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Board Approved

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South Dakota Department of Education

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INTRODUCTION/OVERVIEW

PREFACE

These Science Standards are set forth to ensure graduates of South Dakota's public schools have the knowledge, skills, and competencies essential to leading productive, fulfilling, and successful lives as they continue their education, enter the workforce, and assume their civic responsibilities.

In 1997, the South Dakota State Legislature passed SB170 that amended South Dakota Codified Law 13-3-48 to address the issue of challenging state content standards. The adopted amendment reads as follows: "The Secretary of the Department of Education and Cultural Affairs [now the Department of Education] shall prepare and submit for approval of the South Dakota Board of Education academic content standards in language arts, mathematics, social studies, and science for grades one through twelve. Each school district shall adopt and implement clearly defined and measurable course guidelines so as to meet the state academic content standards."

With input from students, parents, teachers, and communities of South Dakota, the Science Standards Revision Committee was charged with revision of the current South Dakota Content Standards and Performance Descriptors. The final document evolved from recent research in best practices in teaching, the No Child Left Behind legislation, experience in classrooms with the existing South Dakota Content Standards, the evolution of published standards from other states, the National Science Education Standards, and National Assessment of Educational Progress (NAEP) Frameworks and Descriptors, numerous professional publications, and lengthy discussions by experienced kindergarten through grade sixteen South Dakota educators.

The content students need to acquire at each grade level is stated explicitly in these standards. With student mastery of this content, South Dakota schools will be competitive with the best educational systems in other states and nations. The standards are comprehensive and specific, they are rigorous, and they represent South Dakota's commitment to excellence. The standards are firm but not unyielding; they will be modified in future years to reflect new research and scholarship.

THE PURPOSE OF THE SOUTH DAKOTA SCIENCE STANDARDS DOCUMENT

The South Dakota Science Standards provide a listing of essential core content to be taught and learned. The standards are designed to guide the planning of instruction and to anchor the assessment of learning from kindergarten through twelfth grade. Performance descriptors bridge the content standards to assessments of the standards, provide information to teachers and students regarding student progress toward mastery of the standards, and specify targets for instruction and learning. The document presents a

starting point for informed dialogue among those dedicated and committed to quality education in South Dakota. By providing a common set of goals and expectations for all students in all schools, this dialogue will be strengthened and enhanced.

KEY CONSIDERATIONS FOR SCIENCE STANDARDS DEVELOPMENT

As students move from kindergarten through grade 12, levels of cognitive demand and complexity of content, skills, and processes increase. New skills emerge and basic skills are subsumed within more advanced skills as students progress through the grades. In particular, mastery of Nature of Science standards and Science, Technology, Environment, and Society standards tends to emerge in later grades. These processes and skills are taught and practiced as Physical, Life, and Earth/Space Science content and skills are acquired. Mastery of most science content standards, however, requires a level of cognitive development not attained by most students until intermediate or middle school grades. Based on information available through national standards work and developmental research, consideration has been given in these standards to the developmental appropriateness of skills required at each grade level. In consideration of developmental appropriateness, the committee has provided emphasis in each grade span as follows.

- Kindergarten through grade 2 standards emphasize building foundational skills in Physical, Life, and Earth/Space Sciences. Teachers guide students through a variety of activities to learn this content.
- Grades 3 through 5 standards continue the emphasis on the Physical, Life, and Earth/Space Science strands with emerging mastery of skills in the Science, Technology, Environment, and Society strand. The Nature of Science strand continues to be represented in the teaching and learning process through a variety of activities applied to Physical, Life, and Earth/Space Science strands.
- Grade 6 standards emphasize an integration of Physical, Life, and Earth/Space Science. Grade 7 standards emphasize Life Science. Grade 8 standards emphasize Earth/Space Science. Nature of Science and Science, Technology, Environment, and Society standards continue to emerge over these grades. (After careful consideration of current research and input from educators throughout the state, the Committee revised former middle school standards to facilitate effective instruction and student mastery.)
- Grades 9 through 12 standards emphasize continuing mastery of the Nature of Science strand and the Science, Technology, Environment, and Society strand in applications to Physical, Life, and Earth/Space Science strands. Content may be embedded in the core classes of Physical Science and Biology or through advanced courses, such as Physics and Chemistry. This content should merge across strands realistically as they do in the natural world.
- The increase in the level of science mastery is a life-long process.

Grade-level standards specify what students should know and be able to do by the end of each grade level while curriculum specifies what teachers will teach. Because standards

are not curriculum, any necessary review embedded in curriculum does not appear from grade-to-grade across grade-level standards. Teachers are charged with introducing skills in earlier grades before mastery is expected and with reviewing skills students will need to use in mastering the grade-level standards.

The Science Standards Revision Committee developed these standards based on several concepts that all teachers and students of science should keep in mind during the learning process:

- Technology is an important tool of science. Access to and application of technology to science is an opportunity that should be available to every South Dakota student.
- Reading and mathematics are basic to the acquisition and communication of scientific knowledge. Emerging mastery of science rests heavily upon students' application of reading and mathematics. All teachers of science should consider themselves teachers of applied reading and mathematics and the specialized uses of these skills in a scientific context.
- Scientists are essentially problem solvers. Every student of science should learn, acquire, and apply problem-solving skills through problem-based learning opportunities in science.
- Science is a process, not a recipe. Students of science need more than a step-by-step set of directions to learn the processes of scientific inquiry.
- Science should be made relevant to students. The application of sciences to everyday life and work should be emphasized (or made clear) to students during the teaching and learning process. The relevance of science to career opportunities should be communicated as a part of science instruction.
- Scientific knowledge is constantly changing and emerging. For this reason, teachers should strive to be current with the constantly emerging advances in science and flexible in adapting their teaching to these new advances. In this context, teachers need to take advantage of the teachable moments that evolving scientific knowledge and current events provide.
- The state of South Dakota offers a treasure-trove of opportunities for observing science in the natural world and in the evolving applications of science to industry and society. Teachers should take advantage of these opportunities to make science real and present to students. (See the Resource list in Appendix C for a few ideas.)
- Science is participatory, not passive knowledge acquisition. Laboratory opportunities for experimenting with and experiencing science should be universally available to every South Dakota student.
- Teaching and learning in a standards-based system is not a textbook-driven process. Textbooks are tools that, when used appropriately, enhance teaching and learning by providing instructional materials relevant to the specified standards.
- While standards are the core that all students should learn and master, teachers will expand upon these standards and introduce related topics to students in the course of instruction.

Teachers and researchers have learned that in order for students to demonstrate mastery of skills specified in the standards on summative (end-of-year) assessments, **teachers**

must teach and students must learn at a level of fluency that exceeds the apparent expectations of the grade-level standard. For this reason, teachers must be knowledgeable and talented in teaching the content, skills, and processes described in standards immediately below and above as well as at their own grade-level assignment.

FORMAT OF THE STANDARDS DOCUMENT

Standards

The standards are the targets all students need to meet at the proficient level by the end of each grade level. The standards are presented in two formats. The first format organizes the standards by grade level so a student, parent, classroom teacher, administrator, or local school board member can quickly review what learning is expected at each specific grade. The Bloom's Taxonomy level of cognitive challenge is listed in the standards document to make clear the level at which each standard should be assessed.

At grades 9 through 12, schools teach skills and courses in a variety of configurations to accommodate students and school personnel, especially in rural settings. For this reason, the grade-level standards are grouped into core and advanced standards. The core high school standards all students are expected to meet by graduation include topics of physical science and biology with core standards from earth science applied in these courses. The advanced high school standards apply to students who have completed the core standards and choose an advanced science curriculum. Students who plan to attend post-secondary educational institutions should complete science courses reflected in the advanced standards. However, these advanced science standards may also be incorporated into elective science courses that all students should have the opportunity to learn and master.

All standards in each grade level and the core standards for high school need to be met at the proficient level by the time students are tested for these skills on the state assessments. For early grades not assessed on the state assessments, students need to master the standards at each grade level in order to be adequately prepared to meet the next grade-level standards and subsequently, to achieve the proficient level at the grade levels tested.

The standards are also provided in a side-by-side format so the alignment of standards from grade-to-grade is immediately apparent. This section of the document contains content goals, indicators, grade-level standards, and performance descriptors. Each has a role in shaping the expected outcomes for South Dakota students.

- **Strands** are the broad conceptual content areas that define science. They are: Nature of Science, Physical Science, Life Science, Earth/Space Science, and Science, Technology, Environment, and Society.
- **Indicators** are the common threads of a strand that represent expected outcomes for all students preparing to graduate from South Dakota schools.

- **Grade-level content standards** represent expected outcomes for students completing each grade level.
- **Grade-level supporting skills** represent enabling skills students may need to be taught in order to achieve the standards. Those identified by a (•) bullet are enablers to the specific grade-level standard. Those identified by a checkmark (√) are enablers to the next higher grade-level standards that are related to current grade-level standards and thus may be introduced at an earlier time.
- **Examples** represent some possible materials, activities, or sub-skills classroom instructors could use in teaching the standards or supporting skills. Examples are not provided where the meaning of the standard should be evident to the reader. While the intention of providing examples is to clarify what is intended in terms of the complexity and level of challenge of the standard, these examples do not represent actual test items that will appear on the assessment.

Performance Descriptors

The performance descriptors are organized into proficiency levels. These proficiency levels describe the content and processes that a student at a given proficiency level would be expected to know, demonstrate, or perform. To identify increasing proficiency in science, the levels are labeled as follows:

- **Advanced:** A student performing at the advanced level exceeds expectations for that grade level. The student is able to perform the content standards for the grade at a high level of difficulty, complexity, or fluency beyond that specified by the grade-level standards.
- **Proficient:** A student performing at the proficient level meets expectations for that grade level. The student is able to perform the content standards for the grade at the level of difficulty, complexity, or fluency specified by the grade-level standards.
- **Basic:** A student performing at the basic level performs below expectations for that grade level. The student is able to perform some of the content standards for the grade below the level of difficulty, complexity, or fluency specified by the grade-level standards.

A student performing below the basic level is unable to perform the content standards for the grade. Therefore, no description is provided below the basic level.

ADDITIONAL RESOURCES

Since this document uses appropriate science terminology, a reader may occasionally encounter an unfamiliar term. In order to assist the reader with terminology used in this document, a **glossary** has been included with specific definitions to clarify intended meaning.

In addition, a **resource list** is provided in the appendix as a sampling of possible information sources. Because new resources are constantly becoming available, this list is intended to be neither an exhaustive nor a required list of resources.

A MESSAGE TO TEACHERS, PRINCIPALS, SUPERINTENDENTS, AND OTHERS WHO WILL USE THE DOCUMENT

The Science Standards Committee was made up of a group of K-16 teachers who collaborated to establish a starting point for reaching South Dakota's goal: each student performing to at least the proficient level.

A set of standards is simply a place to begin—it lays the foundation for measurable, consistent, high-level student learning; however, teachers must consider the needs of their individual students and select the methods that will work best for their classrooms. Examples and lists of supporting skills have been provided to clarify but not limit the meaning of the standards. ***The curriculum of each district must provide students with rigor and topics beyond those of the standards in order to ensure mastery.***

Clearly, there is more to teaching and learning than these standards. Adjustments will need to be made for those students who exceed the standards and for those who cannot easily meet them. The standards are a starting point in creating an environment where students can learn to live and thrive in a constantly changing, increasingly complex world.

IMPORTANT NOTE TO TEACHERS: Not every supporting skill presented in this document needs to be taught in order for students to master the associated standard. This is also true for the examples that appear in this document. Supporting skills and examples are provided only to illustrate the standard and are not designed as requirements to be taught.

CONCLUSION

South Dakota's students must continue to progress in their mastery of science. They will need a wide repertoire of science concepts, applications, and skills in order to be successful learners, workers, and citizens. The ultimate purpose of the Science Content Standards is to ensure that all students are offered opportunities, encouragement, and experiences to develop the understanding of science needed to pursue lifelong goals.

Science Standards

K-12

Goals and Indicators

NATURE OF SCIENCE STANDARDS

Goal 1: Students will explore, evaluate, and communicate personal and scientific investigations to understand the nature of science.

RATIONALE:

The nature of science goal emphasizes those "processes of science" that should integrate with scientific knowledge to develop an understanding of how science works. Science involves a systematic approach to information gathering and problem solving through processes such as inquiry, observation, data analysis, experimentation, communication, and collaboration. Students use scientific inquiry to ask questions, plan and conduct investigations, use appropriate tools and techniques to gather data, think critically and logically about relationships between evidence and explanations, construct and analyze alternative explanations, and communicate scientific arguments. Through these processes, scientific knowledge is studied, tested, and increased over time.

Indicator 1: Understand the nature and origin of scientific knowledge.

Indicator 2: Apply the skills necessary to conduct scientific investigations.

PHYSICAL SCIENCE STANDARDS

Goal 2: Students will use appropriate scientific models to describe and quantify the nature and interactions of matter and energy.

RATIONALE:

Physical science is concerned with matter and energy, and the interactions between the two. Students begin the study of the physical world by learning about the properties of objects and materials, the position and motion of objects, light, heat, electricity, and magnetism. Understanding changes of properties in matter, motions, forces, and transfer of energy provide a basis for learning about the structure of atoms, structure of matter, chemical reactions, conservation of energy, and the interactions of energy and matter. The science facts, concepts, principles, theories, and models related to physical science that are important for all students to know, understand, and use are the focus of the standards for this goal.

Indicator 1: Describe structures and properties of, and changes in, matter.

Indicator 2: Analyze forces, their forms, and their effects on motions.

Indicator 3: Analyze interactions of energy and matter.

LIFE SCIENCE STANDARDS

Goal 3: Students will describe structures and attributes of living things, processes of life, and interaction with each other and the environment.

RATIONALE:

The life science standards emphasize a complex understanding of the characteristics and diversity of organisms and the interaction of organisms with their environment. Students begin by learning about the characteristics and life cycles of organisms and the interaction between organisms and various environments. Students develop an understanding of the relationship between structure and function in living systems, reproduction and heredity, regulation and behavior, populations and ecosystems, and diversity and adaptation of organisms. This knowledge provides a foundation for learning more complex concepts related to the structures and functions of the cell, heredity, behavior and interdependence of organisms, and the organization of living systems. Life science facts, concepts, principles, theories, and models that are important for all students to know, understand, and use are the focus of these standards.

Indicator 1: Understand the fundamental structures, functions, classifications, and mechanisms found in living things.

Indicator 2: Analyze various patterns and products of natural and induced biological change.

Indicator 3: Analyze how organisms are linked to one another and the environment.

EARTH/SPACE SCIENCE STANDARDS

Goal 4: Students will analyze the composition, formative processes, and history of the universe, solar system, and Earth.

RATIONALE:

Earth/space science focuses on the processes and interactions of the universe, solar system, and Earth. Investigations of Earth focus on interacting and dynamic systems including the lithosphere, the hydrosphere, the atmosphere, and the biosphere. Each system is composed of unique characteristics which interact and interrelate to form a single, universal system. Forces acting throughout the solar system and the universe influence all bodies in space, including Earth. Studying the universe enhances our understanding of Earth and its place in the universe.

Indicator 1: Analyze the various structures and processes of the Earth system.

Indicator 2: Analyze essential principles and ideas about the composition and structure of the universe.

SCIENCE, TECHNOLOGY, ENVIRONMENT, AND SOCIETY STANDARDS

Goal 5: Students will identify and evaluate the relationships and ethical implications of science upon technology, environment, and society.

RATIONALE:

The interrelationships among science, technology, the environment, and society establish connections between the natural and designed worlds and provide students with opportunities to develop decision-making abilities. Technology is essential to science because it enhances scientific observations of phenomena and provides tools for investigations, inquiry, and analysis. Science and technology provide the solutions to many human problems; however, solutions may have unintended consequences. An important purpose of science education is to give students a means to understand and act on personal and social issues. These standards help students develop decision-making skills through a better understanding of the costs, benefits, risks, and constraints of scientific problem solving. These standards emphasize abilities associated with the process of design and fundamental understandings about the enterprise of science and its various linkages with technology.

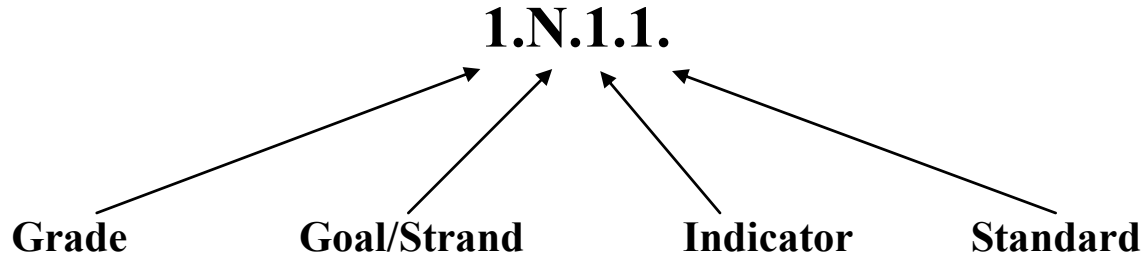
Indicator 1: ***Analyze various implications/effects of scientific advancement within the environment and society.***

Indicator 2: ***Analyze the relationships/interactions among science, technology, environment, and society.***

Guide to the Numbering and Symbol System

Used in the Document

Standards are coded to cross-reference grades, goals/strands, indicators, and standards.



Grade refers to the grade level at which the standards are to be mastered by students.

Goal or Strand refers to the major area of science (e.g., physical science, life science, earth and space science) this group of standards address. These strands are coded:

N for Nature of Science

P for Physical Science

L for Life Science

E for Earth and Space Science

S for Science, Technology, Environment, and Society

Indicator refers to the number of the indicator for this goal or strand. Each goal has one or more related indicators that describe key aspects of the goal.

Standard refers to the number of the grade-level standard for the indicator. Each indicator has one or more grade-level standard(s) that describes what students will know and be able to do related to the indicator at the specific grade level.

Examples in bold type are directly related and aligned to the level of the standard. These examples represent the level of difficulty intended in the grade-level standard and possible materials, activities, or sub-skills classroom instructors could use in teaching the standards.

Grade-level supporting skills represent enabling skills students may need to be taught in order to achieve the standards.

(•) Bullets represent enabling skills to the current grade-level standard students may need to be taught in order to achieve the standards.

(√) Checkmarks are enabling skills to the next higher grade-level standards that are related to current grade-level standards and thus may be introduced at an earlier time.

Examples that are NOT in bold type are related and aligned to the level of the bullets/supporting skills and checkmarks. These examples represent the level of difficulty intended in the grade-level standard. They represent some possible materials, activities, or sub-skills classroom instructors could use in teaching the supporting skills.

Kindergarten Nature of Science
Grade Standards, Supporting Skills, and Examples

Indicator 1: Understand the nature and origin of scientific knowledge.

Bloom's Taxonomy Level	Standard, Supporting Skills, and Examples
	(Mastery of this indicator does not emerge until eighth grade.)

Indicator 2: Apply the skills necessary to conduct scientific investigations.

Note: These skills should be taught and practiced in grade-level study of Physical, Life, and Earth/Space Science although mastery is not expected at these grade levels.

Bloom's Taxonomy Level	Standard, Supporting Skills, and Examples
	✓ Students are able to use scientific thinking skills of observing and communicating. • Use their senses and simple instruments/tools to make observations. Example: Use hand lenses, balance scales. • Use non-standard units of measurement to compare objects. Example: Compare length of various leaves to determine which are longer/shorter than a given example. ✓ Students are able to safely conduct simple experiments.

Kindergarten Nature of Science
Performance Descriptors

Note: At the K-2 level, the teachers need to focus on observing and collecting information about the progress students are making related to the checkmark statements. The skills and concepts addressed in this goal are to be included across the other goals. Appropriate scientific instruction should provide students the opportunity to actively engage in scientific investigations.

Kindergarten Physical Science
Grade Standards, Supporting Skills, and Examples

Indicator 1: Describe structures and properties of, and changes in, matter.

Bloom's Taxonomy Level	Standard, Supporting Skills, and Examples
(Comprehension)	**K.P.1.1. Students are able to use senses to describe solid objects in terms of physical attributes.** • Explain how larger objects are made of smaller pieces. Examples: Use hand lenses to observe particle board to conclude that it is made from sawdust and wood chips and to see that fabric is made from fibers. • Identify similarities /differences of various objects. Example: Given a collection of shoes, students can describe ways the shoes are alike and ways the shoes are different.
(Knowledge)	**K.P.1.2. Students are able to identify water in its solid and liquid forms.** • Observe ice in the environment. Examples: Observe ice in/on ponds, icicles, frost on playground surfaces. • Observe water in the environment. Examples: Observe rain, puddles, river, water fountain. ✓ Students are able to observe physical changes in matter. Examples: Observe melting chocolate, freezing ice cubes, bending straws, tearing paper.

Indicator 2: Analyze forces, their forms, and their effects on motions.

Note: These skills should be taught and practiced although mastery is not expected until a later grade level.

Bloom's Taxonomy Level	Standard, Supporting Skills, and Examples
	✓ Students are able identify things that move. Examples: wheels, swings, bicycles, bodies ✓ Students are able to explore magnets.

Bloom's Taxonomy Level	Standard, Supporting Skills, and Examples
	Example: Use a variety of magnets (horseshoe, donut, bar, ball/marble, wand magnets) to test attraction. Test on wood, paper, water, metals, etc.

Indicator 3: Analyze interactions of energy and matter.

Note: These skills should be taught and practiced although mastery is not expected until a later grade level.

Bloom's Taxonomy Level	Standard, Supporting Skills, and Examples
	✓ Students are able to explore vibration and sound. Examples: Use musical instruments, voice box, rubber bands, to see/feel vibrations and hear different sound tones, pitches, etc.

Kindergarten Physical Science
Performance Descriptors

Advanced	**Kindergarten students performing at the advanced level:** • categorize solid objects by physical attributes; • describe how to transform water from a solid to a liquid.
Proficient	**Kindergarten students performing at the proficient level:** • describe solid objects in terms of physical attributes; • identify water in its solid and liquid forms.
Basic	**Kindergarten students performing at the basic level:** • describe solid objects in terms of one physical attribute; • identify water in its liquid form.

