baking soda, and cornstarch. Students begin by focusing on the physical properties of color, form, and texture. Next, they explore chemical properties by observing how the five powders interact with water, vinegar, iodine, and red cabbage juice. These tests enable them to explore phenomena such as crystallization and to observe the processes of evaporation and filtration. Finally, students apply their skills and their knowledge of the five chemicals to identify a variety of “mystery” mixtures. As a result of conducting these investigations, students develop scientific skills such as observing and recording results, forming conclusions on the basis of experience, communicating results, and applying their knowledge to solve problems.

Science Content

This unit focuses on the properties of materials that can be observed and investigated with simple physical and chemical tests. Students learn about chemicals through direct experience with everyday substances and observe changes in properties as they mix one substance with another. Through



investigation, students are introduced to solubility, filtration, evaporation, and acids, bases, and neutrals. Students develop basic laboratory skills; strengthen their ability to collect, record, and organize data; and learn about laboratory safety.

Assessment

Chemical Tests begins with a pre-unit assessment lesson in which students share what they know and would like to know about chemicals.

Students also observe and describe an unknown material. In a matched post-unit assessment, the class revisits the pre-unit assessment questions and activity. In Lesson 11, as students review evidence gathered in the unit, teachers can assess students' ability to interpret the importance of specific test results in identifying unknowns. A set of criteria helps guide this assessment. An embedded assessment in Lesson 16 challenges students to synthesize and apply what they have learned to identify unlabeled test liquids. Additional assessments at the close of the unit include a student self-assessment and a performance-based assessment in which students analyze the composition of unknown mixtures they created in Lesson 14.

Goals for *Chemical Tests*

In this unit, students investigate the properties of a variety of common household chemicals. From their experiences, they are introduced to the following concepts, skills, and attitudes.

Concepts

- Common household chemicals have different physical and chemical properties.
- Chemicals undergo changes in form, color, or texture when they are mixed together, separated, or heated.
- Some chemicals can be identified by their interaction with water, vinegar, iodine, red cabbage juice, and heat.
- Different types of mixtures, such as solutions or suspensions, are created when solids are combined with water.
- Evaporation and filtration are methods for separating mixtures of solids and liquids.
- Some chemicals can be classified as acids, bases, or neutral substances on the basis of their reactions with red cabbage juice.

Skills

- Observing and describing properties of materials.
- Learning to perform different physical and chemical tests.
- Predicting, observing, describing, and recording results of tests.
- Analyzing and drawing conclusions from the results of tests.
- Comparing and contrasting test results to define the properties of household chemicals so they can be identified.
- Supporting conclusions with reasons based on experiences.
- Communicating results and reflecting on experiences through writing and discussion.
- Applying previously learned knowledge and skills to solve a problem.
- Reading to enhance understanding of chemistry concepts.
- Developing proper laboratory techniques to ensure safety and avoid contamination.

Attitudes

- Developing an interest in exploring and investigating properties of chemicals.
- Recognizing the importance of guidelines for experimentation.
- Developing an awareness of the importance of chemicals in our lives.
- Developing an appreciation for the safe handling of chemicals.



Chemical Tests

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).

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.
- Materials can exist in different states—solid, liquid, and gas.

Light, heat, electricity, and magnetism

- Heat can be produced in many ways such as burning or mixing one substance with another.

Earth and Space Science

Properties of earth materials

- Earth materials are varied and have different physical and chemical properties that make them useful in different ways. Earth materials provide many of the resources needed by humans.

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 to solve them.
- Scientists and engineers often work in teams with different individuals doing different things that contribute to the results.
- 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.

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.

History and Nature of Science

Science as a human endeavor

- 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

Sound

Narrative Summary

Third-graders use tuning forks, slide whistles, strings, and other sound-producing objects to investigate the characteristics of sound. Students learn that sound is caused by vibrations, and they explore how sound travels. They learn about the relationship of pitch and volume to the frequency and amplitude of vibrations. They discover, for example, that they can alter pitch by varying the length or tension of a string.