Kindergarten Life Science
Grade Standards, Supporting Skills, and Examples

Indicator 1: Understand the fundamental structures, functions, classifications, and mechanisms found in living things.

Bloom's Taxonomy Level	Standard, Supporting Skills, and Examples
(Application)	**K.L.1.1. Students are able to sort living from non-living things.** **Example**: Use concrete examples to sort living and non-living things. Have examples available and observable in the classroom (non-pollen plants, fish, snails, insects, worms, rocks/sand, sea shells, etc.). **Example**: Use magazines or pictures to group things into living and non-living. ✓ Students are able to discuss the basic needs of plants and animals. Example: Demonstrate what happens to plants after a week or two of not watering. ✓ Students are able to compare size and shape of living things. Example: Gather and sort a variety of leaves from local trees and plants. Example: Order a variety of mammals from smallest to largest (mouse, coyote, buffalo).

Indicator 2: Analyze various patterns and products of natural and induced biological change.

Note: These skills should be taught and practiced although mastery is not expected until a later grade level.

Bloom's Taxonomy Level	Standard, Supporting Skills, and Examples
	✓ Recognize similarities and differences between animal offspring and their parents. Example: matching adults to babies using pictures of animals or of students and families

Indicator 3: Analyze how organisms are linked to one another and the environment.

Note: These skills should be taught and practiced although mastery is not expected until a later grade level.

Bloom's Taxonomy Level	Standard, Supporting Skills, and Examples
	✓ Students are able to explore the local habitat. Example: Conduct nature walks around school yard and neighborhood looking for specific examples of a variety of living things (plants, evidence of animals).

Kindergarten Life Science
Performance Descriptors

Advanced	**Kindergarten students performing at the advanced level:** • identify basic needs of plants and animals; • compare size and shape of living things; • identify similarities between adult animals and their offspring.
Proficient	**Kindergarten students performing at the proficient level:** • sort living from non-living things.
Basic	**Kindergarten students performing at the basic level:** • identify pictures of living things.

Kindergarten Earth/Space Science
Grade Standards, Supporting Skills, and Examples

Indicator 1: Analyze the various structures and processes of the Earth system.

Bloom's Taxonomy Level	Standard, Supporting Skills, and Examples
(Comprehension)	**K.E.1.1. Students are able to describe simple Earth patterns in daily life.** **Examples**: weather observations, seasons, night and day ✓ Explore rocks, sand, water, and soil. Examples of tools and materials to use include sand and water table, sifters, screens.

Indicator 2: Analyze essential principles and ideas about the composition and structure of the universe.

Bloom's Taxonomy Level	Standard, Supporting Skills, and Examples
	(Mastery of this indicator does not emerge until third grade.)

Kindergarten Earth/Space Science
Performance Descriptors

Advanced	**Kindergarten students performing at the advanced level:** • identify the seasons.
Proficient	**Kindergarten students performing at the proficient level:** • describe simple Earth patterns in daily life.
Basic	**Kindergarten students performing at the basic level:** • name a difference between day and night and between summer and winter.

Kindergarten Science, Technology, Environment, and Society
Grade Standards, Supporting Skills, and Examples

Indicator 1: Analyze various implications/effects of scientific advancement within the environment and society.

Note: These skills should be taught and practiced in grade-level study of Physical, Life, and Earth/Space Science although mastery is not expected at these grade levels.

Bloom's Taxonomy Level	Standard, Supporting Skills, and Examples
	✓ Students are able to recognize technology in school, home, and community. Example: Recognize computers, pencils, refrigerators, Velcro, fire trucks as technology. ✓ Care for the environment around the school. Example: Pick up litter on the playground and around the school. ✓ Recognize ways to reuse various materials. Example: Reuse materials in art projects like paper, milk cartons, egg cartons, newspapers, etc. Example: Use both sides of a sheet of paper.

Indicator 2: Analyze the relationships/interactions among science, technology, environment, and society.

Bloom's Taxonomy Level	Standard, Supporting Skills, and Examples
	(Mastery of this indicator does not emerge until fifth grade.)

Kindergarten Science Technology, Environment, and Society
Performance Descriptors

Note: At the K-2 level, the teachers need to focus on observing and collecting information about the progress students are making related to the checkmark statements. The skills and concepts addressed in this goal are to be included across the other goals. Appropriate scientific instruction should provide students the opportunity to actively engage in scientific investigations.

First Grade Nature of Science
Grade Standards, Supporting Skills, and Examples

Indicator 1: Understand the nature and origin of scientific knowledge.

Bloom's Taxonomy Level	Standard, Supporting Skills, and Examples
	(Mastery of this indicator does not emerge until eighth grade.)

Indicator 2: Apply the skills necessary to conduct scientific investigations.

Note: These skills should be taught and practiced in grade-level study of Physical, Life, and Earth/Space Science although mastery is not expected at these grade levels.

Bloom's Taxonomy Level	Standard, Supporting Skills, and Examples
	✓ Use scientific thinking skills of observing, communicating, and comparing. • Enhance observations by using senses and simple instruments/tools to identify differences in properties. Example: Use magnets, balance scales, hand lenses, rulers for simple experiments. • Record observations and data. Example: Use pictures, numbers, graphs, or written statements to record experiment data. • Measure length, mass, and volume using non-standard and standard units when appropriate. Example: Use a balance scale to determine how many cubes it takes to balance a rock sample. ✓ Use safety procedures in conducting science investigations. Example: Explain why food used in an experiment is not for eating; wash hands after handling living things. Example: When exploring light/heat sources, do not touch hot things.

First Grade Nature of Science
Performance Descriptors

Note: At the K-2 level, the teachers need to focus on observing and collecting information about the progress students are making related to the checkmark statements. The skills and concepts addressed in this goal are to be included across the other goals. Appropriate scientific instruction should provide students the opportunity to actively engage in scientific investigations.

First Grade Physical Science
Grade Standards, Supporting Skills, and Examples

Indicator 1: Describe structures and properties of, and changes in, matter.

Bloom's Taxonomy Level	Standards, Supporting Skills, and Examples
(Analysis)	**1.P.1.1. Students are able to categorize objects by physical attributes such as color, size, and shape.** **Examples**: Sort leaves, rocks, buttons, seeds, beans, animals.
(Comprehension)	**1.P.1.2. Students are able to compare objects in terms of heavier or lighter.** **Example**: Use film canisters filled with various materials such as pennies, sand, yarn, popcorn, washers. Students order the canisters from lightest to heaviest.
(Application)	**1.P.1.3. Students are able to predict how common materials interact with water.** • Floating/sinking Example: Use items to float/sink: clay, wood, cork, pencils, crayons, coins, cotton balls, etc. ✓ Soluble/nonsoluble Example: Try to dissolve or mix salt, sugar, toothpaste, oil, etc. in water.

Indicator 2: Analyze forces, their forms, and their effects on motions.

Bloom's Taxonomy Level	Standard, Supporting Skills, and Examples
(Comprehension)	**1.P.2.1. Students are able to describe relative positions of objects.** **Examples**: Use positional words (far, near, in front, behind) to describe the location of objects in the classroom or on the playground. ✓ Show how magnets can be used to make some things move without being touched. Example: Use magnetic games such as fishing pole with magnet attached to line and fish with paper clips attached. Example: Use a magnet under a maze page to move the paper clip across the page.

	✓ Demonstrate ways to make objects move faster or slower or in a different direction. Example: Use inclined planes with smooth surfaces and rough surfaces (sandpaper or felt) to observe change in motion of an object. For objects use balls, boxes, toy cars, blocks, etc.

Indicator 3: Analyze interactions of energy and matter.

Note: These skills should be taught and practiced although mastery is not expected at these grade levels.

Bloom's Taxonomy Level	Standard, Supporting Skills, and Examples
	✓ Identify heat and light sources. Example: Identify heat and light sources in student's home: oven, lamp, furnace, candle, etc. (Warning: DO NOT TOUCH) ✓ Create shadows. Example: Use a light source and solid objects to create shadows on the wall.

First Grade Physical Science
Performance Descriptors

Advanced	**First grade students performing at the advanced level:** • create and explain categories for sorting solid objects by physical attributes; • describe motion in terms of changes in position; • identify sources of heat and light; • show how magnets make things move; • predict solubility of common materials with water.
Proficient	**First grade students performing at the proficient level:** • categorize solid objects by multiple physical attributes such as color, size, and shape; • compare objects in terms of heavier or lighter; • describe relative positions of objects; • predict how common materials interact with water.
Basic	**First grade students performing at the basic level:** • categorize objects by one physical attribute; • demonstrate the relative positions of over, under, in, and out; • identify a material that will float in water and one that will sink.

First Grade Life Science
Grade Standards, Supporting Skills, and Examples

Indicator 1: Understand the fundamental structures, functions, classifications, and mechanisms found in living things.

Bloom's Taxonomy Level	Standard, Supporting Skills, and Examples
(Application)	**1.L.1.1. Students are able to discover life needs of green plants.** • Grow plants using variables such as sunlight/no sunlight, soil/no soil, sand or rock.
(Knowledge)	**1.L.1.2. Students are able to identify the parts of a plant.** **Examples**: Draw and label seeds, roots, stems, fruit.
(Knowledge)	**1.L.1.3. Students are able to list life needs of people and other animals.** **Example**: Illustrate life needs of an animal living in your area. (Be sure to include food, air, water, place to live as life needs.)

Indicator 2: Analyze various patterns and products of natural and induced biological change.

Bloom's Taxonomy Level	Standard, Supporting Skills, and Examples
(Comprehension)	**1.L.2.1. Students are able to describe physical similarities and differences between parents and offspring.** **Example**: Tell how puppies are like dogs, ducklings are like ducks, etc.

Indicator 3: Analyze how organisms are linked to one another and the environment.

Bloom's Taxonomy Level	Standard, Supporting Skills, and Examples
(Application)	**1.L.3.1. Students are able to relate characteristics of plants and animals that allow them to live in specific habitats.** **Example**: Explain what physical characteristics allow a fish to live in water, or a cactus on the prairie, etc. **Example**: Wet two paper towels. Leave one flat and roll one up. Observe how rolled paper towel retains water better. Relate observations to the structure of a cactus.

First Grade Life Science
Performance Descriptors

Advanced	**First grade students performing at the advanced level:** • compare life needs of plants and animals in various habitats; • compare observable parts of plants; • describe physical similarities and differences between parents and offspring.
Proficient	**First grade students performing at the proficient level:** • describe life needs of plants and animals in various habitats; • identify observable parts of a plant; • identify physical similarities and differences between parents and offspring.
Basic	**First grade students performing at the basic level:** • describe food and water as life needs of animals; • identify roots, leaf, and stem of plants; • identify observable similarities between parents and offspring.

First Grade Earth/Space Science
Grade Standards, Supporting Skills, and Examples

Indicator 1: Analyze the various structures and processes of the Earth system.

Bloom's Taxonomy Level	Standard, Supporting Skills, and Examples
(Comprehension)	**1.E.1.1. Students are able to recognize changes in weather over time.** • Seasonal changes Example: Graph sunny, cloudy, rainy, windy, and stormy days.
(Comprehension)	**1.E.1.2. Students are able to describe rocks in terms of properties.** **Example**: Describe the texture, size, and color of a rock.

Indicator 2: Analyze essential principles and ideas about the composition and structure of the universe.

Bloom's Taxonomy Level	Standard, Supporting Skills, and Examples
	✓ Identify what can be observed in the sky by the unaided eye in the day and at night. Example: Illustrate a day sky and a night sky including Sun, Moon, stars, clouds, etc.

First Grade Earth/Space Science
Performance Descriptors

Advanced	**First grade students performing at the advanced level:** • identify what can be observed in the sky by the unaided eye in the day and at night.
Proficient	**First grade students performing at the proficient level:** • recognize changes in weather over time; • describe rocks.
Basic	**First grade students performing at the basic level:** • describe the current day's weather; • identify rocks .

First Grade Science, Technology, Environment, and Society
Grade Standards, Supporting Skills, and Examples

Indicator 1: Analyze various implications/effects of scientific advancement within the environment and society.

Note: These skills should be taught and practiced in grade-level study of Physical, Life, and Earth/Space Science although mastery is not expected at these grade levels.

Bloom's Taxonomy Level	Standard, Supporting Skills, and Examples
	✓ Describe ways technology makes life easier for people. Example: Explain ways computers, lamps, microwave, pencil sharpener, pens make life easier. ✓ Investigate natural resources and their uses. Example: Illustrate ways we use water, trees, soil, and rocks. ✓ Investigate how to recycle and reuse products made from natural resources. Examples: Recycle paper products, cans, baby food jars, etc. in the classroom.

Indicator 2: Analyze the relationships/interactions among science, technology, environment, and society.

Note: These skills should be taught and practiced in grade-level study of Physical, Life, and Earth/Space Science although mastery is not expected at these grade levels.

Bloom's Taxonomy Level	Standard, Supporting Skills, and Examples
	✓ Identify how technology has helped people solve everyday problems. Example: Find three different technology tools in your classroom or on your clothes. Include clothing fasteners such as buttons, zippers, Velcro and/or assistive technologies for special needs students such as touch pads or switches for communication, eyeglasses, and contacts. ✓ Develop personal habits that display concern for the environment. Example: Use the trash can in the park or on the school playground.

First Grade Science, Technology, Environment, and Society
Performance Descriptors

Note: At the K-2 level, the teachers need to focus on observing and collecting information about the progress students are making related to the checkmark statements. The skills and concepts addressed in this goal are to be included across the other goals. Appropriate scientific instruction should provide students the opportunity to actively engage in scientific investigations.

Second Grade Nature of Science
Grade Standards, Supporting Skills, and Examples

Indicator 1: Understand the nature and origin of scientific knowledge.

Note: These skills should be taught and practiced in grade-level study of Physical, Life, and Earth/Space Science although mastery is not expected at these grade levels.

Bloom's Taxonomy Level	Standard, Supporting Skills, and Examples
	✓ Explore scientific contributions made by people. Example: Share a presentation with the class on Alexander Graham Bell, Ben Franklin, Rachel Carson, Thomas Edison, George Washington Carver, Wright brothers.

Indicator 2: Apply the skills necessary to conduct scientific investigations.

Note: These skills should be taught and practiced in grade-level study of Physical, Life, and Earth/Space Science although mastery is not expected at these grade levels.

Bloom's Taxonomy Level	Standard, Supporting Skills, and Examples
	✓ Use scientific thinking skills of observing, communicating, classifying, and comparing. • Measure length, volume, mass, and temperature in appropriate units. Examples: Use rulers to measure plant growth. Use balance scales to compare the mass (weight) of rocks. Example: Read thermometers on a daily basis to record outside temperature as part of a daily weather log. • Make predictions based on observations rather than random guesses. Example: Given a collection of objects, predict which will sink and which will float. • Record and interpret observations and data. Example: Use data from weather journal to create a monthly weather graph. Example: Make a timeline to illustrate the life cycle of an insect. ✓ Write descriptions and/or draw pictures to represent

	sequences of steps, events, and observations. Examples: Create scientific diagrams illustrating a life cycle; write the steps for doing an experiment with magnets. ✓ Recognize importance of safety procedures and equipment. Example: Direct projectiles away from peers when flying gliders.

Second Grade Nature of Science
Performance Descriptors

Note: At the K-2 level, the teachers need to focus on observing and collecting information about the progress students are making related to the checkmark statements. The skills and concepts addressed in this goal are to be included across the other goals. Appropriate scientific instruction should provide students the opportunity to actively engage in scientific investigations.

Second Grade Physical Science
Grade Standards, Supporting Skills, and Examples

Indicator 1: Describe structures and properties of, and changes in, matter.

Bloom's Taxonomy Level	Standard, Supporting Skills, and Examples
(Application)	**2.P.1.1. Students are able to classify solids in terms of the materials they are made of and their physical properties.** **Examples** of materials: cloth, paper, wood, metal, plastic, etc. **Examples** of physical properties: color, size, shape, opacity, mass, texture, flexibility, etc. • Define a solid.
(Comprehension)	**2.P.1.2. Students are able to describe visually observable properties of liquids and classify liquids by their physical properties.** **Examples:** translucent, transparent, opaque, color, foamy, bubbly, viscous, etc. • Define a liquid. ✓ Explore properties of gases. Example: Use a balloon to demonstrate air taking the shape of the container.
(Application)	**2.P.1.3. Students are able to identify mixtures of solid substances and ways to separate them.** **Examples**: Separate trail mix, rocks and sand, types of beans.

Indicator 2: Analyze forces, their forms, and their effects on motions.

Bloom's Taxonomy Level	Standard, Supporting Skills, and Examples
(Application)	**2.P.2.1. Students are able to demonstrate how moving objects exhibit different types of motion.** **Examples**: straight, circular, back and forth • Describe motions of common objects in terms of change in position or direction (e.g., up-down, left- right, fast-slow). • Describe how pushes or pulls can change motion of an object.

(Application)	**2.P.2.2. Students are able to predict the effects of magnets on other magnets and other objects.** • Attracting and repelling Example: Stack donut magnets on a pencil. Example: Use classroom objects to test which objects are attracted to the magnet. ✓ Explore magnetic poles. Example: Use a bar magnet to move another bar magnet.

Indicator 3: Analyze interactions of energy and matter.

Bloom's Taxonomy Level	Standard, Supporting Skills, and Examples
(Comprehension)	**2.P.3.1. Students are able to compare sounds in terms of high pitch, low pitch, loud and soft (volume).** **Example**: Use a variety of rubber band widths and sizes to compare the pitch and volume when the band is plucked. ✓ Describe ways heat can be produced. Example: Create heat by rubbing hands together. Example: Turn on heat lamp to warm incubator. ✓ Demonstrate how light can pass through some objects and not others. • Predict the casting of shadows. Example: Use 2- and 3-dimensional objects at different distances from light source to cast a variety of shadows. ✓ Explore sources of energy. Examples: Discuss moving water, food, wind, sun, rubber bands, batteries as sources of energy.

Second Grade Physical Science
Performance Descriptors

Advanced	**Second grade students performing at the advanced level:** • predict the casting of shadows; • select materials based on physical properties to solve a task; • identify ways to separate mixtures, including solids and liquids; • describe interactions of magnetic poles; • demonstrate ways to change pitch; • describe ways heat can be produced.
Proficient	**Second grade students performing at the proficient level:** • describe and classify solids and liquids in terms of physical properties; • identify and separate mixtures; • demonstrate different ways objects move and affect other objects; • compare sounds in terms of pitch and volume.
Basic	**Second grade students performing at the basic level:** • describe solids and liquids in terms of physical properties; • demonstrate ways objects move; • compare sounds in terms of volume.

Second Grade Life Science
Grade Standards, Supporting Skills, and Examples

Indicator 1: Understand the fundamental structures, functions, classifications, and mechanisms found in living things.

Bloom's Taxonomy Level	Standard, Supporting Skills, and Examples
(Application)	**2.L.1.1. Students are able to classify plants according to similarities and differences.** **Examples**: Classify plants by kinds of seeds, color, size, shape, and structure.
(Application)	**2.L.1.2. Students are able to classify people and animals according to similarities and differences.** **Examples**: Classify animals by color, size, shape, body parts, gender, and offspring.

Indicator 2: Analyze various patterns and products of natural and induced biological change.

Bloom's Taxonomy Level	Standard, Supporting Skills, and Examples
(Comprehension)	**2.L.2.1. Students are able to describe how flowering plants go through a series of orderly changes in their life cycle.** **Example**: Illustrate ways flowering plants undergo many changes from the formation of a flower to the development of the fruit.
(Comprehension)	**2.L.2.2. Students are able to compare life cycles of various living things.** **Example**: Diagram life cycles using tadpoles to frogs and kittens to cats.

Indicator 3: Analyze how organisms are linked to one another and the environment.

Bloom's Taxonomy Level	Standard, Supporting Skills, and Examples
(Comprehension)	**2.L.3.1. Students are able to describe ways that plants and animals depend on each other.** **Example**: Illustrate ways seeds are dispersed in the environment. **Example**: Describe how cattle need grass in order to survive.
(Comprehension)	**2.L.3.2. Students are able to associate adaptations in plants and animals in response to seasonal changes.** **Examples**: Find examples of animals that migrate, hibernate, use camouflage, or go dormant.
(Knowledge)	**2.L.3.3. Students are able to recognize what it means for a species to be extinct or endangered.** **Examples**: Discuss dinosaurs, black-footed ferret, mammoth.

Second Grade Life Science
Performance Descriptors

Advanced	**Second grade students performing at the advanced level:** • illustrate and label examples of plant and animal life cycles; • explain how plants and animals depend on each other and respond to seasonal changes in the environment; • identify possible reasons for the disappearance of a species.
Proficient	**Second grade students performing at the proficient level:** • given illustrations, classify plants and animals according to their similarities and differences; • sequence a plant life cycle and an animal life cycle; • describe ways plants and animals depend on each other and respond to seasonal changes in the environment; • identify a species that is extinct and one that is endangered.
Basic	**Second grade students performing at the basic level:** • given illustrations, describe similarities between plants or between animals; • describe an example of a life cycle of a plant or of an animal; • identify a species that is extinct.

Second Grade Earth/Space Science
Grade Standards, Supporting Skills, and Examples

Indicator 1: Analyze the various structures and processes of the Earth system.

Bloom's Taxonomy Level	Standard, Supporting Skills, and Examples
(Comprehension)	**2.E.1.1. Students are able to describe types and patterns of weather during different seasons.** • Measure and record weather data such as high and low temperature, wind, precipitation, clouds using tools such as a rain gauge, anemometer, wind sock, etc. ✓ Practice reading thermometers.
(Knowledge)	**2.E.1.2. Students are able to identify and locate geological features using maps and globes.** **Examples**: Locate mountains, plains, valleys, and bodies of water on a globe or map. • Recognize most of the Earth's surface is covered with water.
(Comprehension)	**2.E.1.3. Students are able to recognize and distinguish between forms of water in the Earth system.** **Examples**: snow, ice, fresh water, salt water ✓ Recognize ways fossils provide evidence about plants and animals that lived long ago. Example: Looking at fossilized teeth, determine if animal ate plants or meat.

Indicator 2: Analyze essential principles and ideas about the composition and structure of the universe.

Bloom's Taxonomy Level	Standard, Supporting Skills, and Examples
	✓ Identify the basic components of space. Examples: Label Sun, Moon, planets, stars.

Second Grade Earth/Space Science
Performance Descriptors

Advanced	**Second grade students performing at the advanced level:** • identify the basic components of space; • read a thermometer.
Proficient	**Second grade students performing at the proficient level:** • describe types and patterns of weather during different seasons; • identify and locate geological features using maps and globes; • recognize and distinguish between forms of water in the Earth system.
Basic	**Second grade students performing at the basic level:** • describe the weather associated with a season; • identify land and water on maps and globes.

Second Grade Science, Technology, Environment, and Society
Grade Standards, Supporting Skills, and Examples

Indicator 1: Analyze various implications/effects of scientific advancement within the environment and society.

Note: These skills should be taught and practiced in grade-level study of Physical, Life, and Earth/Space Science although mastery is not expected at these grade levels.

Bloom's Taxonomy Level	Standard, Supporting Skills, and Examples
	✓ Explore how technology has changed daily life. Examples: Compare and contrast: email/postal service, computers/pencils, light bulb/candles, microwave/wood-burning stove, etc. ✓ Recognize ways to recycle, reuse, renew, and reduce. Examples: Generate ideas on ways to reuse, renew, or reduce the use of water, trees, soil, and other natural resources.

Indicator 2: Analyze the relationships/interactions among science, technology, environment, and society.

Note: These skills should be taught and practiced in grade-level study of Physical, Life, and Earth/Space Science although mastery is not expected at these grade levels.

Bloom's Taxonomy Level	Standard, Supporting Skills, and Examples

	✓ Investigate and describe ways science/technology is used to solve problems. Examples: Describe ways wheels and ramps make it easier to do work; there are handicap-accessible modifications for public buildings. ✓ Explain how scientific findings have generated solutions to various environmental and social concerns. Example: Discuss water pollution, West Nile, germs, and diseases.

Second Grade Science, Technology, Environment, and Society
Performance Descriptors

Note: At the K-2 level, the teachers need to focus on observing and collecting information about the progress students are making related to the checkmark statements. The skills and concepts addressed in this goal are to be included across the other goals. Appropriate scientific instruction should provide students the opportunity to actively engage in scientific investigations.

NATURE OF SCIENCE STANDARDS
K-2

Indicator 1: Understand the nature and origin of scientific knowledge.

Note: Mastery is not expected at these grade levels.

Indicator 2: Apply the skills necessary to conduct scientific investigations.

Note: Mastery is not expected at these grade levels.

PHYSICAL SCIENCE STANDARDS
K-2

Indicator 1: Describe structures and properties of, and changes in, matter.

Kindergarten	First Grade	Second Grade
K.P.1.1. (Comprehension) Use senses to describe solid objects in terms of physical attributes.	1.P.1.1. (Analysis) Categorize objects by physical attributes such as color, size, and shape.	2.P.1.1. (Application) Classify solids in terms of the materials they are made of and their physical properties.
K.P.1.2. (Knowledge) Identify water in its solid and liquid forms.	1.P.1.2. (Comprehension) Compare objects in terms of heavier or lighter.	2.P.1.2. (Comprehension) Describe visually observable properties of liquids and classify liquids by their physical properties.
	1.P.1.3. (Application) Predict how common materials interact with water.	2.P.1.3. (Application) Identify mixtures of solid substances and ways to separate them.

Indicator 2: Analyze forces, their forms, and their effects on motions.

Kindergarten	First Grade	Second Grade
	1.P.2.1. (Comprehension) Describe relative positions of objects.	2.P.2.1. (Application) Demonstrate how moving objects exhibit different types of motion.
		2.P.2.2. (Application) Predict the effects of magnets on other magnets and other objects.

Indicator 3: Analyze interactions of energy and matter.

Kindergarten	First Grade	Second Grade
		2.P.3.1. (Comprehension) Compare sounds in terms of high pitch, low pitch, loud and soft (volume).

LIFE SCIENCE STANDARDS
K-2

Indicator 1: Understand the fundamental structures, functions, classifications, and mechanisms found in living things.

Kindergarten	First Grade	Second Grade
K.L.1.1. (Application) Sort living from non-living things.	1.L.1.1. (Application) Discover life needs of green plants.	2.L.1.1. (Application) Classify plants according to similarities and differences.
	1.L.1.2. (Knowledge) Identify the parts of a plant.	2.L.1.2. (Application) Classify people and animals according to similarities and differences.
	1.L.1.3. (Knowledge) List life needs of people and other animals.	

Indicator 2: Analyze various patterns of inheritance and biological change.

Kindergarten	First Grade	Second Grade
	1.L.2.1. (Comprehension) Describe physical similarities and differences between parents and offspring.	2.L.2.1. (Comprehension) Describe how flowering plants go through a series of orderly changes in their life cycle.
		2.L.2.2. (Comprehension) Compare life cycles of various living things.

Indicator 3: Analyze how organisms are linked to one another and the environment.

Kindergarten	First Grade	Second Grade
	1.L.3.1. (Application) Relate characteristics of plants and animals that allow them to live in specific habitats.	2.L.3.1. (Comprehension) Describe ways that plants and animals depend on each other.
		2.L.3.2. (Comprehension) Associate adaptations in plants and animals in response to seasonal changes.
		2.L.3.3. (Knowledge) Recognize what it means for a species to be extinct or endangered.

EARTH/SPACE SCIENCE STANDARDS
K-2

Indicator 1: Analyze the various structures and processes of the Earth system.

Kindergarten	First Grade	Second Grade
K.E.1.1. (Comprehension) Describe simple Earth patterns in daily life.	1.E.1.1. (Comprehension) Recognize changes in weather over time.	2.E.1.1. (Comprehension) Describe types and patterns of weather during different seasons.
	1.E.1.2. (Comprehension) Describe rocks in terms of properties.	2.E.1.2. (Knowledge) Identify and locate geological features using maps and globes.
		2.E.1.3. (Comprehension) Recognize and distinguish between forms of water in the Earth system.

Indicator 2: Analyze essential principles and ideas about the composition and structure of the universe.

Note: Mastery is not expected at these grade levels.

SCIENCE, TECHNOLOGY, ENVIRONMENT, AND SOCIETY STANDARDS K-2

Indicator 1: Analyze various implications/effects of scientific advancement within the environment and society.

Note: Mastery is not expected at these grade levels.

Indicator 2: Analyze the relationships/interactions among science, technology, environment, and society.

Note: Mastery is not expected at these grade levels.

Third Grade Nature of Science
Grade Standards, Supporting Skills, and Examples

Indicator 1: Understand the nature and origin of scientific knowledge.

Note: These skills should be taught and practiced in grade-level study of Physical, Life, and Earth/Space Science although mastery is not expected at these grade levels.

Bloom's Taxonomy Level	Standard, Supporting Skills, and Examples
	✓ Identify scientific contributions. • Automobile • Telephone • Flight • Motors ✓ Explain science as a process involving asking and answering questions.

Indicator 2: Apply the skills necessary to conduct scientific investigations.

Note: These skills should be taught and practiced in grade-level study of Physical, Life, and Earth/Space Science although mastery is not expected at these grade levels.

Bloom's Taxonomy Level	Standard, Supporting Skills, and Examples
	✓ Use investigations in science to acquire knowledge. Example: Investigate plant growth given environmental variables. • Make observations. • Make predictions. • Ask questions. • Plan investigations. • Use appropriate scientific equipment and proper safety procedures in all investigations. • Use appropriate metric measurement to collect, record, chart, and/or graph data. • Interpret data. • Communicate results.

Third Grade Nature of Science
Performance Descriptors

Note: At the third grade level, the teachers need to focus on observing and collecting information about the progress students are making related to the checkmark statements. The skills and concepts addressed in this goal are to be included across the other goals. Appropriate scientific instruction should provide students the opportunity to actively engage in scientific investigations.

Third Grade Physical Science
Grade Standards, Supporting Skills, and Examples

Indicator 1: Describe structures and properties of, and changes in, matter.

Bloom's Taxonomy Level	Standard, Supporting Skills, and Examples
(Comprehension)	**3.P.1.1. Students are able to describe physical properties of matter using the senses (touch, smell, etc.).** **Examples**: color, size, shape, hardness, opacity, flexibility, texture, smell, temperature, weight • Define the five senses. • Define solid, liquid, and gas.
(Application)	**3.P.1.2. Students are able to use tools to relate composition to physical properties.** **Example:** Use a magnifying glass to observe that matter is made of component parts. • Describe the basic characteristics of matter in relation to space and mass. • Recognize changes in matter from one state to another using water.
(Application)	**3.P.1.3. Students are able to demonstrate how a different substance can be made by combining two or more substances.** • Identify a mixture. Examples: Flour and water make paste. Flour, water, and salt make play-dough.

Indicator 2: Analyze forces, their forms, and their effects on motions.

Bloom's Taxonomy Level	Standard, Supporting Skills, and Examples
	(Mastery of this indicator does not emerge until fourth grade.)

Indicator 3: Analyze interactions of energy and matter.

Bloom's Taxonomy Level	Standard, Supporting Skills, and Examples
(Knowledge)	**3.P.3.1. Students are able to define energy and differentiate between sources of renewable and non-renewable energy.** • Describe renewable and non-renewable energy. Examples, renewable: wind and water Examples, non-renewable: coal and oil
(Application)	**3.P.3.2. Students are able to demonstrate how sound consists of vibrations and pitch.** • Relate the rate of vibration to the pitch of sound. Example: tuning fork vibrations • Low tones are caused by slow vibrations; high tones are caused by fast vibrations. Example: Varied levels of water in glass containers being struck create different pitches.
(Knowledge)	**3.P.3.3. Students are able to identify how sound is used as a means of communication.** • Give examples of kinds of communication. Examples: telephone ringing, train whistle, fire alarm, sirens, voice, and animal noises

Third Grade Physical Science
Performance Descriptors

Advanced	**Third grade students performing at the advanced level:** • compare and contrast the physical properties of granite and calcite; • predict what would happen if we overused a renewable or non-renewable energy/resource; • demonstrate how sound travels.
Proficient	**Third grade students performing at the proficient level:** • use a magnifying glass to observe and describe the physical properties of a rock; • demonstrate how individual materials combine to make a different substance; • define energy and label pictures of renewable and non-renewable energy; • demonstrate how sound consists of vibrations and how pitch changes; • explain the different ways sound is used to communicate.

Basic	**Third grade students performing at the basic level:** • recognize physical properties of object; • use flour and water to make a substance; • sort pictures of renewable and non-renewable energy; • recognize different pitches.

Third Grade Life Science
Grade Standards, Supporting Skills, and Examples

Indicator 1: Understand the fundamental structures, functions, classifications, and mechanisms found in living things.

Bloom's Taxonomy Level	Standard, Supporting Skills, and Examples
(Knowledge)	**3.L.1.1. Students are able to identify the basic structures, functions, and needs of plants in relation to their environment.** **Examples**: leaves, stems, roots, flowers • Differentiate between plants and animals.
(Knowledge)	**3.L.1.2. Students are able to identify characteristic features of animals and their related functions in relation to their environment.** **Examples:** wings/ hollow bones, webbed feet, fins • Differentiate between plants and animals.
(Comprehension)	**3.L.1.3. Students are able to describe life cycles, including growth and metamorphosis, of familiar organisms.** • Differentiate between adult males and females. Example: dull-colored female birds/colorful male

Indicator 2: Analyze various patterns and products of natural and induced biological change.

Bloom's Taxonomy Level	Standard, Supporting Skills, and Examples
(Analysis)	**3.L.2.1. Students are able to explain how animals instinctively meet basic needs in their environment.** • Give examples of basic needs. Example: Instincts such as baby birds know to open their mouths for food; newborn turtles know to go to water.

Indicator 3: Analyze how organisms are linked to one another and the environment.

Bloom's Taxonomy Level	Standard, Supporting Skills, and Examples
(Comprehension)	**3.L.3.1. Students are able to describe how species depend on one another and on the environment for survival.** • Describe cause-and-effect relationships in living systems.
(Comprehension)	**3.L.3.2. Students are able to explain how environments support a diversity of plants and animals.** • Describe types of environments. Example: deserts and what lives there
(Comprehension)	**3.L.3.3. Students are able to describe ways humans impact air, water, and habitat quality.** **Example**: water pollution from chemical waste • Define pollution.
(Application)	**3.L.3.4. Students are able to examine fossils and describe how they provide evidence of change in organisms.** • Define a fossil.

Third Grade Life Science
Performance Descriptors

Advanced	**Third grade students performing at the advanced level:** • explain how an animal or plant is specially adapted to meet its survival needs; • analyze the impact humans have on the environment.
Proficient	**Third grade students performing at the proficient level:** • name the basic structures, functions, characteristics, and basic needs of plants and animals; • describe life cycles, including growth and metamorphosis, of familiar organisms; • describe how living things are supported by the environment, yet are diverse and interdependent; • describe ways humans impact air, water, and habitat quality; • describe how fossils provide evidence of change.
Basic	**Third grade students performing at the basic level:** • explain the basic needs of plants and animals; • explain how plants and animals adapt to their environment; • name one way humans affect the environment;

	• identify a fossil.

Third Grade Earth/Space Science
Grade Standards, Supporting Skills, and Examples

Indicator 1: Analyze the various structures and processes of the Earth system.

Bloom's Taxonomy Level	Standard, Supporting Skills, and Examples
(Knowledge)	**3.E.1.1. Students are able to define the difference between a rock and a mineral.** **Example:** Minerals look the same throughout while you can see different minerals within a rock. ✓ Examine fossils and describe how they are formed.
(Comprehension)	**3.E.1.2. Describe how humans use Earth's natural resources.** **Example**: using minerals for jewelry or trees for paper • Define natural resources.

Indicator 2: Analyze essential principles and ideas about the composition and structure of the universe.

Bloom's Taxonomy Level	Standard, Supporting Skills, and Examples
(Knowledge)	**3.E.2.1. Students are able to identify the Earth as one of the planets that orbits the Sun.** • All planets orbit the Sun.
(Analysis)	**3.E.2.2. Students are able to recognize changes in the appearance of the Moon over time.** • Know that the Moon does not change shape, but at different times appears to change shape. ✓ Explain the relationship between the rotation of the Earth on its axis and the day/night cycle. • Describe the causes for Earth's seasons.

Third Grade Earth/Space Science
Performance Descriptors

Advanced	**Third grade students performing at the advanced level:** • compare and contrast rocks and minerals; • create a visual representation of the Sun and planets.
Proficient	**Third grade students performing at the proficient level:** • group rocks and minerals; • describe Earth's natural resources and their products; • identify the Sun, Earth, and Moon as a system; • describe the change in appearance of the Moon over time.
Basic	**Third grade students performing at the basic level:** • locate the Sun and the Earth; • recognize natural resources.

Third Grade Science, Technology, Environment, and Society
Grade Standards, Supporting Skills, and Examples

Indicator 1: Analyze various implications/effects of scientific advancement within the environment and society.

Bloom's Taxonomy Level	Standard, Supporting Skills, and Examples
(Analysis)	**3.S.1.1. Students are able to recognize ways to recycle, reuse, and reduce consumption of natural resources.** **Example**: using less water when brushing your teeth to reduce consumption of water • Define recycle, reuse, and reduce.

Indicator 2: Analyze the relationships/interactions among science, technology, environment, and society.

Note: These skills should be taught and practiced in grade-level study of Physical, Life, and Earth/Space Science although mastery is not expected at these grade levels.

Bloom's Taxonomy Level	Standard, Supporting Skills, and Examples
	✓ Investigate how natural events and human influences can affect the survival of species. Examples: rainfall, flooding, and drought Example: Hunting regulations have developed to control

	wildlife populations. ✓ Describe solutions to environmental problems. Example: planting grass to prevent erosion caused by runoff Example: using no-till farming to prevent erosion

Third Grade Science Technology, Environment, and Society
Performance Descriptors

Advanced	**Third grade students performing at the advanced level:** • analyze ways recycling, reusing, and reducing conserves natural resources.
Proficient	**Third grade students performing at the proficient level:** • recognize items for reuse or recycling.
Basic	**Third grade students performing at the basic level:** • recognize items for reuse or recycling.

Fourth Grade Nature of Science
Grade Standards, Supporting Skills, and Examples

Indicator 1: Understand the nature and origin of scientific knowledge.

Note: These skills should be taught and practiced in grade-level study of Physical, Life, and Earth/Space Science although mastery is not expected at these grade levels.

Bloom's Taxonomy Level	Standard, Supporting Skills, and Examples
	✓ Identify people who have revolutionized scientific thinking. • Samuel Morse • Thomas Edison • Benjamin Franklin ✓ Describe science as the process of asking and answering questions and comparing the results to what is already known. Example: KWL Chart

Indicator 2: Apply the skills necessary to conduct scientific investigations.

Note: These skills should be taught and practiced in grade-level study of Physical, Life, and Earth/Space Science although mastery is not expected at these grade levels.

Bloom's Taxonomy Level	Standard, Supporting Skills, and Examples
	✓ Use investigations in science to acquire knowledge. Example: Investigate the effect of surface area and air temperature on evaporation. • Make observations. • Make predictions. • Ask questions. • Form a simple hypothesis. • Plan investigations. • Use appropriate scientific equipment and proper safety procedures in all investigations. • Use appropriate metric measurement to collect, record, chart, and/or graph data.

	• Interpret data. • Communicate results. ✓ Recognize the effect of manipulated variables on the outcomes of events.

Fourth Grade Nature of Science
Performance Descriptors

Note: At the fourth grade level, the teachers need to focus on observing and collecting information about the progress students are making related to the checkmark statements. The skills and concepts addressed in this goal are to be included across the other goals. Appropriate scientific instruction should provide students the opportunity to actively engage in scientific investigations.

Fourth Grade Physical Science
Grade Standards, Supporting Skills, and Examples

Indicator 1: Describe structures and properties of, and changes in, matter.

Bloom's Taxonomy Level	Standards, Supporting Skills, and Examples
(Comprehension)	**4.P.1.1. Students are able to describe observable physical changes and properties in matter.** **Examples:** solubility (matter dissolving into water) and density (floating and sinking) • Define matter.
(Analysis)	**4.P.1.2. Students are able to explain how some physical properties remain the same as the mass is changed.** **Example**: A block of salt will taste the same as a grain of salt. • Define mass.
(Comprehension)	**4.P.1.3. Students are able to differentiate between the states of matter caused by changes in temperature using water.** **Example:** from ice to water to water vapor • Define states of matter.

Indicator 2: Analyze forces, their forms, and their effects on motions.

Bloom's Taxonomy Level	Standard, Supporting Skills, and Examples
(Application)	**4.P.2.1. Students are able to demonstrate how forces act over a distance.** **Example:** magnetism • Define force.

Indicator 3: Analyze interactions of energy and matter.

Bloom's Taxonomy Level	Standard, Supporting Skills, and Examples
(Knowledge)	**4.P.3.1. Students are able to identify materials as being conductors or insulators of electricity.** **Examples:** aluminum, wood, paper, plastic, glass, rubber band, iron, and steel • Define a conductor and an insulator.
(Application)	**4.P.3.2. Students are able to construct and define a simple circuit.** **Examples:** open and closed circuits • Give examples of simple circuits. ✓ Define parallel and series circuits.
(Application)	**4.P.3.3. Students are able to use magnets, electromagnets, magnetic fields, and compasses to explore magnetic energy.** • Define magnets and their properties. ✓ Explain that electrical circuits can produce magnetic force. ✓ Demonstrate polarity using magnets and dry cells.

Fourth Grade Physical Science
Performance Descriptors

Advanced	**Fourth grade students performing at the advanced level:** • create water vapor; • design an electromagnet; • design an invention which conducts electricity; • demonstrate the difference between parallel and series circuits.
Proficient	**Fourth grade students performing at the proficient level:** • describe what happens to water when it is heated or cooled; • use magnets to define and demonstrate force at varying distances; • sort materials by their conductivity; • construct and define a simple electrical circuit.
Basic	**Fourth grade students performing at the basic level:** • identify the three states of water; • explore the capabilities of magnets; • construct a simple electrical circuit.

Fourth Grade Life Science
Grade Standards, Supporting Skills, and Examples

Indicator 1: Understand the fundamental structures, functions, classifications, and mechanisms found in living things.

Bloom's Taxonomy Level	Standard, Supporting Skills, and Examples
(Knowledge)	**4.L.1.1. Students are able to identify the basic systems (digestive, skeletal, muscular, nervous, respiratory, and circulatory) and major organs.** **Examples:** circulatory-heart, blood vessels, blood ✓ Primary function in the human body.
(Comprehension)	**4.L.1.2. Students are able to differentiate between vertebrates and invertebrates, and classify the five groups of vertebrates (mammal, reptile, amphibian, bird, and fish) based on characteristics.** **Examples**: reproduction (live birth or eggs), body covering, respiration • Define vertebrate and invertebrates.

Indicator 2: Analyze various patterns and products of natural and induced biological change.

Bloom's Taxonomy Level	Standard, Supporting Skills, and Examples
(Knowledge)	**4.L.2.1. Students are able to identify behavioral and structural adaptations that allow a plant or animal to survive in a particular environment.** **Examples:** hibernation and migration • Explain environments and adaptations.
(Analysis)	**4.L.2.2. Students are able to explain how a size of a population is dependent upon the available resources within its community.** • Know community resources. • Define population.

Indicator 3: Analyze how organisms are linked to one another and the environment.

Bloom's Taxonomy Level	Standard, Supporting Skills, and Examples
(Comprehension)	**4.L.3.1. Students are able to describe the flow of energy through food chains and webs.** • Understand food chains.