Constructing simple stringed instruments, they discover how they can increase the volume of the sound produced by the strings. Students investigate the characteristics of another common sound-producing mechanism—the human vocal cords—and build model vocal cords. They also learn about the anatomy and functioning of the human ear. They apply what they learn in the unit by designing and building musical instruments or other sound-producing devices.

Science Content

Students investigate objects of differing length, thickness, and tension as they vibrate and produce different pitches. Students engage in technological design as they design and build their own stringed instruments, develop criteria for comparing different designs, and investigate sounds using their own instruments. Investigations of how size, tension, and material affect pitch and volume enable stu-



dents to incorporate these variables into the design of their own musical instrument. By making simple models of the human eardrum and vocal cords, students further explore the concepts of vibration and pitch.

Assessment

In a pre-unit assessment in Lesson 1, students develop three class charts in which they generate their own ideas about sounds they have heard, ways to make sounds,

and questions they have about sound. Students revisit these discussions at the end of the unit. Two embedded assessments allow teachers to assess students' abilities to apply concepts learned in the unit to a new situation. First, in Lesson 7, students are assessed as they design a wind instrument. Then, in Lessons 15 and 16, they are challenged to design any type of musical instrument or other device to show what they have learned about how sound is produced and changed, how it travels, and how it is received by the human ear. Additional assessments at the close of the unit include a student self-assessment, suggestions for reviewing student products, and guidelines for conducting individual student meetings.

Goals for Sound

In this unit, students investigate the phenomenon of sound. Their experiences introduce them to the following concepts, skills, and attitudes.

Concepts

- Sounds are produced by vibrating objects and vibrating columns of air.
- Pitch and volume are two characteristics of sound.
- Changing the way an object vibrates can change the pitch and volume of the sound produced.
- Pitch is determined by the frequency of the vibrations; volume is determined by the amplitude of the vibrations.
- Changing the length, tension, or thickness of a string affects the frequency of vibration and, therefore, the pitch of the sound produced.
- The human ear has a membrane that vibrates when sound reaches it; the ear and the brain translate these vibrations into the sensation of sound.
- Sound is produced by the human vocal cords as air moves through the tightened cords.

Skills

- Performing experiments with sound.
- Describing the results of investigations with sound.
- Comparing and discussing the volume and pitch of the sounds produced.
- Communicating results through writing and with graphs.
- Reflecting on experiences with sound through writing and discussion.
- Using the results of previous experiments with sound to predict outcomes in new situations.
- Applying previously learned concepts and skills to design new sound-producing devices.
- Reading to obtain more information about sound, hearing, and the vocal cords.

Attitudes

- Developing an interest in investigating sound.
- Recognizing the importance of hearing safety.



Sound

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.
- Scientists use different kinds of investigations, depending on the questions they are trying to answer.
- Simple instruments, such as magnifiers and rulers, 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 investigations 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, and the ability to react with other substances. Those properties can be measured using tools, such as a ruler.
- Objects are made of one or more materials, such as paper, wood, and metal. Objects can be described by the properties of the materials from which they are made.

Position and motion of objects

- An object's motion can be described.
- Sound is produced by vibrating objects. The pitch of the sound can be varied by changing the rate of vibration.

Life Science

Characteristics of organisms

- The behavior of organisms is influenced by internal and external cues. Humans and other organisms have senses that help them detect internal and external cues.

Organisms and their environments

- All organisms cause changes in the environment in which they live. Some of these changes are detrimental to the organism or other organisms, whereas others are beneficial.
- Humans change environments in ways that can be either beneficial or detrimental for themselves and other organisms.

Science and Technology

Abilities of technological design

- Identify a simple problem.
- Propose a solution.
- Implementing proposed solutions.
- Evaluate a product or design.
- Communicate a problem, design, and solution.

Understandings about science and technology

- People have always had questions about their 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.

Science in Personal and Social Perspectives

Personal health

- Safety and security are basic needs of humans.

Science and technology in local challenges

- People continue inventing new ways of doing things, solving problems, and getting work done. New ideas and inventions often affect other people.
- Science and technology have greatly improved health and communication.

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.
- 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