Fourth Grade Life Science
Performance Descriptors

Advanced	**Fourth grade students performing at the advanced level:** • create a visual representation of the body including the skeletal, muscular, digestive, nervous, respiratory, and circulatory systems; • differentiate between groups of vertebrates based on their characteristics; • construct a food web/chain.
Proficient	**Fourth grade students performing at the proficient level:** • name the basic body systems (digestive, skeletal, muscular, nervous, respiratory, and circulatory,) and explain their primary functions; • differentiate between vertebrates and invertebrates, and name five groups of vertebrates (mammal, amphibian, bird, fish, and reptile); • describe adaptations that allow plants and animals to survive; • describe the flow of energy through food chains and webs.
Basic	**Fourth grade students performing at the basic level:** • identify the skeletal system and describe one basic function; • name an animal without a backbone; • recognize plants and animals can change to survive; • identify the parts of a basic food chain.

Fourth Grade Earth/Space Science
Grade Standards, Supporting Skills, and Examples

Indicator 1: Analyze the various structures and processes of the Earth system.

Bloom's Taxonomy Level	Standard, Supporting Skills, and Examples
(Comprehension)	**4.E.1.1. Students are able to describe the basic stages of the water cycle.** **Example:** model of water cycle • Define evaporation, condensation, and precipitation.
(Comprehension)	**4.E.1.2. Students are able to describe how weather conditions and phenomena occur and can be predicted.** • Identify the positive and negative impacts of weather on the environment. Example: flooding vs adequate rainfall ✓ Explain the use of weather instruments. Examples: rain gauge, weather vane, thermometer, and barometer ✓ Identify the Earth's atmosphere, biosphere, lithosphere, and hydrosphere.

Indicator 2: Analyze essential principles and ideas about the composition and structure of the universe.

Bloom's Taxonomy Level	Standard, Supporting Skills, and Examples
(Comprehension)	**4.E.2.1. Students are able to describe the motions of Earth, Sun, and Moon.** • Revolution and rotation ✓ Use terminology to describe the phases of the Moon. Examples: waning moon or waxing moon ✓ Describe relative size and position of moons, planets, and stars. ✓ Identify the characteristics of the planets. Examples: appearance, size, distance from the Sun

Fourth Grade Earth/Space Science
Performance Descriptors

Advanced	**Fourth grade students performing at the advanced level:** • demonstrate the water cycle; • interpret a weather map; • describe the relationship between the tilt of the Earth and seasons.
Proficient	**Fourth grade students performing at the proficient level:** • explain the basic water cycle; • identify negative and positive effects of weather conditions; • describe the relationship between rotation and revolution of the Earth.
Basic	**Fourth grade students performing at the basic level:** • recognize the basic water cycle; • describe the weather today; • demonstrate rotation using a globe.

Fourth Grade Science, Technology, Environment, and Society
Grade Standards, Supporting Skills, and Examples

Indicator 1: Analyze various implications/effects of scientific advancement within the environment and society.

Bloom's Taxonomy Level	Standard, Supporting Skills, and Examples
(Comprehension)	**4.S.1.1. Students are able to describe how people continue to invent new ways of doing things, solving problems, and getting work done.** • Ways progress makes our lives easier • People and inventions can have tremendous impact on our daily lives. Examples: CDs vs tapes; cell phones vs telephones; ziplock baggies vs wax paper
(Comprehension)	**4.S.1.2. Students are able to explain how new ideas and inventions often affect people.** • Explain the benefits of new ideas and inventions. Examples: television, electric lights

Indicator 2: Analyze the relationships/interactions among science, technology, environment, and society.

Note: These skills should be taught and practiced in grade-level study of Physical, Life, and Earth/Space Science although mastery is not expected at these grade levels.

Bloom's Taxonomy Level	Standard, Supporting Skills, and Examples
	✓ Identify South Dakota environmental concerns and describe possible solutions. Example: Pollution along our highways and roads led to our adopt-a-highway program. • Describe the relationship between the use of natural resources and the environment. Example: Open- pit mining in the Black Hills led to reclamation.

Fourth Grade Science, Technology, Environment, and Society
Performance Descriptors

Advanced	**Fourth grade students performing at the advanced level:** • analyze the positive and negative ways electricity has changed our lives.
Proficient	**Fourth grade students performing at the proficient level:** • describe ways electricity has changed our lives.
Basic	**Fourth grade students performing at the basic level:** • sequence a group of pictures depicting the progression of communication from the telegraph to cell phones.

Fifth Grade Nature of Science
Grade Standards, Supporting Skills, and Examples

Indicator 1: Understand the nature and origin of scientific knowledge.
Note: These skills should be taught and practiced in grade-level study of Physical, Life, and Earth/Space Science although mastery is not expected at these grade levels.

Bloom's Taxonomy Level	Standard, Supporting Skills, and Examples
	✓ Investigate scientific contributions of people who have revolutionized scientific thinking. ✓ Describe science as a body of knowledge and an investigative process. ✓ Describe how scientific knowledge increases and changes over time.

Indicator 2: Apply the skills necessary to conduct scientific investigations.
Note: These skills should be taught and practiced in grade-level study of Physical, Life, and Earth/Space Science although mastery is not expected at these grade levels.

Bloom's Taxonomy Level	Standard, Supporting Skills, and Examples
	✓ Use investigations in science to accumulate knowledge. Example: Record daily weather conditions to form a weather pattern. • Make observations. • Make predictions. • Differentiate between a hypothesis and a prediction. • Ask questions. • Formulate hypotheses based on cause and effect relationships. • Plan investigations. • Use appropriate scientific equipment and proper safety procedures in all investigations. • Use appropriate metric measurement to collect, record, chart, and/or graph data. • Interpret data and recognize numerical data that are contradictory or unusual in experimental results. • Communicate results. • Define variables that must be held constant in a specific experimental situation.

Fifth Grade Nature of Science
Performance Descriptors

Note: At the fifth grade level, the teachers need to focus on observing and collecting information about the progress students are making related to the checkmark statements. The skills and concepts addressed in this goal are to be included across the other goals. Appropriate scientific instruction should provide students the opportunity to actively engage in scientific investigations.

Fifth Grade Physical Science
Grade Standards, Supporting Skills, and Examples

Indicator 1: Describe structures and properties of, and changes in, matter.

Bloom's Taxonomy Level	Standard, Supporting Skills, and Examples
(Knowledge)	**5.P.1.1. Students are able to define matter on the basis of observable physical properties.** **Examples:** mass, volume, density, magnetism, physical state, and the ability to conduct heat, electricity, and sound • Explain the relationships among elements, molecules, and matter. Examples: carbon dioxide, water ✓ Explain differences and similarities between a solution and other mixtures and changes that occur within. Examples: solution (sugar dissolving in water) and mixture (trail mix)

Indicator 2: Analyze forces, their forms, and their effects on motions.

Bloom's Taxonomy Level	Standard, Supporting Skills, and Examples
(Knowledge)	**5.P.2.1. Students are able to identify forces in specific situations that require objects to interact, change directions, or stop.** • Give examples of ways gravitational forces affect every object.
(Analysis)	**5.P.2.2. Students are able to analyze the structure and design of simple and compound machines to determine how the machines make work easier by trading force for distance.** • Distinguish between simple and compound machines. Examples: lever, pulley, wheel, axle, inclined plane, wedge, screw Example: how scissors cut paper

Indicator 3: Analyze interactions of energy and matter.

Bloom's Taxonomy Level	Standard, Supporting Skills, and Examples
(Application)	**5.P.3.1. Students are able to demonstrate and explain how to measure heat flow into an object.** **Example**: Measure temperatures of various materials placed in sunlight. • Interpret a thermometer.
(Correspondence)	**5.P.3.2. Students are able to describe the Sun's ability to produce energy in the forms of light and heat.** • Understand that the Sun produces energy. Example: energy from the Sun stored in coal and plants ✓ Describe significant characteristics of different forms of energy. ✓ Explain energy transfers and transformation of light.
(Correspondence)	**5.P.3.3. Students are able to describe basic properties of light.** **Examples:** reflection, scattering, color spectrum, shadows

Fifth Grade Physical Science
Performance Descriptors

Advanced	**Fifth grade students performing at the advanced level:** • demonstrate how compound machines make work easier by trading force for distance.
Proficient	**Fifth grade students performing at the proficient level:** • identify matter according to its observable physical properties; • demonstrate how simple machines make work easier by trading force for distance; • measure the temperature of two different objects to compare heat flow; • describe basic properties of light (reflection, scattering, color spectrum, shadows).
Basic	**Fifth grade students performing at the basic level:** • define matter; • identify a simple machine; • measure temperature; • identify the spectrum of light.

Fifth Grade Life Science
Grade Standards, Supporting Skills, and Examples

Indicator 1: Understand the fundamental structures, functions, classifications, and mechanisms found in living things.

Bloom's Taxonomy Level	Standard, Supporting Skills, and Examples
(Comprehension)	**5.L.1.1. Students are able to describe the basic process of photosynthesis and the role of light as a source of energy in plants.** • Use words to describe photosynthesis. Example: Carbon dioxide + water → sunlight; chlorophyll = sugar and oxygen.

Indicator 2: Analyze various patterns and products of natural and induced biological change.

Bloom's Taxonomy Level	Standard, Supporting Skills, and Examples
(Evaluation)	**5.L.2.1. Students are able to predict physical characteristics with family lineage.** • Describe family trees. • Explain how physical traits pass from generation to generation. Examples: height, hair color, eye color
(Comprehension)	**5.L.2.2. Students are able to describe structures and processes involved in plant reproduction.** **Example**: fertilization • Know parts of the plant.

Indicator 3: Analyze how organisms are linked to one another and the environment.

Bloom's Taxonomy Level	Standard, Supporting Skills, and Examples
(Comprehension)	**5.L.3.1. Students are able to describe how natural events and/or human influences may help or harm ecosystems.** **Example**: biotic (over-population) and abiotic (floods) • Define ecosystem.
(Application)	**5.L.3.2. Students are able to analyze the roles of organisms to determine the transfer of energy using an energy pyramid model.** **Examples**: producer, consumer, decomposer, herbivore, carnivore, omnivore, predator – prey • Define an energy pyramid. • Define an organism.
(Correspondence)	**5.L.3.3. Students are able to describe how interrelationships enable some organisms to survive.** • Define interrelationships. ✓ Adaptation, parasitism, mutation

Fifth Grade Life Science
Performance Descriptors

Advanced	**Fifth grade students performing at the advanced level:** • illustrate the roles of reactants (carbon dioxide and water), products (sugar and oxygen), and sunlight in photosynthesis; • describe characteristics of worms, mollusks, arthropods, and echinoderms; • predict outcomes of combinations of physical trait; • develop a plan to protect an ecosystem; • illustrate the transfer of energy in a food pyramid.
Proficient	**Fifth grade students performing at the proficient level:** • describe structures and life processes of plants; • predict physical characteristics of offspring; • describe how natural events, interrelationships of organisms, and/or human influences may help or harm ecosystems; • describe the roles of producers, consumers, and decomposers to determine the transfer of energy.
Basic	**Fifth grade students performing at the basic level:** • explain how plants get food; • describe how offspring resemble their parents; • explain the relationship between plants and animals.

Fifth Grade Earth/Space Science
Grade Standards, Supporting Skills, and Examples

Indicator 1: Analyze the various structures and processes of the Earth system.

Bloom's Taxonomy Level	Standard, Supporting Skills, and Examples
(Comprehension)	**5.E.1.1. Students are able to describe the basic structure of Earth's interior.** • Define crust, mantle, and core. ✓ Explain the formation of geological features of the Earth through plate tectonics. Examples: volcanoes, faults, ocean trenches ✓ Describe how Earth's surface is constantly changing. Examples: earthquakes, volcanoes, weathering, erosion, and deposition ✓ Examine topographical maps.

Indicator 2: Analyze essential principles and ideas about the composition and structure of the universe.

Bloom's Taxonomy Level	Standard, Supporting Skills, and Examples
(Comprehension)	**5.E.2.1. Students are able to describe the components (Sun, planets, and moons) of the solar system.** • Relative size • Order and relative distance from the Sun and each other ✓ Describe the relative scale of the Earth to the Sun, planets, and the Moon.
(Comprehension)	**5.E.2.2. Students are able to explain how the Earth's rotation affects the appearance of the sky.** • Constellations appear to move as a result of Earth's rotation. Example: The Big Dipper appears in different locations throughout the night. • Apparent brightness of a star depends in part upon its distance from the Earth. Example: A flashlight beam appears brighter as it moves closer.

Fifth Grade Earth/Space Science
Performance Descriptors

Advanced	**Fifth grade students performing at the advanced level:** • list the characteristics of the Earth's interior; • compare and contrast the components of the solar system.
Proficient	**Fifth grade students performing at the proficient level:** • describe the layers of the Earth's interior; • describe the components (Sun, planets, and moons) of the solar system; • explain how the Earth's rotation affects the appearance of the sky.
Basic	**Fifth grade students performing at the basic level:** • recognize the layers of the Earth; • identify the nine planets in our solar system.

Fifth Grade Science, Technology, Environment, and Society
Grade Standards, Supporting Skills, and Examples

Indicator 1: Analyze various implications/effects of scientific advancement within the environment and society.

Bloom's Taxonomy Level	Standard, Supporting Skills, and Examples
(Knowledge)	**5.S.1.1. Students are able to identify scientific changes that have affected transportation, health, sanitation, and communication.**
(Comprehension)	**5.S.1.2. Students are able to describe how designing a solution may have constraints.** **Examples**: costs, time, space, materials, and safety • Explain why the benefits of science and technology are not available to all people. • Describe the consumption of resources over time. Examples: oil, gold, and coal

Indicator 2: Analyze the relationships/interactions among science, technology, environment, and society.

Bloom's Taxonomy Level	Standard, Supporting Skills, and Examples
(Evaluation)	**5.S.2.1. Students are able to explain the interrelationship of**

	populations, resources, and environments. **Example**: human populations encroaching upon wildlife habitat **Example:** Technology such as fish finders affects fish population. • Define interrelationships. ✓ Describe conservation practices. Examples: crop rotation, shelter belts, fishing limits, hybrid automobiles

Fifth Grade Science, Technology, Environment, and Society
Performance Descriptors

Advanced	**Fifth grade students performing at the advanced level:** • evaluate positive and negative effects of modern transportation, health, sanitation, and communication; • given a specific issue or problem, identify and explain constraints that would prohibit the implementation of the solution; • develop a solution to a human/animal cohabitation problem.
Proficient	**Fifth grade students performing at the proficient level:** • list ways that modern transportation, health, communication, and sanitation has changed our lives; • explain how factors such as cost, time, and resources affect problem solving; • explain the effects of humans encroaching on wildlife habitats.
Basic	**Fifth grade students performing at the basic level:** • identify ways modern transportation has changed our lives; • name a constraint in solving a problem; • name one effect of humans encroaching on wildlife habitat.

NATURE OF SCIENCE STANDARDS
3-5

Indicator 1: Understand the nature and origin of scientific knowledge.

Note: Mastery is not expected at these grade levels.

Indicator 2: Apply the skills necessary to conduct scientific investigations.

Note: Mastery is not expected at these grade levels.

PHYSICAL SCIENCE STANDARDS
3-5

Indicator 1: Describe structures and properties of, and changes in, matter.

Third Grade	Fourth Grade	Fifth Grade
3.P.1.1. (Comprehension) Describe physical properties of matter using the senses (touch, smell, etc.).	4.P.1.1. (Comprehension) Describe observable physical changes and properties in matter.	5.P.1.1. (Knowledge) Define matter on the basis of observable physical properties.
3.P.1.2. (Application) Use tools to relate composition to physical properties.	4.P.1.2. (Analysis) Explain how some physical properties remain the same as the mass is changed.	
3.P.1.3. (Application) Demonstrate how a different substance can be made by combining two or more substances.	4.P.1.3. (Comprehension) Differentiate between the states of matter caused by changes in temperature using water.	

Indicator 2: Analyze forces, their forms, and their effects on motions.

Third Grade	Fourth Grade	Fifth Grade
	4.P.2.1. (Application) Demonstrate how forces act over a distance.	5.P.2.1. (Knowledge) Identify forces in specific situations that require objects to interact, change directions, or stop.
		5.P.2.2. (Analysis) Analyze the structure and design of simple and compound machines to determine how the machines make work easier by trading force for distance.

Indicator 3: Analyze interactions of energy and matter.

Third Grade	Fourth Grade	Fifth Grade
3.P.3.1. (Knowledge) Define energy and differentiate between sources of renewable and non-renewable energy.	4.P.3.1. (Knowledge) Identify materials as being conductors or insulators of electricity.	5.P.3.1. (Application) Demonstrate and explain how to measure heat flow into an object.
3.P.3.2. (Application) Demonstrate how sound consists of vibrations and pitch.	4.P.3.2. (Application) Construct and define a simple circuit.	5.P.3.2. (Comprehension) Describe the Sun's ability to produce energy in the forms of light and heat.
3.P.3.3. (Knowledge) Identify how sound is used as a means of communication.	4.P.3.3. (Application) Use magnets, electromagnets, magnetic fields, and compasses to explore magnetic energy.	5.P.3.3. (Comprehension) Describe basic properties of light.

LIFE SCIENCE STANDARDS
3-5

Indicator 1: Understand the fundamental structures, functions, classifications, and mechanisms found in living things.

Third Grade	Fourth Grade	Fifth Grade
3.L.1.1. (Knowledge) Identify the basic structures, functions, and needs of plants in relation to their environment.	4.L.1.1. (Knowledge) Identify the basic systems (digestive, skeletal, muscular, nervous, respiratory, and circulatory) and major organs.	5.L.1.1. (Comprehension) Describe the basic process of photosynthesis and the role of light as a source of energy in plants.
3.L.1.2. (Knowledge) Identify characteristic features of animals and their related functions in relation to their environment.	4.L.1.2. (Comprehension) Differentiate between vertebrates and invertebrates, and classify the five groups of vertebrates (mammal, reptile, amphibian, bird, and fish) based on characteristics.	
3.L.1.3. (Comprehension) Describe life cycles, including growth and metamorphosis, of familiar organisms.		

Indicator 2: Analyze various patterns of inheritance and biological change.

Third Grade	Fourth Grade	Fifth Grade
3.L.2.1. (Analysis) Explain how animals instinctively meet basic needs in their environment.	4.L.2.1. (Knowledge) Identify behavioral and structural adaptations that allow a plant or animal to survive in a particular environment.	5.L.2.1. (Evaluation) Predict physical characteristics with family lineage.
	4.L.2.2. (Analysis) Explain how a size of a population is dependent upon the available resources within its community.	5.L.2.2. (Comprehension) Describe structures and processes involved in plant reproduction.

Indicator 3: Analyze how organisms are linked to one another and the environment.

Third Grade	Fourth Grade	Fifth Grade
3.L.3.1. (Comprehension) Describe how species depend on one another and on the environment for survival.	4.L.3.1. (Comprehension) Describe the flow of energy through food chains and webs.	5.L.3.1. (Comprehension) Describe how natural events and/or human influences may help or harm ecosystems.
3.L.3.2. (Comprehension) Explain how environments support a diversity of plants and animals.		5.L.3.2. (Application) Using an energy pyramid model, analyze the roles of organisms to determine the transfer of energy.
3.L.3.3. (Comprehension) Describe ways humans impact air, water, and habitat quality.		5.L.3.3. (Comprehension) Describe how interrelationships enable some organisms to survive.
3.L.3.4. (Application) Examine fossils and describe how they provide evidence of change in organisms.		

EARTH/SPACE SCIENCE STANDARDS
3-5

Indicator 1: Analyze the various structures and processes of the Earth system.

Third Grade	Fourth Grade	Fifth Grade
3.E.1.1. (Knowledge) Define the difference between a rock and a mineral.	4.E.1.1. (Comprehension) Describe the basic stages of the water cycle.	4.E.1.1. (Comprehension) Describe the basic structure of Earth's interior.
3.E.1.2. (Comprehension) Describe how humans use Earth's natural resources.	4.E.1.2. (Comprehension) Describe how weather conditions and phenomena occur and can be predicted.	

Indicator 2: Analyze essential principles and ideas about the composition and structure of the universe.

Third Grade	Fourth Grade	Fifth Grade
3.E.2.1. (Knowledge) Identify the Earth as one of the planets that orbit the Sun.	4.E.2.1. (Comprehension) Describe the motions of Earth, Sun, and Moon.	5.E.2.1. (Comprehension) Describe the components (Sun, planets and moons) of the solar system.
3.E.2.2. (Analysis) Recognize changes in the appearance of the Moon over time.		5.E.2.2. (Comprehension) Explain how the Earth's rotation affects the appearance of the sky.

SCIENCE, TECHNOLOGY, ENVIRONMENT, AND SOCIETY STANDARDS 3-5

Indicator 1: Analyze various implications/effects of scientific advancement within the environment and society.

Third Grade	Fourth Grade	Fifth Grade
3.S.1.1. (Analysis) Recognize ways to recycle, reuse, and reduce consumption of natural resources.	4.S.1.1. (Comprehension) Describe how people continue to invent new ways of doing things, solving problems, and getting work done.	5.S.1.1. (Knowledge) Identify scientific changes that have affected transportation, health, sanitation, and communication.
	4.S.1.2. (Comprehension) Explain how new ideas and inventions often affect people.	5.S.1.2. (Comprehension) Describe how designing a solution may have constraints.

Indicator 2: Analyze the relationships/interactions among science, technology, environment, and society.

Third Grade	Fourth Grade	Fifth Grade
		5.S.2.1. (Evaluation) Explain the interrelationship of populations, resources, and environments.

Sixth Grade Nature of Science
Grade Standards, Supporting Skills, and Examples

Indicator 1: Understand the nature and origin of scientific knowledge.

Note: These skills should be taught and practiced in grade-level study of Physical, Life, and Earth/Space Science although mastery is not expected at these grade levels.

Bloom's Taxonomy Level	Standard, Supporting Skills, and Examples
	✓ Recognize scientific knowledge as not merely a set of static facts, but is dynamic and affords the best current explanations. Examples: flat Earth, spontaneous generation ✓ Identify important contributions to the advancement of science from people of differing cultures, genders, and ethnicity. Examples: George W. Carver-peanuts, Gregor Mendel-genetics, Sylvia Earle-oceanography, Darwin-evolution

Indicator 2: Apply the skills necessary to conduct scientific investigations.

Bloom's Taxonomy Level	Standard, Supporting Skills, and Examples
(Application)	**6.N.2.1. Students are able to pose questions that can be explored through scientific investigations.** **Example**: How does light affect plant growth? ✓ Conduct systematic scientific investigations. • Use appropriate supportive technologies. • Describe the limits of accuracy inherent in a particular measuring device or measurement procedure. • Manipulate one variable over time with many repeated trials to test a hypothesis. • Construct and interpret graphs from data to make predictions. • Use research methods to investigate practical and/or personal scientific problems and questions. ✓ Describe and demonstrate various safety factors associated

	with different types of scientific activity. • Use appropriate scientific equipment safely in all investigations. • Wear appropriate attire.

Sixth Grade Nature of Science
Performance Descriptors

Advanced	**Sixth grade students performing at the advanced level:** • pose a question and a hypothesis that can be explored through scientific exploration.
Proficient	**Sixth grade students performing at the proficient level:** • pose questions that can be explored through scientific investigations.
Basic	**Sixth Grade students performing at the basic level:** • given a prompt, pose one question that can be scientifically explored.

Sixth Grade Physical Science
Grade Standards, Supporting Skills, and Examples

Indicator 1: Describe structures and properties of, and changes in, matter.

Bloom's Taxonomy Level	Standard, Supporting Skills, and Examples
(Knowledge)	**6.P.1.1. Students are able to identify the subatomic particles that make up atoms.** • Electrons, protons, and neutrons
(Application)	**6.P.1.2. Students are able to classify matter based on physical and chemical properties.** **Examples**: mass, weight, volume, acidity, density, texture, color, melting point, boiling point ✓ Compare and contrast compounds and elements. Examples: sugar, salt, water (as compounds); Au, Fe, Na (as element symbols) ✓ Use the Periodic Table as a tool to describe elements. Examples: symbols, metals/non-metals, groups/rows, families
(Comprehension)	**6.N.1.3. Students are able to describe phase changes in matter differentiating between the particle motion in solids, liquids, and gases.**

Indicator 2: Analyze forces, their forms, and their effects on motions.

Bloom's Taxonomy Level	Standard, Supporting Skills, and Examples
(Comprehension)	**6.P.2.1. Students are able to describe how push/pull forces acting on an object produce motion.** **Examples**: illustration of see-saw, sailboat on water, kite ✓ Demonstrate how all forces have magnitude and direction. ✓ Newton's Laws of Motion

Indicator 3: Analyze interactions of energy and matter.

Bloom's Taxonomy Level	Standard, Supporting Skills, and Examples
(Comprehension)	**6.P.3.1. Students are able to identify types of energy transformations.** **Examples**: mechanical to electrical, chemical to light, kinetic to potential (and vice versa) ✓ Explain basic principles of electricity and magnetism including static, current, circuits, and magnetic fields. ✓ Investigate the properties of light (electromagnetic spectrum). ✓ Illustrate sunlight to chemical (photosynthesis).

Sixth Grade Physical Science
Performance Descriptors

Advanced	**Sixth grade students performing at the advanced level:** • draw models of simple atoms indicating appropriate positions of protons, electrons, and neutrons; • identify physical and chemical changes; • explain the role of temperature in phase changes of matter; • predict motion(s) of an object acted on by multiple push/pull forces; • given a scenario, identify energy transformation(s).
Proficient	**Sixth grade students performing at the proficient level:** • identify the subatomic particles that make up atoms; • classify matter based on physical and chemical properties; • describe phase changes in matter differentiating between the particle motion in solids, liquids, and gases; • describe how push/pull forces acting on an object produce motion; • identify types of energy transformations.
Basic	**Sixth grade students performing at the basic level:** • label the protons, neutrons, and electrons of an atom; • classify matter based on physical property; • given an illustration of particle motion, can identify solids, liquids, and gases; • given an illustration, identify push/pull forces; • give an example of one energy transformation.

Sixth Grade Life Science
Grade Standards, Supporting Skills, and Examples

Indicator 1: Understand the fundamental structures, functions, classifications, and mechanisms found in living things.

Bloom's Taxonomy Level	Standard, Supporting Skills, and Examples
(Comprehension)	**6.L.1.1. Students are able to illustrate the difference between plant and animal cells.** • Plant cells have chloroplasts and cell walls. ✓ Identify basic cell organelles and their functions. ✓ Recognize cells as the building blocks of living things. • Observe cells with a compound microscope.
(Comprehension)	**6.L.1.2. Students are able to explain the importance and scientific use of a classification system.** • Management of diversity for organization and categorization • Uniform scientific communication Example: identification and classification of newly-discovered organisms ✓ Kingdom, phylum, class, order, family, genus, species ✓ Kingdom classification system (monera, protista, plantae, fungi, animalia)

Indicator 2: Analyze various patterns and products of natural and induced biological change.

Bloom's Taxonomy Level	Standard, Supporting Skills, and Examples
	✓ Investigate the lineage of organisms to predict traits and features. Examples: family genealogy, Mendel's pea plants, Punnett Squares ✓ Describe the difference between a hybrid and a purebred trait.

Indicator 3: Analyze how organisms are linked to one another and the environment.

Bloom's Taxonomy Level	Standard, Supporting Skills, and Examples
	✓ Model cycles in ecosystems. Examples: water, carbon dioxide/oxygen ✓ Describe the relationship between characteristics of biomes and the organisms that live there. ✓ Describe how organisms adapt to biotic and abiotic factors in a biome.

Sixth Grade Life Science
Performance Descriptors

Advanced	**Sixth grade students performing at the advanced level:** • explain the reasons for the differences between plant and animal cells; • design a classification system.
Proficient	**Sixth grade students performing at the proficient level:** • illustrate the difference between plant and animal cells; • explain the importance and scientific use of a classification system.
Basic	**Sixth grade students performing at the basic level:** • name two similarities and differences between plant and animal cells; • list the five kingdoms.

Sixth Grade Earth/Space Science
Grade Standards, Supporting Skills, and Examples

Indicator 1: Analyze the various structures and processes of the Earth system.

Bloom's Taxonomy Level	Standard, Supporting Skills, and Examples
(Comprehension)	**6.E.1.1. Students are able to describe how the spheres (lithosphere, hydrosphere, atmosphere, and biosphere) of the Earth interact.** • Impact of humans and natural events ✓ Composition of spheres
(Application)	**6.E.1.2. Students are able to examine the role of water on the Earth.** • Surface Examples: waves, glaciers, rivers • Underground Example: aquifers • Atmosphere Examples: precipitation, humidity
(Comprehension)	**6.E.1.3. Students are able to explain processes involved in the formation of the Earth's structure.** **Examples**: plate tectonics, volcanoes, earthquakes ✓ Interpret topographic and digital imagery or remotely sensed data to identify surface features. Examples: local, global, regional ✓ Explain the formation of different rock types and their characteristics. ✓ Use geospatial technologies to investigate natural phenomena. Examples: GPS, GIS, remote sensing

Indicator 2: Analyze essential principles and ideas about the composition and structure of the universe.

Bloom's Taxonomy Level	Standard, Supporting Skills, and Examples
(Knowledge)	**6.E.2.1. Students are able to identify the organization and relative scale of the solar system.** • Sun, Moon, Earth, other planets and their moons, meteors, asteroids, and comets ✓ Origins and age of the universe ✓ Explain the association of time measurement with celestial motions. Examples: time zones, leap years, international dateline

Sixth Grade Earth/Space Science
Performance Descriptors

Advanced	**Sixth grade students performing at the advanced level:** • analyze the role of water as it interacts with the Earth's spheres; • explain the role of plate tectonics in shaping the earth; • compare and contrast terrestrial and gaseous planets.
Proficient	**Sixth grade students performing at the proficient level:** • describe how the spheres (lithosphere, hydrosphere, atmosphere, and biosphere) of the Earth interact; • examine the role of water on the Earth; • explain processes involved in the formation of the Earth's structure; • identify the organization and relative scale of the solar system.
Basic	**Sixth grade students performing at the basic level:** • identify the spheres of Earth; • list two effects of water on Earth; • identify processes of weathering and erosion in the formation of earth's structures; • list the planets in order from the Sun outward.

Sixth Grade Science, Technology, Environment, and Society
Grade Standards, Supporting Skills, and Examples

Indicator 1: Analyze various implications/effects of scientific advancement within the environment and society.

Bloom's Taxonomy Level	Standard, Supporting Skills, and Examples
(Comprehension)	**6.S.1.1. Students are able to describe how science and technology have helped society to solve problems.** **Examples**: GPS, GIS, remote sensing, prevention and treatment of diseases, vaccinations, water treatment, prosthetics

Indicator 2: Analyze the relationships/interactions among science, technology, environment, and society.

Bloom's Taxonomy Level	Standard, Supporting Skills, and Examples
(Knowledge)	**6.S.2.1. Students are able, given a scenario, to identify the problem(s) of human activity on the local, regional, or global environment.** **Examples**: urban expansion, water treatment

Sixth Grade Science Technology, Environment, and Society
Performance Descriptors

Advanced	**Sixth grade students performing at the advanced level:** • list pros and cons of technological solutions to problems.
Proficient	**Sixth grade students performing at the proficient level:** • describe how science and technology have helped society to solve problems; • given a scenario, identify the problem(s) of human activity on the local, regional, or global environment.
Basic	**Sixth grade students performing at the basic level:** • recognize a problem.

Seventh Grade Nature of Science
Grade Standards, Supporting Skills, and Examples

Indicator 1: Understand the nature and origin of scientific knowledge.

Note: These skills should be taught and practiced in grade-level study of Physical, Life, and Earth/Space Science although mastery is not expected at these grade levels.

Bloom's Taxonomy Level	Standard, Supporting Skills, and Examples
	✓ Describe societal response to major scientific findings or theories. Examples: cloning, stem cell research, biotechnology ✓ Investigate important contributions to the advancement of science from people of differing cultures, genders, and ethnicity. Examples: Louis Pasteur-disease, Rachel Carson-ecology, Linnaeus- classification, Redi-biology, Darwin-evolution, Jane Goodall-zoology

Indicator 2: Apply the skills necessary to conduct scientific investigations.

Bloom's Taxonomy Level	Standard, Supporting Skills, and Examples
(Application)	**7.N.2.1. Students are able to conduct scientific investigations using given procedures**. • Use appropriate supportive technologies. • Determine the limits of accuracy inherent in a particular measuring device or procedure. • Control variables to test hypotheses by repeated trials. • Identify sources of experimental error. • Interpret to make predictions and/or justify conclusions. • Use research methods to investigate practical and/or personal scientific problems and questions. ✓ Describe and demonstrate various safety factors associated with different types of scientific activity. • Demonstrate appropriate use of apparatus and technologies for investigations. • Use proper safety procedures in all investigations. • Wear appropriate attire. ✓ Analyze the benefits and potential of scientific investigations.

Seventh Grade Nature of Science
Performance Descriptors

Advanced	**Seventh grade students performing at the advanced level:** • design a replicable scientific investigation.
Proficient	**Seventh grade students performing at the proficient level:** • conduct scientific investigations using given procedures.
Basic	**Seventh grade students performing at the basic level:** • identify steps necessary to conduct a replicable scientific investigation.

Seventh Grade Physical Science
Grade Standards, Supporting Skills, and Examples

After careful consideration of current research and input from educators throughout the state, the Committee revised former standards to facilitate effective instruction and student mastery. Grade seven standards emphasize Life Science.

Seventh Grade Life Science
Grade Standards, Supporting Skills, and Examples

Indicator 1: Understand the fundamental structures, functions, classifications, and mechanisms found in living things.

Bloom's Taxonomy Level	Standard, Supporting Skills, and Examples
(Knowledge)	**7.L.1.1. Students are able to identify basic cell organelles and their functions.** • Observe cells with a compound microscope. Examples: cell membranes, cell wall, cytoplasm, vacuoles, nucleus • Describe the function of the cell membrane to include active transport and passive transport (diffusion, osmosis). • Describe cell walls as providing support and shape. • Describe cytoplasm. • Describe vacuoles. • Describe the function of the nucleus. ✓ DNA replication ✓ Protein synthesis (ribosomes) ✓ Transcription/translation ✓ Endoplasmic reticulum ✓ Lysosomes ✓ Chloroplasts role in photosynthesis ✓ Mitochondria role in respiration
(Comprehension)	**7.L.1.2. Students are able to identify and explain the function of the human systems and the organs within each system.** • Skeletal/support • Muscular • Digestive • Respiratory • Circulatory • Reproductive ✓ Endocrine

	✓ Immune ✓ Nervous ✓ Excretory ✓ Integumentary
(Application)	**7.L.1.3. Students are able to classify organisms by using the currently recognized kingdoms.** **Examples**: monera, protista, plantae, fungi, animalia ✓ Identify and compare the basic structure and function of major taxa. ✓ Describe the levels of organization within organisms. Example: cells to tissues to organs to systems to organisms
(Comprehension)	**7.L.1.4. Students are able to describe and identify the structure of vascular and non-vascular plants.** **Examples**: structures of root stems, leaves, and flowers

Indicator 2: Analyze various patterns and products of natural and induced biological change.

Bloom's Taxonomy Level	Standard, Supporting Skills, and Examples
(Comprehension)	**7.L.2.1. Students are able to distinguish between processes involved in sexual and asexual reproduction.** • Model the process of cell division. Examples: mitosis and meiosis ✓ Identify the role of genetics in the transmission of traits and characteristics in organisms. Examples: Punnett Square, selective breeding, adaptations, natural selection, multiple traits, pedigree

Indicator 3: Analyze how organisms are linked to one another and the environment.

Bloom's Taxonomy Level	Standard, Supporting Skills, and Examples
(Application)	**7.L.3.1. Students are able to predict the effects of biotic and abiotic factors on a species' survival.** **Examples**: adaptations, genetic defects, population disturbances, over-reproduction, animal behavior, flooding, global warming, oil spills, human activity ✓ Describe processes by which matter and energy flow through an ecosystem. Examples: photosynthesis, respiration, nitrogen cycle ✓ Use geospatial technologies to investigate natural phenomena. Examples: GPS, GIS, remote sensing

Seventh Grade Life Science
Performance Descriptors

Advanced	**Seventh grade students performing at the advanced level:** • compare and contrast hierarchical levels within the five kingdoms; • identify organism by taxonomic level using a dichotomous key; • given the characteristics of a plant, classify it as vascular or non-vascular; • compare and contrast sexual and asexual reproduction in plants and animals.
Proficient	**Seventh grade students performing at the proficient level:** • identify basic cell organelles and their functions; • identify and explain the function of the human systems and the organs within each system; • classify organisms by using the currently recognized kingdoms; • describe and identify the structure of vascular and non-vascular plants; • distinguish between processes involved in sexual and asexual reproduction; • predict the effects of biotic and abiotic factors on a species survival.
Basic	**Seventh grade students performing at the basic level:** • label the basic cell parts using a word bank; • using a list, order the organization of organisms; • give examples and characteristics of organisms from each kingdom;

	• using a word bank, label the parts of a flower; • define sexual and asexual reproduction.

Seventh Grade Earth/Space Science
Grade Standards, Supporting Skills, and Examples

After careful consideration of current research and input from educators throughout the state, the Committee revised former standards to facilitate effective instruction and student mastery. Grade seven standards emphasize Life Science.

Seventh Grade Science, Technology, Environment, and Society
Grade Standards, Supporting Skills, and Examples

Indicator 1: Analyze various implications/effects of scientific advancement within the environment and society.

Bloom's Taxonomy Level	Standard, Supporting Skills, and Examples
(Comprehension)	**7.S.1.1. Students are able to describe how science and technology are used to solve problems in different professions and businesses.** **Examples**: GPS, GIS, remote sensing, agriculture and genetics, medical and bio-technology (EKG), food industry and chemistry

Indicator 2: Analyze the relationships/interactions among science, technology, environment, and society.

Bloom's Taxonomy Level	Standard, Supporting Skills, and Examples
(Application)	**7.S.2.1. Students are able, given a scenario, to predict the consequence(s) of human activity on the local, regional, or global environment.** **Example**: Missouri River dams and water needs

Seventh Grade Science, Technology, Environment, and Society
Performance Descriptors

Advanced	**Seventh grade students performing at the advanced level:** • develop solutions to problems.
Proficient	**Seventh grade students performing at the proficient level:** • describe how science and technology are used to solve problems in different professions and businesses; • given a scenario, predict the consequence(s) of human activity on the local, regional, or global environment.
Basic	**Seventh grade students performing at the basic level:** • identify the problem and one possible solution.

Eighth Grade Nature of Science
Grade Standards, Supporting Skills, and Examples

Indicator 1: Understand the nature and origin of scientific knowledge.

Bloom's Taxonomy Level	Standard, Supporting Skills, and Examples
(Comprehension)	**8.N.1.1. Students are able to differentiate among facts, predictions, theory, and law/principles in scientific investigations.** • Define fact, predictions, theory, and law/principle. • Discuss how theory can become law. ✓ Evaluate important contributions to the advancement of science from people of differing cultures, genders, and ethnicity. Examples: Marie Curie-radiation, Hess, Galileo- astronomy, Kepler-astronomy, Newton-physics, Neil Tice-astronomy, Mendeleev-physics

Indicator 2: Apply the skills necessary to conduct scientific investigations.

Bloom's Taxonomy Level	Standard, Supporting Skills, and Examples
(Synthesis)	**8.N.2.1. Students are able to design a replicable scientific investigation.** • Use appropriate supportive technologies. • Assess the limits of accuracy inherent in a particular measuring device or procedure. • Control variables to test hypotheses by repeated trials and by identifying sources of experimental error. • Interpret data to justify predictions or conclusions. • Use research methods to investigate practical and/or personal scientific problems and questions. • Select appropriate scientific equipment and technologies for investigations and experiments. • Use proper safety procedures in all investigations. • Wear appropriate attire. ✓ Evaluate the benefits and potential of scientific investigations.

Eighth Grade Nature of Science
Performance Descriptors

Advanced	**Eighth grade students performing at the advanced level:** • justify facts, predictions, theory, and law/principles in scientific investigations; • design and conduct a replicable scientific investigation.
Proficient	**Eighth grade students performing at the proficient level:** • differentiate among facts, predictions, theory, and law/principles in scientific investigations; • design a replicable scientific investigation.
Basic	**Eighth grade students performing at the basic level:** • define fact, prediction, and theory; • follow instructions to conduct a systematic scientific investigation.

Eighth Grade Physical Science
Grade Standards, Supporting Skills, and Examples

After careful consideration of current research and input from educators throughout the state, the Committee revised former standards to facilitate effective instruction and student mastery. Grade eight standards emphasize Earth/Space Science.

Indicator 1: Describe structures and properties of, and changes in, matter.

Bloom's Taxonomy Level	Standard, Supporting Skills, and Examples
(Analysis)	**8.P.1.1. Students are able to classify matter as elements, compounds, or mixtures.** **Example**: Na and Cl are elements that, chemically combined, form salt (NaCl) (compound). **Example**: Salt and water form a mixture that can be physically separated. ✓ Formulas

(Application)	**8.P.1.2. Students are able to use the Periodic Table to compare and contrast families of elements and to classify elements as metals, metalloids, or non-metals.** • Describe the relationship between the organization and the predictive nature of the Periodic Table. • Use the Bohr model to show the arrangement of the subatomic particles of atomic numbers 1 through 18. ✓ Compare and contrast other atomic models.
(Comprehension)	**8.P.1.3. Students are able to compare properties of matter resulting from physical and chemical changes.** **Examples**: weathering, burning, melting, acid rain ✓ Ionic/covalent bonding

Indicator 2: Analyze forces, their forms, and their effects on motions.

See note above.

Indicator 3: Analyze interactions of energy and matter.

See note above.

Eighth Grade Physical Science
Performance Descriptors

Advanced	**Eighth grade students performing at the advanced level:** • create models of elements, compounds, or mixtures; • explain the predictive nature of the Periodic Table; • predict properties of matter resulting from physical and chemical changes.
Proficient	**Eighth grade students performing at the proficient level:** • classify matter as elements, compounds, or mixtures; • use the Periodic Table to compare and contrast families of elements and classify elements as metals, metalloids, non-metals; • compare properties of matter resulting from physical and chemical changes.
Basic	**Eighth grade students performing at the basic level:** • define elements, compounds, and mixtures; • use the Periodic Table to identify elements as metals, metalloids, non-metals;

	• identify physical and chemical changes.

Eighth Grade Life Science
Grade Standards, Supporting Skills, and Examples

After careful consideration of current research and input from educators throughout the state, the Committee revised former standards to facilitate effective instruction and student mastery. Grade eight standards emphasize Earth/Space Science.

Eighth Grade Earth/Space Science
Grade Standards, Supporting Skills, and Examples

Indicator 1: Analyze the various structures and processes of the Earth system.

Bloom's Taxonomy Level	Standard, Supporting Skills, and Examples
(Application)	**8.E.1.1. Students are able to identify and classify minerals and rocks.** **Examples:** luster, streak, fracture/cleavage, hardness (Mohs Scale), specific gravity, color, magnetism, acid test, flame test, fluorescence • Rocks as sedimentary, igneous, or metamorphic. • Rock Cycle ✓ Law of Conservation of Energy and Matter • Minerals as carbonates (CO3) or Silicates (SiO2) ✓ Minerals as oxides, sulfides, halides, sulfates
(Analysis)	**8.E.1.2. Students are able to explain the role of plate tectonics in shaping Earth.** • Plates boundaries • Volcanoes • Earthquakes • Seismic waves • Mountains • Convection currents in the mantle • Changes over time Examples: adaptations, extinction, geologic time (relative and absolute), extinct species, fossils, surface features
(Analysis)	**8.E.1.3. Students are able to explain the factors that create weather and the instruments and technologies that assess it.** **Examples**: NOAA, AMS • Differentiate between climate and climate zones. Examples: air masses, fronts, pressure systems, Coriolis effect, wind systems, humidity, storms ✓ Effects of the ocean on weather

	✓ Condensation ✓ Evaporation ✓ Cloud Formation
(Application)	**8.E.1.4. Students are able to examine the chemical and physical properties of the ocean to determine causes and effects of currents and waves.** **Examples**: density, temperature, salinity ✓ El Niño ✓ Ocean zones ✓ Ocean floor features
(Analysis)	**8.E.1.5. Students are able to explain the impact of weathering and erosion on the Earth.** • Soil formation • Deposition (deltas) • Land transformations (Grand Canyon) • Glaciation ✓ Use geospatial technologies to investigate natural phenomena. Examples: GPS, GIS, remote sensing

Indicator 2: Analyze essential principles and ideas about the composition and structure of the universe.

Bloom's Taxonomy Level	Standard, Supporting Skills, and Examples
(Analysis)	**8.E.2.1. Students are able to compare celestial bodies within the solar system using composition, size, and orbital motion.** • Describe the composition of the Sun, the planets, asteroids, and comets. ✓ Use of spectroscopic analysis of celestial bodies ✓ Measurement in space ✓ Constellations ✓ Galaxies ✓ Life cycle of a star ✓ HR Diagram

	✓ Law of Gravitation ✓ Big Bang Theory ✓ Doppler Effect
(Analysis)	**8.E.2.2. Students are able to differentiate the influences of the relative positions of the Earth, Moon, and Sun.** • Lunar and solar eclipses, moon phases, tides, seasons

Eighth Grade Earth/Space Science
Performance Descriptors

Advanced	**Eighth grade students performing at the advanced level:** • use classification methods, identify, and classify unknown minerals and rocks; • give evidence that supports the theory of plate tectonics; • analyze weather maps and make basic predictions; • predict the climate of a coastal region based on ocean currents; • given a scenario, predict the consequences of weathering and/or erosion; • construct a scale model of the solar system; • predict the effects on the Earth's environment if tilt, distance, or atmosphere were changed.
Proficient	**Eighth grade students performing at the proficient level:** • identify and classify minerals and rocks; • explain the role of plate tectonics in shaping Earth; • explain the factors that create weather and the instruments that assess it; • examine the chemical and physical properties of the ocean to determine causes and effects of currents and waves; • explain the impact of weathering and erosion on the earth; • compare celestial bodies within the solar system using composition, size, and orbital motion; • differentiate the influences of the relative positions of the Earth, Moon, and Sun.
Basic	**Eighth grade students performing at the basic level:** • identify rocks as sedimentary, igneous, or metamorphic; • describe activity that occurs along plate boundaries; • define basic weather vocabulary; • list a physical and chemical property of the oceans; • describe the difference between weathering and erosion; • identify the basic objects of the solar system; • describe how the tilt of the Earth is a cause of the seasons.

Eighth Grade Earth/Space Science
ELL Performance Descriptors

Proficient	**Eighth grade ELL students performing at the proficient level:** • identify minerals and rocks according to physical properties; • describe activity that occurs along plate boundaries; • define basic weather vocabulary; • list a physical and chemical property of the oceans; • describe the difference between weathering and erosion; • identify the basic objects of the solar system (planets, comets, asteroids, moons); • describe how the tilt of the Earth is a cause of the seasons; • ask questions related to science topics.
Intermediate	**Eighth grade ELL students performing at the intermediate level:** • identify rocks according to physical properties; • recognize that earthquakes occur along plate boundaries; • use basic weather vocabulary; • list a physical property of the oceans; • recognize differences between weathering and erosion; • name the basic objects of the solar system; • recognize that the Earth tilts on its axis; • give simple oral responses to questions on topics presented in class.
Basic	**Eighth grade ELL students performing at the basic level:** • recognize that physical properties identify rocks; • recognize that the Earth's crust is made up of plates; • know basic weather vocabulary; • know that the ocean has physical properties (big, made of water, plant and animal life); • name one cause of weathering or erosion; • label the Earth, Moon and Sun on a diagram; • recognize that the Earth tilts; • participate in science activities and experiments with other students; • use correct pronunciation of science words; • respond correctly to yes or no questions on topics presented in class.
Emergent	**Eighth grade ELL students performing at the emergent level:** • use correct pronunciation of science words; • use non-verbal communication to express scientific ideas.

Pre-emergent	**Eighth grade ELL students performing at the pre-emergent level:** • observe and model appropriate cultural and learning behaviors from peers and adults; • listen to and observe comprehensible instruction and communicate understanding non-verbally.

Eighth Grade Science, Technology, Environment, and Society
Grade Standards, Supporting Skills, and Examples

Indicator 1: Analyze various implications/effects of scientific advancement within the environment and society.

Bloom's Taxonomy Level	Standard, Supporting Skills, and Examples
(Comprehension)	**8.S.1.1. Students are able to describe how science and technology have been influenced by social needs, attitudes, and values.** **Examples**: GPS, GIS, remote sensing, Corps of Engineers (dams), NOAA (weather satellites), NASA (earth and space exploration), USGS (mapping)

Indicator 2: Analyze the relationships/interactions among science, technology, environment, and society.

Bloom's Taxonomy Level	Standard, Supporting Skills, and Examples
(Synthesis)	**8.S.2.1. Students are able, given a scenario, to offer solutions to problems created by human activity on the local, regional, or global environment.** **Examples**: global warming, deforestation

Eighth Grade Science, Technology, Environment, and Society
Performance Descriptors

Advanced	**Eighth grade students performing at the advanced level:** • defend a proposed solution or offer alternative solutions to a problem.
Proficient	**Eighth grade students performing at the proficient level:** • describe how science and technology have been influenced by social needs, attitudes, and values; • given a scenario, offer solutions to problems created by human activity on the local, regional, or global environment.
Basic	**Eighth grade students performing at the basic level:** • predict a possible consequence of a solution to a problem.

NATURE OF SCIENCE STANDARDS
6-8

Indicator 1: Understand the nature and origin of scientific knowledge.

Sixth Grade	Seventh Grade	Eighth Grade
		8.N.1.1. (Comprehension) Differentiate among facts, predictions, theory, and laws/principles in scientific investigations.

Indicator 2: Apply the skills necessary to conduct scientific investigations.

Note: These skills should be taught and practiced in grade-level study of Physical, Life, and Earth/Space Science although mastery is not expected at these grade levels.

Sixth Grade	Seventh Grade	Eighth Grade
6.N.2.1 (Application) Pose questions that can be explored through scientific investigations.	7.N.2.1. (Application) Conduct scientific investigations using given procedures.	8.N.2.1. (Synthesis) Design a replicable scientific investigation.

PHYSICAL SCIENCE STANDARDS
6-8

After careful consideration of current research and input from educators throughout the state, the Committee revised former standards to facilitate effective instruction and student mastery. Grade six standards emphasize an integration of Physical, Life, and Earth/Space Science. Grade seven standards emphasize Life Science. Grade eight standards emphasize Earth/Space Science. Nature of Science and Science, Technology, Environment, and Society standards continue to emerge over these grades.

Indicator 1: Describe structures and properties of, and changes in, matter.

Sixth Grade	Seventh Grade	Eighth Grade
6.P.1.1. (Knowledge) Identify the subatomic particles that make up atoms.	*See note above*.	8.P.1.1. (Analysis) Classify matter as elements, compounds, or mixtures.
6.P.1.2. (Application) Classify matter based on physical and chemical properties.		8.P.1.2. (Application) Use the Periodic Table to compare and contrast families of elements and to classify elements as metals, metalloids, or non-metals.
6.P.1.3. (Comprehension) Describe phase changes in matter differentiating between the particle motion in solids, liquids, and gases.		8.P.1.3. (Comprehension) Compare properties of matter resulting from physical and chemical changes.

Indicator 2: Analyze forces, their forms, and their effects on motions.

Sixth Grade:	Seventh Grade:	Eighth Grade:
6.P.2.1. (Comprehension) Describe how push/pull forces acting on an object produce motion.	*See note above*.	*See note above*.

Indicator 3: Analyze interactions of energy and matter.

Sixth Grade:	Seventh Grade:	Eighth Grade:
6.P.3.1. (Comprehension) Identify types of energy transformations.	*See note above.*	*See note above*.

LIFE SCIENCE STANDARDS
6-8

After careful consideration of current research and input from educators throughout the state, the Committee revised former standards to facilitate effective instruction and student mastery. Grade six standards emphasize an integration of Physical, Life, and Earth/Space Science. Grade seven standards emphasize Life Science. Grade eight standards emphasize Earth/Space Science. Nature of Science and Science, Technology, Environment, and Society standards continue to emerge over these grades.

Indicator 1: Understand the fundamental structures, functions, classifications, and mechanisms found in living things.

Sixth Grade	Seventh Grade	Eighth Grade
6.L.1.1. (Comprehension) Illustrate the difference between plant and animal cells.	7.L.1.1. (Knowledge) Identify basic cell organelles and their functions.	*See note above*.
6.L.1.2. (Comprehension) Explain the importance and scientific use of a classification system.	7.L.1.2. (Comprehension) Identify and explain the function of the human systems and the organs within each system.	
	7.L.1.3. (Application) Classify organisms by using the currently recognized kingdoms.	
	7.L.1.4. (Comprehension) Describe and identify the structure of vascular and non-vascular plants.	

Indicator 2: Analyze various patterns and products of natural and induced biological change.

Sixth Grade	Seventh Grade	Eighth Grade
	7.L.2.1. (Comprehension) Distinguish between processes involved in sexual and asexual reproduction.	*See note above*.

Indicator 3: Analyze how organisms are linked to one another and the environment.

Sixth Grade	Seventh Grade	Eighth Grade
	7.L.3.1. (Application) Predict the effects of biotic and abiotic factors on a species' survival.	*See note above*.

EARTH/SPACE SCIENCE STANDARDS
6-8

After careful consideration of current research and input from educators throughout the state, the Committee revised former standards to facilitate effective instruction and student mastery. Grade six standards emphasize an integration of Physical, Life, and Earth/Space Science. Grade seven standards emphasize Life Science. Grade eight standards emphasize Earth/Space Science. Nature of Science and Science, Technology, Environment, and Society standards continue to emerge over these grades.

Indicator 1: Analyze the various structures and processes of the Earth system.

Sixth Grade	Seventh Grade	Eighth Grade
6.E.1.1. (Comprehension) Describe how the spheres (lithosphere, hydrosphere, atmosphere, and biosphere) of the Earth interact.	*See note above*.	8.E.1.1. (Application) Identify and classify minerals and rocks.
6.E.1.2. (Application) Examine the role of water on the Earth.		8.E.1.2. (Analysis) Explain the role of plate tectonics in shaping Earth.
6.E.1.3. (Comprehension) Explain processes involved in the formation of the Earth's structure.		8.E.1.3. (Analysis) Explain the factors that create weather and the instruments and technologies that assess it.
		8.E.1.4. (Application) Examine the chemical and physical properties of the ocean to determine causes and effects of currents and waves.
		8.E.1.5. (Analysis) Explain the impact of weathering and erosion on the Earth.

Indicator 2: Analyze essential principles and ideas about the composition and structure of the universe.

Sixth Grade	Seventh Grade	Eighth Grade
6.E.2.1. (Knowledge) Identify the organization and relative scale of the solar system.	*See note above*.	8.E.2.1. (Analysis) Compare celestial bodies within the solar system using composition, size, and orbital motion.
		8.E.2.2. (Analysis) Differentiate the influences of the relative positions of the Earth, Moon, and Sun.

SCIENCE, TECHNOLOGY, ENVIRONMENT, AND SOCIETY STANDARDS 6-8

Indicator 1: Analyze various implications/effects of scientific advancement within the environment and society.

Sixth Grade	Seventh Grade	Eighth Grade
6.S.1.1. (Comprehension) Describe how science and technology have helped society to solve problems.	7.S.1.1. (Comprehension) Describe how science and technology are used to solve problems in different professions and businesses.	8.S.1.1. (Comprehension) Describe how science and technology have been influenced by social needs, attitudes, and values.

Indicator 2: Analyze the relationships/interactions among science, technology, environment, and society.

Sixth Grade	Seventh Grade	Eighth Grade
6.S.2.1. (Knowledge) Given a scenario, identify the problem(s) of human activity on the local, regional, or global environment.	7.S.2.1. (Application) Given a scenario, predict the consequence(s) of human activity on the local, regional, or global environment.	7.S.2.1. (Synthesis) Given a scenario, offer solutions to problems created by human activity on the local, regional, or global environment.

Core High School Nature of Science
Standards, Supporting Skills, and Examples

Indicator 1: Understand the nature and origin of scientific knowledge.

Bloom's Taxonomy Level	Standard, Supporting Skills, and Examples
(Evaluation)	**9-12.N.1.1. Students are able to evaluate a scientific discovery to determine and describe how societal, cultural, and personal beliefs influence scientific investigations and interpretations.** **Examples**: telescope, birth control pill, penicillin, electricity • Recognize scientific knowledge is not merely a set of static facts but is dynamic and affords the best current explanations. Examples: spontaneous generation, relativity, geologic time • Discuss how progress in science can be affected by social issues.
(Synthesis)	**9-12.N.1.2. Students are able to describe the role of observation and evidence in the development and modification of hypotheses, theories, and laws.** • Research, communicate, and support a scientific argument. • Recognize and analyze alternative explanations and models. • Evaluate the scientific accuracy of information relevant to a specific issue (pseudo-science).

Indicator 2: Apply the skills necessary to conduct scientific investigations.

Bloom's Taxonomy Level	Standard, Supporting Skills, and Examples
(Synthesis)	**9-12.N.2.1. Students are able to apply science process skills to design and conduct student investigations.** • Identify the questions and concepts to guide the development of hypotheses. • Analyze primary sources of information to guide the development of the procedure. • Select and use appropriate instruments to extend observations and measurements. • Revise explanations and models based on evidence and logic. • Use technology and mathematic skills to enhance investigations, communicate results, and defend conclusions. Examples: Computer-based data collection Graphical analysis and representation Use appropriate technology to display data (i.e. spreadsheets, PowerPoint, web).
(Application)	**9-12.N.2.2. Students are able to practice safe and effective laboratory techniques.** • Handle hazardous materials properly. • Use safety equipment correctly. • Practice emergency procedure. • Wear appropriate attire. • Practice safe behaviors.

Core High School Nature of Science
Performance Descriptors

Advanced	**High school students performing at the advanced level:** • given a scientific discovery, evaluate how different societal, cultural, and personal beliefs influenced the investigation and its interpretation; • design and conduct an investigation using an alternative student- developed hypothesis.
Proficient	**High school students performing at the proficient level:** • given a scientific discovery narrative, determine and describe how societal, cultural, and personal beliefs influenced the investigation and its interpretation; • describe the role of observation and evidence in the development and modification of hypotheses, theories, and laws; then apply science process skills to design and conduct student investigations.
Basic	**High school students performing at the basic level:** • describe the role of observation in the development of hypotheses, theories, and laws and conduct student investigations; • given a scientific discovery narrative, identify the cultural and personal beliefs that influenced the investigation.

Core High School Physical Science
Standards, Supporting Skills, and Examples

Indicator 1: Describe structures and properties of, and changes in, matter

Bloom's Taxonomy Level	Standard, Supporting Skills, and Examples
(Analysis)	**9-12.P.1.1. Students are able to use the Periodic Table to determine the atomic structure of elements, valence number, family relationships, and regions (metals, nonmetals, and metalloids).** • Determine protons, neutrons, electrons, mass number, and atomic number from the Periodic Table. • Determine the number of valence electrons for elements in the main (s&p) blocks of the Periodic Table. • Identify the relative metallic character of an element based on its location on the Periodic Table.

(Comprehension)	**9-12.P.1.2. Students are able to describe ways that atoms combine.** • Name and write formulas for binary ionic and covalent compounds. Example: sodium chloride (NaCl), carbon dioxide (CO_2) • Compare the roles of electrons in covalent, ionic, and metallic bonding. • Discuss the special nature of carbon covalent bonds.
(Application)	**9-12.P.1.3. Students are able to predict whether reactions will speed up or slow down as conditions change.** **Examples**: temperature, concentration, surface area, and catalysts
(Application)	**9-12.P.1.4. Students are able to balance chemical equations by applying the Law of Conservation of Matter.** • Trace number of particles in diagrams and pictures of balanced equations. Example: Write out an equation with symbols: $Mg + 2HCL \rightarrow MgCl_2 + 2H_2$
(Comprehension)	**9-12.P.1.5. Students are able to distinguish among chemical, physical, and nuclear changes.** • Differentiate between physical and chemical properties used to describe matter. • Identify key indicators of chemical and physical changes. • Describe the effects of changing pressure, volume, or temperature upon gases. • Identify characteristics of a solution and factors that affect the rate of solution formation. • Explain the differences among nuclear, chemical, and physical changes at the atomic level. Examples: solute, solvent, concentrated, dilute, saturated, unsaturated, supersaturated Factors affecting rate: agitation, heating, particle size, pictures of particles

Indicator 2: Analyze forces, their forms, and their effects on motions.

Bloom's Taxonomy	Standard, Supporting Skills, and Examples

Level	
(Analysis)	**9-12.P.2.1. Students are able to apply concepts of distance and time to the quantitative relationships of motion using appropriate mathematical formulas, equations, and units.** • Evaluate speed, velocity, and acceleration both qualitatively and quantitatively. Examples: Identify the sign (+,-, 0) of an object's acceleration based on velocity information. Predict whether an object speeds up, slows down, or maintains a constant speed based on the forces acting upon it. Calculate acceleration using the equation $A_{avg}=\Delta V/\Delta t$. • Given distance and time, calculate the velocity or speed of an object. • Create and interpret graphs of linear motion. Example: Given a velocity-time or a distance-time graph with different slopes, determine the motion of an object. • Distinguish between velocity and acceleration as related to force.
(Application)	**9-12.P.2.2. Students are able to predict motion of an object using Newton's Laws.** • Describe how inertia is related to Newton's First Law. • Explain the effect of balanced and unbalanced forces. • Identify the forces at work on action/reaction pairs as distinguished from balanced forces. Examples: Draw a linear force diagram for the forces acting on an object in contact with another. Identify action/reaction pairs. • Explain how force, mass, and acceleration are related.
(Application)	**9-12.P.2.3. Students are able to relate concepts of force, distance, and time to the quantitative relationships of work, energy, and power.** • Apply appropriate mathematical formulas and equations

	to concepts using appropriate units. Examples: Calculate power given force, distance and time. Calculate work done on an object given force and distance.

Indicator 3: Analyze interactions of energy and matter.

Bloom's Taxonomy Level	Standard, Supporting Skills, and Examples
(Application)	**9-12.P.3.1. Students are able to describe the relationships among potential energy, kinetic energy, and work as applied to the Law of Conservation of Energy.** • Describe how energy can be transferred and transformed to produce useful work. Examples: Diagram simple energy transfers, describing the objects and the forms of energy gained and lost. Use simple machines as an example of the transmission of energy. • Given the formulas, calculate the mechanical advantage and efficiency of selected systems. • Explain methods of heat transfer. Examples: conduction, radiation, and convection
(Comprehension)	**9-12.P.3.2. Students are able to describe how characteristics of waves are related to one another.** • Relate wavelength, speed, and frequency ($v = f$). • Distinguish between transverse and longitudinal waves. Examples: Discuss changes in frequency of waves using the Doppler Effect. Compare the energy of different frequency ranges of waves with in the electromagnetic spectrum. Describe how different colors of light waves have different amounts of energy.
(Application)	**9-12.P.3.3. Students are able to describe electrical effects in terms of motion and concentrations of charged particles.**

	• Relate potential difference to current. • Describe how static electricity is different from current electricity. • Interpret and apply Ohm's Law. • Describe electrical attractions and repulsions. • Describe how magnetism originates from motion of charged particles.

Core High School Physical Science
Performance Descriptors

Advanced	**High school students performing at the advanced level:** • predict the type of bonds formed as elements combine; • balance chemical equations involving polyatomic ions; • analyze and solve a problem involving velocity, acceleration, force, work, energy, or power; • construct or design a model that illustrates the Law of Conservation of Energy to show energy changes from potential to kinetic in doing work; • describe electrical effects in terms of motion and concentrations of charged particles.
Proficient	**High school students performing at the proficient level:** • use the Periodic Table to determine the properties of elements and the ways they combine; • given a variable, predict whether reactions will speed up or slow down as conditions change; • balance simple chemical equations; • describe chemical, physical, and nuclear changes at the atomic and macroscopic levels; • calculate velocity, acceleration, force, work, energy, and power given the formulas; • given the forces acting on an object, predict its motion using Newton's Laws; • apply the Law of Conservation of energy to show energy changes from potential to kinetic in doing work; • describe how characteristics of waves are related to one another; • describe electrical effects in terms of motion and concentrations of charged particles.
Basic	**High school students performing at the basic level:** • use the Periodic Table to determine the properties of the 1st 18 elements; • provide the coefficients for an unbalanced synthesis or decomposition equation; • identify chemical and physical changes at the macroscopic level; • calculate velocity and force given the formulas; • given an example, identify which of Newton's Laws is illustrated; • identify the characteristics of waves; • identify electricity as movement of charged particles.

Core High School Life Science
Standards, Supporting Skills, and Examples

Indicator 1: Understand the fundamental structures, functions, classifications, and mechanisms found in living things.

Bloom's Taxonomy Level	Standard, Supporting Skills, and Examples
(Analysis)	**9-12.L.1.1. Students are able to relate cellular functions and processes to specialized structures within cells.** • Transport Examples: cell membrane, homeostasis • Photosynthesis and respiration Examples: ATP-ADP energy cycle Role of enzymes Mitochondria Chloroplasts • Storage and transfer of genetic information Examples: replication, transcription, and translation • Cell life cycles Examples: somatic cells (mitosis), germ cells (meiosis)
(Application)	**9-12.L.1.2. Students are able to classify organisms using characteristics and evolutionary relationship of major taxa.** • Kingdoms Examples: animals, plants, fungi, protista, monera • Phyla Examples: invertebrates, vertebrates, divisions of plants Note: There is an ongoing scientific debate about the number of groupings and which organisms should be included in each.
(Analysis)	**9-12.L.1.3. Students are able to identify structures and function relationships within major taxa.** **Examples**: Relate how the layers in a leaf support leaf function. Interaction of agonist and antagonist muscles to support bone movement

Indicator 2: Analyze various patterns and products of natural and induced biological change.

Bloom's Taxonomy Level	Standard, Supporting Skills, and Examples
(Application)	**9-12.L.2.1. Students are able to predict inheritance patterns using a single allele.** • Solve problems involving simple dominance, co-dominance, and sex-linked traits using Punnett squares for F1 and F2 generations. Examples: color blindness, wavy hair • Discuss disorders resulting from alteration of a single gene. Example: hemophilia, cystic fibrosis
(Synthesis)	**9-12.L.2.2. Students are able to describe how genetic recombination, mutations, and natural selection lead to adaptations, evolution, extinction, or the emergence of new species.** **Examples**: behavioral adaptations, environmental pressures, allele variations, bio-diversity • Use comparative anatomy to support evolutionary relationships.

Indicator 3: Analyze how organisms are linked to one another and the environment.

Bloom's Taxonomy Level	Standard, Supporting Skills, and Examples
(Comprehension)	**9-12.L.3.1. Students are able to identify factors that can cause changes in stability of populations, communities, and ecosystems.** • Define populations, communities, ecosystems, niches and symbiotic relationships. • Predict the results of biotic and abiotic interactions. Examples: Responses to changing of the seasons Tolerances (temperature, weather, climate) Dormancy and migration Fluctuation in available resources (water, food, shelter) Human activity Biogeochemical cycles

	Energy flow Cooperation and competition in ecosystems Response to external stimuli

Core High School Life Science
Performance Descriptors

Advanced	**High school students performing at the advanced level:** • explain the steps of photophosphorylation and the Calvin Cycle; • analyze chemical reaction and chemical processes involved in the Calvin Cycle and Krebs Cycle; • predict the function of a given structure; • predict the outcome of changes in the cell cycle; • explain how protein production is regulated; • predict how homeostasis is maintained within living systems; • predict how traits are transmitted from parents to offspring; • construct an original dichotomous key.
Proficient	**High school students performing at the proficient level:** • describe and give examples of chemical reactions required to sustain life (hydrolysis, dehydration synthesis, photosynthesis, cellular respiration, ADP/ATP, role of enzymes); • describe the relationship between structure and function (cells, tissues, organs, organ systems, and organisms); • compare and contrast the cell cycles in somatic and germ cells; • tell how DNA determines protein formation; • explain how homeostasis is maintained within living systems; • explain how traits are transmitted from parents to offspring; • predict the impact of genetic changes in populations (mutation, natural selection and artificial selection, adaptation/extinction); • predict how life systems respond to changes in the environment; • classify organisms using a dichotomous key.
Basic	**High school students performing at the basic level:** • name chemical reactions required to sustain life (hydrolysis, dehydration synthesis, photosynthesis, cellular respiration, ADP/ATP, role of enzymes); • recognize that different structures perform different functions;

	• describe the life cycle of somatic cells; • identify DNA as the structure that carries the genetic code; • define homeostasis; • identify that genetic traits can be transmitted from parents to offspring; • know the purpose of a dichotomous key.

Core High School Earth/Space Science
Standards, Supporting Skills, and Examples

Indicator 1: Analyze the various structures and processes of the Earth system.

Bloom's Taxonomy Level	Standard, Supporting Skills, and Examples
(Comprehension)	**9-12.E.1.1. Students are able to explain how elements and compounds cycle between living and non-living systems.** • Diagram and describe the N, C, O and H_2O cycles. • Describe the importance of the N, C, O and H_2O cycles to life on this planet. Examples: water cycle including evaporation, cloud formation, condensation.
(Application)	**9-12.E.1.2. Students are able to describe how atmospheric chemistry may affect global climate.** **Examples**: Greenhouse Effect, ozone depletion, ocean's effects on weather
(Analysis)	**9-12.E.1.3. Students are able to assess how human activity has changed the land, ocean, and atmosphere of Earth.** **Examples**: forest cover, chemical usage, farming, urban sprawl, grazing

Indicator 2: Analyze essential principles and ideas about the composition and structure of the universe.

Bloom's Taxonomy Level	Standard, Supporting Skills, and Examples
(Comprehension)	**9-12.E.2.1. Students are able to recognize how Newtonian mechanics can be applied to the study of the motions of the solar system.** • Given a set of possible explanations of orbital motion

	(revolution), identify those that make use of gravitational forces and inertia.

Core High School Earth/Space Science
Performance Descriptors

Advanced	**High school students performing at the advanced level:** • predict the effect of an interruption in a given cycles; • predict how human activity may change the land, ocean, and atmosphere of Earth.
Proficient	**High school students performing at the proficient level:** • explain how H_20, N, C, and O cycle between living and non-living systems; • recognize how Newtonian mechanics can be applied to the study of the motions of the solar system; • describe how various factors may affect global climate; • explain how human activity changes the land, ocean, and atmosphere of Earth.
Basic	**High school students performing at the basic level:** • given pictorial representations of the H_20 and C cycles, explain how elements and compounds move between living and nonliving systems; • identify the forces that cause motion in the solar system; • describe one factor that may affect global climate; • give an example of human activity that changes the land, ocean, or atmosphere of Earth.

Core High School Science, Technology, Environment, and Society
Standards, Supporting Skills, and Examples

Indicator 1: Analyze various implications/effects of scientific advancement within the environment and society.

Bloom's Taxonomy Level	Standard, Supporting Skills, and Examples
(Application)	**9-12.S.1.1. Students are able to explain ethical roles and responsibilities of scientists and scientific research.** **Examples:** Sharing of data Accuracy of data Acknowledgement of sources Following laws Animal research Human research Managing hazardous materials and wastes
(Evaluation)	**9-12.S.1.2. Students are able to evaluate and describe the impact of scientific discoveries on historical events and social, economic, and ethical issues.** **Examples**: cloning, stem cells, gene splicing, nuclear power, patenting new life forms, emerging diseases, AIDS, resistant forms of bacteria, biological and chemical weapons, global warming, and alternative fuels

Indicator 2: Analyze the relationships/interactions among science, technology, environment, and society.

Bloom's Taxonomy Level	Standard, Supporting Skills, and Examples
(Evaluation)	**9-12.S.2.1. Students are able to describe immediate and long-term consequences of potential solutions for technological issues.** **Examples**: environmental, communication, internet, entertainment, construction, manufacturing, power and transportation, energy sources, health technology, and biotechnology issues • Describe how the pertinent technological system operates. Example: waste management facility

(Analysis)	**9-12.S.2.2. Students are able to analyze factors that could limit technological design**. **Examples**: ethics, environmental impact, manufacturing processes, operation, maintenance, replacement, disposal, and liability
(Synthesis)	**9-12.S.2.3. Students are able to analyze and describe the benefits, limitations, cost, and consequences involved in using, conserving, or recycling resources.** **Examples**: mining, agriculture, medicine, school science labs, forestry, energy, disposable diapers, computers, tires

Core High School Science Technology, Environment, and Society
Performance Descriptors

Advanced	**High school students performing at the advanced level:** • modify a technology taking into consideration limiting factors of design; • given a narrative of a scientific discovery, defend a position on the impact of the ethical issues.
Proficient	**High school students performing at the proficient level:** • given a narrative of a scientific discovery, identify and evaluate the immediate and long-term consequences of scientific issues; • identify and explain ethical roles and responsibilities of scientists conducting a given research project.; • evaluate factors that could limit technological design; • given a narrative description of a resource, analyze and describe the benefits, limitations, cost, and consequences involved in its use, conservation, or recycling.
Basic	**High school students performing at the basic level:** • given a narrative of a scientific discovery, identify the immediate consequences of scientific issues; • identify ethical roles and responsibilities concerning a given research project; • identify factors that could limit technological design; • given a narrative description of a resource, describe a benefit and limitation involved in its use, conservation, or recycling.

Advanced High School Nature of Science
Standards, Supporting Skills, and Examples

Indicator 1: Understand the nature and origin of scientific knowledge.

Note: These skills are initially mastered in the high school core standards. Teachers and students should continue to apply them in advanced standards to the study of science content.

Indicator 2: Apply the skills necessary to conduct scientific investigations.

Bloom's Taxonomy Level	Standard, Supporting Skills, and Examples
(Synthesis)	**9-12.N.2.1A. Students are able to manipulate multiple variables with repeated trials.** • Use a control and change one variable at a time. Examples: gas laws, seed germination and plant growth, Newton's Second Law
(Evaluation)	**9-12.N.2.2A. Students are able to use statistical analysis of data to evaluate the validity of results.** • Use correlation coefficient with graphs. Examples: chi-squared value in genetics, determination of absolute zero, verify concentration of an unknown solution
(Analysis)	**9-12.N.2.3A. Students are able to demonstrate correct precision in measurements and calculations.** • Use significant digits to illustrate precision in measurement. • Factor label conversion, scientific notation.

Advanced High School Physical Science
Standards, Supporting Skills, and Examples

Indicator 1: Describe structures and properties of, and changes in, matter.

Bloom's Taxonomy Level	Standard, Supporting Skills, and Examples
(Analysis)	**9-12.P.1.1A. Students are able to distinguish between the changing models of the atom using the historical experimental evidence.** **Examples**: Dalton, Thompson, Rutherford, Bohr, wave-mechanical models
(Synthesis)	**9-12.P.1.2A. Students are able to predict electron configuration, ion formation, reactivity, compound formation, periodic trends, and types of compounds formed based on location on the Periodic Table.** **Examples**: periodic trends including ionization, energy, electronegativity, atomic and ionic size, and shielding effect.
(Synthesis)	**9-12.P.1.3A. Students are able to identify five basic types of chemical reactions and predict the products.** • Single replacement, double replacement, synthesis, decomposition, and combustion reactions • Describe the properties and interactions of acids, bases, and salts. • Calculate pH, pOH, $[H_3O^+]$, $[OH^-]$. • Distinguish between Arrhenius, Bronsted-Lowry, and Lewis definitions of acids and bases.
(Synthesis)	**9-12.P.1.4A. Students are able to describe factors that affect solution interactions.** • Calculate concentration of solutions. • "Like dissolves like" • Vander Waal's forces

(Application)	**9-12.P.1.5A. Students are able to examine energy transfer as matter changes.** **Examples**: Determine ΔH, ΔG, ΔS for thermo-chemical equations. Calculate energy involved in phase changes. Compare the specific heats of various substances. • Describe physical and chemical processes that result in endothermic and exothermic changes. • Describe energy transfer as matter changes from one phase to another.
(Application)	**9-12.P.1.6A. Students are able to perform stoichiometric calculations.** • Convert between moles, mass, particles, volume. • Calculate empirical and molecular formulas from mass percents. • Determine limiting and excess reactants and percent yield in chemical reactions.
(Application)	**9-12.P.1.7A. Students are able to apply the kinetic molecular theory to solve quantitative problems involving pressure, volume, temperature, and number of moles of gas.** • Apply Boyle's Law, Charles' Law, Gay-Lussac's Law, Combined Gas Law, and Ideal Gas Law.
(Synthesis)	**9-12.P.1.8A. Students are able to use models to make predictions about molecular structure, chemical bonds, chemical reactivity, and polarity of molecules.** • Create Lewis structures for molecules and polyatomic ions. • Determine molecular shape using VSEPR theory. • Determine the polarity of a molecule.
(Analysis)	**9-12.P.1.9A. Students are able to describe the characteristics of equilibria.** • Apply LeChatelier's principle to equilibrium reactions. • Identify factors that drive reactions toward completion. • Calculate K_{eq} values for equilibrium reactions.

Indicator 2: Analyze forces, their forms, and their effects on motions.

Bloom's Taxonomy Level	Standard, Supporting Skills, and Examples
(Synthesis)	**9-12.P.2.1A. Students are able to solve vector problems graphically and analytically.** • Define and manipulate vectors and scalars. • Determine if an object is in equilibrium and distinguish among stable, neutral, and unstable equilibria. Examples: center of mass, torque
(Analysis)	**9-12.P.2.2A. Students are able to relate gravitational or centripetal force to projectile or uniform circular motion.** • Analyze and graph projectile motion.

Indicator 3: Analyze interactions of energy and matter.

Bloom's Taxonomy Level	Standard, Supporting Skills, and Examples
(Synthesis)	**9-12.P.3.1A. Students are able to explain wave behavior in the fundamental processes of reflection, refraction, diffraction, interference, resonance, and image formation.** • Construct ray diagrams to show the relationship between image and focal point. • Compare properties of images (real vs virtual). • Identify situations when diffraction occurs. • Identify conditions necessary for refraction to occur.
(Application)	**9-12.P.3.2A. Students are able to describe the relationship between charged particles, static electricity, and electric fields.** • Use Coulomb's Law to calculate forces. • Explain methods of transferring charge. Examples: induction, conduction, friction, electron guns • Describe the direction and general shape of electric fields.

(Analysis)	**9-12.P.3.3A. Students are able to describe the relationship between changing magnetic and electric fields.** • Explain the properties of magnetic fields. • Describe how electric and magnetic fields can induce each other.

Advanced High School Life Science
Standards, Supporting Skills, and Examples

Indicator 1: Understand the fundamental structures, functions, classifications, and mechanisms found in living things.

Bloom's Taxonomy Level	Standard, Supporting Skills, and Examples
(Synthesis)	**9-12.L.1.1A. Students are able to explain the physical and chemical processes of photosynthesis and cell respiration and their importance to plant and animal life.** **Examples**: photosystems, photophosphorylation, Calvin Cycle and Krebs Cycle
(Synthesis)	**9-12.L.1.2A. Students are able to describe how living systems use biofeedback mechanisms to maintain homeostasis.** **Examples**: endocrine, nervous, immune
(Synthesis)	**9-12.L.1.3A. Students are able to explain how gene expression regulates cell growth and differentiation.** **Examples:** Tissue formation Development of new cells from original stem cells
(Application)	**9-12.L.1.4A. Students are able to identify factors that change the rates of enzyme catalyzed reactions.** **Examples**: inhibitors, co-enzymes, ph balance, environment
(Analysis)	**9-12.L.1.5A. Students are able to classify organisms using characteristics and evolutionary relationships of domains.** **Examples:** eubacteria, archaebacteria, and eukaryotes

Indicator 2: Analyze various patterns and products of natural and induced biological change.

Bloom's Taxonomy Level	Standard, Supporting Skills, and Examples
(Synthesis)	**9-12.L.2.1A. Students are able to predict the results of complex inheritance patterns involving multiple alleles and genes.** **Examples**: human skin color, polygenic inheritance • Relate crossing over to genetic variation. • Evaluate changes in gene frequencies in populations to

	see if Hardy-Weinberg equilibrium exists or evolution has occurred.

Indicator 3: Analyze how organisms are linked to one another and the environment.

Bloom's Taxonomy Level	Standard, Supporting Skills, and Examples
(Synthesis)	**9-12.L.3.1A. Students are able to relate genetic, instinct, and behavior patterns to biodiversity and survival of species.** • Compare and contrast learned behavior vs instinct. Example: nature vs nurture • Relate the introduction of non-native species to the disruption of an ecosystem. Examples: Asian lady beetle, Asian carp, zebra mussels, Eurasian watermilfoil, salt cedar

Advanced High School Earth/Space Science
Standards, Supporting Skills, and Examples

Indicator 1: Analyze the various structures and processes of the Earth system.

Bloom's Taxonomy Level	Standard, Supporting Skills, and Examples
(Application)	**9-12.E.1.1A. Students are able to explain how elements and compounds cycle between living and non-living systems.** • Diagram and describe the P, S, and Ca cycles.
(Analysis)	**9-12.E.1.2A. Students are able to compare, quantitatively and qualitatively, methods used to determine geological time.** **Examples**: fossil record, radioactive decay, tree rings, geologic stratification, South Dakota geology • Construct a geologic time scale over the past 4.8 billion years.

Indicator 2: Analyze essential principles and ideas about the composition and structure of the universe.

Bloom's Taxonomy Level	Standard, Supporting Skills, and Examples
(Analysis)	**9-12.E.2.1A. Students are able to describe the evidence supporting the Big Bang theory.** • Describe the four fundamental forces. • Describe the organization of the solar system, the Milky Way galaxy, and the universe of galaxies. • Examine the changing model of the universe using historical experimental evidence.
(Analysis)	**9-12.E.2.2A. Students are able to describe the physical and nuclear dynamics involved in the formation, evolution, and death of a star.** • Use the H-R diagram to determine the life stage of a star. • Discuss how gravitational forces and the products of nuclear fusion reactions affect the dynamics of a star.

(Application)	**9-12.E.2.3A. Students are able to describe various ways data about the universe is collected.** • Describe how information is collected from star light. Examples: star's mass, chemistry, intrinsic brightness, distance, speed, direction, and eventual fate • Describe the use of instruments to collect data. Examples: optical, radio, and x-ray telescopes, spectrometers, space probes, gamma ray detectors, remote sensing • Describe methods of measuring astronomical distance. Examples: parallax, light years, astronomical units

Advanced High School Science, Technology, Environment, and Society
Standards, Supporting Skills, and Examples

Note: All high school students are expected to master the indicators for this goal stated in the Core Standards above. Students will continue to apply them in advanced and elective coursework described for Physical, Life, and Earth/Space Science.

Indicator 1: Analyze various implications/effects of scientific advancement within the environment and society.

See note above.

Indicator 2: Analyze the relationships/interactions among science, technology, environment, and society.

See note above.

NATURE OF SCIENCE STANDARDS
9-12

Indicator 1: Understand the nature and origin of scientific knowledge.

Core HS Standards
9-12.N.1.1. (Evaluation) Evaluate a scientific discovery to determine and describe how societal, cultural, and personal beliefs influence scientific investigations and interpretations.
9-12.N.1.2. (Synthesis) Describe the role of observation and evidence in the development and modification of hypotheses, theories, and laws.

Indicator 2: Apply the skills necessary to conduct scientific investigations.

Note: These skills should be taught and practiced in grade-level study of Physical, Life, and Earth/Space Science although mastery is not expected at these grade levels.

Core HS Standards
9-12.N.2.1. (Synthesis) Apply science process skills to design and conduct student investigations**.**
9-12.N.2.2. (Application) Practice safe and effective laboratory techniques.
Advanced HS Standards
9-12.N.2.1A. (Synthesis) Manipulate multiple variables with repeated trials.
9-12.N.2.2A. (Evaluation) Use statistical analysis of data to evaluate the validity of results.
9-12.N.2.3A. (Analysis) Demonstrate correct precision in measurements and calculations.

PHYSICAL SCIENCE STANDARDS
9-12

Indicator 1: Describe structures and properties of, and changes in, matter.

Core HS Standards
9-12.P.1.1. (Analysis) Use the Periodic Table to determine the atomic structure of elements, valence number, family relationships, and regions (metals, nonmetals, and metalloids).
9-12.P.1.2. (Comprehension) Describe ways that atoms combine.
9-12.P.1.3. (Application) Predict whether reactions will speed up or slow down as conditions change.
9-12.P.1.4. (Application) Balance chemical equations by applying the Law of Conservation of Matter.
9-12.P.1.5. (Comprehension) Distinguish among chemical, physical, and nuclear changes.
Advanced HS Standards
9-12.P.1.1A. (Analysis) Distinguish between the changing models of the atom using the historical experimental evidence.
9-12.P.1.2A. (Synthesis) Predict electron configuration, ion formation, reactivity, compound formation, periodic trends, and types of compounds formed based on location on the Periodic Table.
9-12.P.1.3A. (Synthesis) Identify five basic types of chemical reactions and predict the products.
9-12.P.1.4A. (Synthesis) Describe factors that affect solution interactions.
9-12.P.1.5A. (Application) Examine energy transfer as matter changes.
9-12.P.1.6A. (Application) Perform stoichiometric calculations.
9-12.P.1.7A. (Application) Apply the kinetic molecular theory to solve quantitative problems involving pressure, volume, temperature, and number of

moles of gas.
9-12.P.1.8A. (Synthesis) Use models to make predictions about molecular structure, chemical bonds, chemical reactivity, and polarity of molecules.
9-12.P.1.9A. (Analysis) Describe the characteristics of equilibria.

Indicator 2: Analyze forces, their forms, and their effects on motions.

Core HS Standards
9-12.P.2.1. (Analysis) Apply concepts of distance and time to the quantitative relationships of motion using appropriate mathematical formulas, equations, and units.
9-12.P.2.2. (Application) Predict motion of an object using Newton's Laws.
9-12.P.2.3. (Application) Relate concepts of force, distance, and time to the quantitative relationships of work, energy, and power.
Advanced HS Standards
9-12.P.2.1A. (Synthesis) Solve vector problems graphically and analytically.
9-12.P.2.2A. (Analysis) Relate gravitational or centripetal force to projectile or uniform circular motion.

Indicator 3: Analyze interactions of energy and matter.

Core HS Standards
9-12.P.3.1. (Application) Describe the relationships among potential energy, kinetic energy, and work as applied to the Law of Conservation of Energy.
9-12.P.3.2. (Comprehension) Describe how characteristics of waves are related to one another.
9-12.P.3.3. (Application) Describe electrical effects in terms of motion and concentrations of charged particles.

Advanced HS Standards
9-12.P.3.1A. (Synthesis) Explain wave behavior in the fundamental processes of reflection, refraction, diffraction, interference, resonance, and image formation.
9-12.P.3.2A. (Application) Describe the relationship between charged particles, static electricity, and electric fields.
9-12.P.3.3A. (Analysis) Describe the relationship between changing magnetic and electric fields.

LIFE SCIENCE STANDARDS
9-12

Indicator 1: Understand the fundamental structures, functions, classifications, and mechanisms found in living things.

Core HS Standards
9-12.L.1.1. (Analysis) Relate cellular functions and processes to specialized structures within cells.
9-12.L.1.2. (Application) Classify organisms using characteristics and evolutionary relationship of major taxa.
9-12.L.1.3. (Analysis) Identify structures and function relationships within major taxa.
Advanced HS Standards
9-12.L.1.1A. (Synthesis) Explain the physical and chemical processes of photosynthesis and cell respiration and their importance to plant and animal life.
9-12.L.1.2A. (Synthesis) Describe how living systems use biofeedback mechanisms to maintain homeostasis.
9-12.L.1.3A. (Synthesis) Explain how gene expression regulates cell growth and differentiation.
9-12.L.1.4A. (Application) Identify factors that change the rates of enzyme catalyzed reactions.
9-12.L.1.5A. (Analysis) Classify organisms using characteristics and evolutionary relationships of domains.

Indicator 2: Analyze various patterns and products of natural and induced biological change.

Core HS Standards
9-12.L.2.1. (Application) Predict inheritance patterns using a single allele.

9-12.L.2.2. (Synthesis) Describe how genetic recombination, mutations, and natural selection lead to adaptations, evolution, extinction, or the emergence of new species.
Advanced HS Standards
9-12.L.2.1A. (Synthesis) Predict the results of complex inheritance patterns involving multiple alleles and genes.

Indicator 3: Analyze how organisms are linked to one another and the environment.

Core HS Standards
9-12.L.3.1. (Comprehension) Identify factors that can cause changes in stability of populations, communities, and ecosystems.
Advanced HS Standards
9-12.L.3.1. (Synthesis) Relate genetic, instinct, and behavior patterns to biodiversity and survival of species.

EARTH/SPACE SCIENCE STANDARDS
9-12

Indicator 1: Analyze the various structures and processes of the Earth system.

Core HS Standards
9-12.E.1.1. (Comprehension) Explain how elements and compounds cycle between living and non-living systems.
9-12.E.1.2. (Application) Describe how atmospheric chemistry may affect global climate.
9-12.E.1.3. (Analysis) Assess how human activity has changed the land, ocean, and atmosphere of Earth.
Advanced HS Standards
9-12.E.1.1A (Application) Explain how elements and compounds cycle between living and non-living systems.
9-12.E.1.2A. (Analysis) Compare, quantitatively and qualitatively, methods used to determine geological time.

Indicator 2: Analyze essential principles and ideas about the composition and structure of the universe.

Core HS Standards
9-12.E.2.1. (Comprehension) Recognize how Newtonian mechanics can be applied to the study of the motions of the solar system.
Advanced HS Standards
9-12.E.2.1A. (Analysis) Describe the evidence supporting the Big Bang theory.
9-12.E.2.2A. (Analysis) Describe the physical and nuclear dynamics involved in the formation, evolution, and death of a star.
9-12.E.2.3A. (Application) Describe various ways data about the universe is collected.

SCIENCE, TECHNOLOGY, ENVIRONMENT, AND SOCIETY STANDARDS 9-12

Indicator 1: Analyze various implications/effects of scientific advancement within the environment and society.

Core HS Standards
9-12.S.1.1. (Application) Explain ethical roles and responsibilities of scientists and scientific research.
9-12.S.1.2. (Evaluation) Evaluate and describe the impact of scientific discoveries on historical events and social, economic, and ethical issues.
Advanced HS Standards
See note below.

Indicator 2: Analyze the relationships/interactions among science, technology, environment, and society.

Core HS Standards
9-12.S.2.1. (Evaluation) Describe immediate and long-term consequences of potential solutions for technological issues.
9-12.S.2.2. (Analysis) Analyze factors that could limit technological design.
9-12.S.2.3. (Synthesis) Analyze and describe the benefits, limitations, cost, and consequences involved in using, conserving, or recycling resources.
Advanced HS Standards
See note below.

Note: All high school students are expected to master the indicators for this goal stated in the Core Standards above. Students will continue to apply them in advanced and elective coursework described for Physical, Life, and Earth/Space Science.

SOUTH DAKOTA SCIENCE STANDARDS GLOSSARY

Note: This glossary contains explanations that are not necessarily formal scientific definitions of terms used in the standards document.

ΔG Change in free energy, which is the quantity of energy related to the capacity of a system to do work. This can be used to predict spontaneity.

ΔH Change in enthalpy, which is heat energy released or absorbed when a physical or chemical change occurs at constant pressure.

ΔS Change in entropy or the change in a measure of the randomness or disorder of a system.

Abiotic Refers to absence of living organisms; non-living.

Acceleration Rate of change in velocity.

Acid Substance that produces hydrogen ions; has pH of less than 7.

Action-reaction pair Two forces that are equal in magnitude but opposite in direction and act on two different bodies. The reaction force is dependent on the action force.

Active transport An energy-utilizing mechanism by which a cell moves a substance across the cell membrane from a point of lower concentration to a point of higher concentration, against the diffusion gradient.

Adaptation (1) The change in a population or species over time; (2) in natural selection, a physical or behavioral characteristic of some organisms in a population that improves their chances for survival and reproduction in their environment compared with the chances of other organisms in the population.

ADP Adenosine diphosphate, a compound that has two phosphate groups. Combines with another phosphate group and energy to form ATP (adenosine triphosphate).

Air mass A large body of air with the uniform temperature and humidity of its source region.

Allele One of several possible forms of a gene, each affecting the hereditary trait somewhat differently.

Amplitude (1) In a wave, the distance from the rest position of a medium to either the crest or the trough; (2) the maximum change in the amount of a particular quantity from its equilibrium value in a wave or periodic motion. Examples of such quantities are position, pressure, or electric field intensity.

AMS American Meteorological Society - An organization whose membership promotes the development and dissemination of information and education on the atmospheric and related sciences. (Source: American Meteorological Society. (n.d.) Retrieved November 15, 2004, from http://www.ametsoc.org)

Anemometer An instrument that measures the force and direction of the wind. Also called a wind gauge.

Animalia A eukaryotic kingdom containing all animals.

Aquifer A body of rock that is sufficiently permeable to conduct groundwater and yield economically significant quantities of water to well and springs.

Archaeobacteria An evolutionary distinct group of bacteria that resemble true bacteria but differ biochemically and genetically and are found in diverse and sometimes extreme environments.

Arrhenius acid-base Chemical substances that increase the concentration of hydrogen ions (acid) or hydroxide ions (base) in aqueous solutions.

Asexual reproduction Production of offspring without the fusion of gametes.

Asteroids Small rocky objects in the solar system, mostly lying between the orbits of Mars and Jupiter, ranging in size from small dust particles up to around 1,000 kilometers across.

Atmosphere The mixture of gases and particles surrounding the Earth and other planets.

Atom The smallest part of an element which still has the properties of that element.

ATP Adenosine triphosphate, a compound that has three phosphate groups and is used by cells to store energy.

Attribute A quality, property, or characteristic of somebody or something.

Big Bang Theory A cosmological model, based on Einstein's general theory of relativity, in which the universe was compressed to infinite density approximately 15-20 billion years ago and has been expanding ever since.

Binary compounds Two different elements chemically bonded together.

Biogeochemical cycles A circuit where a nutrient moves back and forth between living and nonliving components of ecosystems.

Biome A region which has distinct types of organisms, substrates, and climate, all interacting to produce a large, distinct, and complex biotic community.

Biosphere The life zone of the Earth.

Biotechnology A set of biological techniques developed through basic research and now applied to research and product development.

Biotic Pertaining to life or organisms.

Bohr model A model of the distribution of electrons in an atom based on the assumption that the electron in a hydrogen atom is in one of a number of circular orbits.

Boiling point The temperature at which the transition from the liquid to the gas phase occurs in a pure substance at a fixed pressure.

Bronsted-Lowry Acid A proton donor.

Bronsted-Lowry Base A proton acceptor.

Camouflage The adaptive characteristic that organisms use to blend into their environment in order to avoid being seen by predators or prey, especially coloration.

Casting To cause to fall onto or over something or in a certain direction, as if by throwing, e.g., candles casting light.

Catalyst A substance that increases the rate of a chemical reaction without being changed itself.

Celestial body Natural objects in space constituting a unit of astronomical study (sun, moon, stars).

Cell The basic structural and functional unit of all organisms.

Cell membrane Selectively permeable boundary of a cell.

Cell wall Semi-rigid permeable structure surrounding the cell membrane in certain organisms.

Centripetal force The force that is directed toward the center of a circle which is necessary to keep a body moving in the circle. The reaction to this force, which acts on another body, is called centrifugal force. Fc=mv2/r

Charged particle An electron, proton, or ion.

Chemical change A change in which different substances with different properties are formed; also called a chemical reaction.

Chemical energy Energy stored or released in chemical bonds.

Chemical property A description of how one substance reacts in the presence of another substance.

Chlorophyll Photoreactive pigments found in photosynthetic organisms.

Chloroplasts Organelles in some organisms responsible for energy production.

Circuit A closed path through which electrons flow.

Circulatory system Pertaining to the heart, blood, and lymph vessels and the circulation of blood and lymph; transports materials.

Class A taxonomic group containing one or more orders.

Classify To assign things or people to classes or groups.

Cleavage The tendency of a rock or mineral to break along planes determined by the crystal structure always parallel to a possible face.

Climate The average weather conditions of an area over a long period of time, i.e. 30 years.

Cloning The process of making genetically similar copies.

Co-dominance Said of trait where no dominance is shown; results in a blending of traits.

Comets Small bodies in orbit around the Sun that are composed of rock and ice.

Comparative anatomy Investigates the inherited similarities and differences among organisms in bone structure and in other parts of the body.

Compare To examine in order to note the similarities or differences of.

Complex machine Machine made of many simple and compound machines.

Component An element of a system.

Compound A chemical combination of two or more different elements (atoms).

Compound machine Machine made of two or more simple machines.

Compound microscope Light microscope that has two lens systems: the objective and the eyepiece.

Concentration A quantitative measurement of the amount of solute dissolved in a given amount of solvent.

Condensation The change of a substance from a vapor to a liquid.

Conduction Transfer of energy through the collision of molecules.

Conductor Material through which electric current passes.

Conservation of Matter (Law of) A fundamental principle of classical physics that states matter cannot be created or destroyed in an isolated system.

Constellation A group of stars interpreted as forming configurations.

Controlled variable A group, individual, or parameter that serves as a standard in an experiment.

Convection current Current caused by the expansion of a liquid or a gas as the temperature rises.

Convection Transfer of energy through the movement of molecules from one place to another.

Coriolis Effect Force due to the Earth's rotation, capable of generating currents. It causes moving bodies to be deflected to the right in the Northern Hemisphere and to the left in the Southern Hemisphere.

Coulomb's Law of Electrostatics A way of predicting the amount and direction of the force between two point charges surrounded by a medium. F = -q1q2/er2, in which q is the charge, r is the distance between the centers of the charges, and e is the dielectric constant of the medium.

Covalent bonding Bonding of atoms by sharing electrons.

Covalent compounds Substances consisting of atoms that share pairs of electrons with each other.

Current (1) The quantity of electrical charge which flows past a point in a given time; (2) ocean water moving in streams.

Cytoplasm The region between the nuclear membrane and the cell membrane.

Data Information, often in the form of facts or figures obtained from experiments or surveys, used as a basis for making calculations or drawing conclusions.

Decomposition reactions The chemical reaction when one substance breaks down into simpler substances.

Dehydration synthesis Enzyme controlled reaction in which substrates are joined together to form one larger substrate by the removal of water.

Density Ratio of the mass per unit of volume. (D=m/v)

Deposition The natural process of depositing materials in layers.

Diagram A chart or graph.

Dichotomous key An identification key that contains pairs of contrasting descriptions, used to identify and classify organisms.

Differentiation Process by which cells specialize and develop into a specific type of cell.

Diffraction The redistribution or spreading of waves in space due to the presence of an intervening object.

Diffusion The movement of particles from an area of higher concentration to an area of lower concentration.

Digestive system System of the body that breaks down food so that it can be used by an organism.

Displacement reaction An atom or molecule replaces another in a compound.

Dissolve To cause to pass into solution.

DNA Deoxyribonucleic acid. DNA molecules carry the genetic information necessary for the structure and function of cells, thereby controlling inheritance.

Doppler effect The apparent change in frequency of sound or light caused by the motion of the source, observer, or both.

Dormancy/dormant In an inactive state, when growth and development slow or cease, in order to survive adverse environmental conditions.

Double displacement reaction The chemical reaction that occurs when the positive ion of one compound replaces the positive ions of another.

Dynamic Characterized by continuous change or activity.

Eclipse The total or partial obscuring of one celestial body by another.

Ecosystem An organization and interaction of a community of organisms with their physical environment.

Ectotherm Organism that is not capable of maintaining its own body heat.

El Nino Upwelling of warm water in the Pacific Ocean characterized by shifts in "normal" weather patterns.

Electromagnet Magnet made from a current-carrying wire.

Electromagnetic Of or caused by a mutual interaction of electric and magnetic fields.

Electromagnetic radiation Radiation consisting of electric and magnetic waves that travel at the speed of light. Examples: visible light, radio waves, gamma rays, x-rays.

Electromagnetic spectrum Range in wavelengths from longest radio to shortest cosmic including visible spectrum.

Electron configuration The arrangement of electrons in an atom.

Electron The particle of an atom which has a negative charge; found outside the nucleus.

Element Matter made up of only one kind of atom.

Empirical formula The symbols for the elements combined in a compound with subscripts showing the smallest whole-number mole ratio of the different atoms in the compound.

Endangered species A species of animal, plant, or other organism, whose numbers are so few, or declining so quickly, that it may soon become extinct.

Endocrine system A system of ductless glands that regulates bodily functions via hormones secreted into the bloodstream.

Endoplasmic reticulum A system of bi-layered membranes that transport and assist in protein synthesis within eukaryotic cells.

Endotherm Organisms that are capable of maintaining their body temperature above the temperature of their environment.

Endothermic A reaction that absorbs energy. The product is in a higher energy state than the reactants.

Energy The capacity to do work.

Energy pyramid Diagram showing the decrease of energy through a food chain.

Environment The sum of all abiotic and biotic factors that act upon an organism or an ecological community and ultimately determine its form and survival.

Equilibria The rate of forward chemical reaction is equal to the rate of the reverse chemical reaction.

Equinox The two instances of the year in which day and night are equal.

Erosion Wearing away of the land by the action of water, ice, or wind.

Eubacteria One of the three superkingdoms or domains of life. Organisms are typically unicellular, prokaryotic, and mainly heterotrophic.

Eukaryotes Organisms whose cells have a nucleus enclosed by a membrane.

Evaporation Change of state from a liquid to a vapor.

Evolution Inheritable changes in a population spread over many generations. Can be precisely defined as any change in the frequency of alleles within a gene pool from one generation to the next.

Excretory system A system that removes wastes from an organism.

Exothermic Release of energy.

Experimental error A measure of the variation which exists among data.

Explore To investigate; examine.

Extinct Having no members of the species or family in existence.

Extinction The elimination of an entire species.

Fact A statement or assertion of verifiable information.

Family (1) A taxonomic group containing one or more genera; (2) a group of elements with similar properties found in a vertical column on the Periodic Table.

Flexibility Capable of being bent or flexed; pliable. Objects that are bendy, soft, smooshy, and rubbery are flexible.

Fluorescence Emission of secondary light generated by excitation by a photon.

Force (1) That which causes or prevents changes of either velocity or shape of a body; (2) a push or pull one body exerts on another.

Formula Abbreviation for a compound.

Fossils Inorganic remains, traces, or imprint of an organism that has been preserved since sometime in the geologic past.

Fracture A break other than along a cleavage plane.

Frequency The number of waves per second.

Friction The force that opposes motion between two surfaces that are touching each other.

Front The atmospheric phenomenon created at the boundary between two different air masses.

Fundamental forces The four known forces which influence all matter in the universe; they include electromagnetic force, strong force, weak force, and gravitational force.

Fungi A kingdom of eukaryotic organisms that include yeasts, molds, smuts, and mushrooms.

Galaxy A large group of stars, gas, and dust held together by gravity.

Gamete A sex cell. (See Germ cell)

Gamma ray detectors Instruments that detect electromagnetic radiation with wavelengths shorter than approximately 1 Angstrom.

Gas A state of matter with indefinite shape and volume.

Gene splicing The process of producing altered DNA, usually by breaking a DNA molecule and inserting new genes.

Genealogy Study of one's ancestry; summary history or table of a person's ancestry.

Genetic recombination A series of techniques in which DNA fragments are linked to self-replicating forms of DNA to create recombinant DNA molecules. These molecules in turn are replicated in a host cell to create clones of the inserted segments.

Genus Taxonomic group containing one or more species.

Geologic stratification The building up of layers of deposits in the Earth's crust.

Geologic time The period of time extending from the formation of the earth to the present.

Geological Features Features of the earth such as mountains, valleys, plains, oceans.

Geospatial technology Technology that typically includes a GIS (geographic information system) and GPS (global positioning system) and remote sensing.

Germ cells Collective term for cells in the reproductive organs of multicellular organisms that divide by meiosis (sex cell formation) to produce gametes (sex cells).

Germination When a seed sprouts.

Gravitational force The pull that makes all bodies in the universe tend to move toward each other due to their masses.

Greenhouse effect An increase in the warming effects of infrared radiation absorption brought about by an increase in levels of carbon dioxide and other greenhouse gases in the atmosphere.

Habitat The place or environment where a plant or animal naturally or normally lives and grows.

Hardy-Weinberg equilibrium Allele frequencies in a population tend to remain the same from generation to generation unless acted on by outside influences.

Hibernation To be in a sleeplike dormant state over the winter while living off the reserves of body fat, with a decrease in body temperature and pulse rate and slower metabolism.

Hierarchical A ranking from the most general to the most specific.

High pressure Air mass of higher than normal pressure.

Homeostasis (1) The maintenance of a stable internal environment in an organism despite changes in the external environment; (2) regulation of a factor that attempts to keep that factor at an equilibrium.

Hormone A chemical substance produced in the body by a gland, which has a specific regulatory effect on the activity of other cells.

HR diagram (Hertzsprung/Russell diagram) shows the relationship of a star's color, temperature, and brightness.

Humidity Water vapor in the air.

Hybrid automobile One that uses both gasoline and an alternative fuel source.

Hybrid Offspring of genetically different parents. (e.g. Tt)

Hydrolysis Enzyme controlled reaction in which a substrate, with the addition of water, is separated into two substrates.

Hydrosphere The water portion of the earth which contains the oceans, seas, lakes, and rivers.

Hypothesis (1) A statement that suggests an explanation for an observation or an answer to a scientific problem and can be tested experimentally; (2) a proposed explanation of a phenomenon.

Image formation The process of bringing waves together in such a way as to produce a likeness of the source of the waves. Lenses or mirrors are used to do this. A real image can be projected onto a screen and is inverted; a virtual image cannot be projected onto a screen.

Immune system The system which protects the body from foreign substances and pathogenic organisms.

Inclined plane Simple machine used to move objects on a slope.

Inertia A property of all matter, representing the resistance to any change in its state of motion.

Inference A logical conclusion drawn from the available evidence and prior knowledge.

Inhibitors A substance that retards or stops a chemical reaction.

Insulator Material through which electric current does not easily pass.

Integumentary system The skin and its accessory structures.

Intensity In sound waves, the amount of energy in each wave.

Interaction The way one object relates to another.

Interference The mutual effect of several waves by which they reinforce or neutralize each other.

Interrelationships To bring into mutual relation.

Invertebrate Organism that does not possess a backbone.

Ion An atom or molecule that has gained or lost one or more electrons and has a negative or positive charge.

Ionic bonding The combining of atoms by losing or gaining electrons.

Ionic compound A compound containing a bond that is formed between oppositely charged ions.

Keq A constant, characteristic for each chemical reaction; relates the specific concentrations of all reactants and products at equilibrium at a given temperature and pressure.

Kinetic energy The amount of work that a system can do because of its motion. Ek = mv2/2

Kinetic molecular theory Explains the properties of gases in terms of energy, size, and motion.

Kingdom The broadest or most generalized division of biological classification.

Krebs Cycle Part of aerobic respiration, also called the citric acid cycle.

KWL chart What you know, what you want to know, and what you learned.

Law A generalization that describes recurring facts or events in nature.

Law of Conservation of Energy The observed fact that in any chemical or physical process, energy is neither created nor destroyed.

Law of Conservation of Matter The observed fact that when two or more elements react to produce a compound, the total mass of the compound is the sum of the masses of the individual elements.

LeChatelier's principle If a system at equilibrium is disturbed by applying stress, the system will adjust in such a way as to counter the stress.

Lewis Acid-base An atom, ion, or molecule that accepts an electron pair (acid) or donates an electron pair (base) to form a covalent bond.

Lewis structures A formula in which atomic symbols represent nuclei and inner-shell electrons; dot-pairs or dashes between two atomic symbols represent electron pairs in covalent bonds, and dots adjacent to only one atomic symbol represent unshared electrons.

Life cycle The series of stages in form and functional activity through which an organism passes between successive recurrences of a specified primary stage.

Light energy The kind of energy that travels as visible radiation consisting of units called photons.

Linear In or like a line.

Liquid Matter with a definite volume and indefinite shape.

Lithosphere The solid part of the Earth; made up of the crust and upper mantle.

Longitudinal wave A periodic disturbance in which particles of the medium move parallel to the line of propagation of the disturbance.

Low pressure An air mass of lower than normal pressure; can bring precipitation.

Lunar eclipse Passing of the moon into the Earth’s shadow.

Luster The appearance of the reflection of light from a surface (e.g., mineral).

Lysosomes A cell organelle that contains digestive enzymes.

Magnet An object that is surrounded by a magnetic field and that has the property, either natural or induced, of attracting iron or steel.

Magnetic field The region around a magnet where the magnetic force acts.

Magnetism Properties or qualities of substance that have the ability to attract iron or steel.

Magnitude The property of relative size or extent.

Main block elements Groups 1-2 and 13-18 on the Periodic Table.

Manipulative variable Experimental factor which can be changed.

Mass The amount of matter an object contains, a measure of its inertia.

Matter Something which occupies space and has mass.

Mechanical advantage The ratio of the output force to the input force.

Mechanical energy A combination of potential and kinetic energy.

Meiosis The process in which chromosome numbers decrease to half the original number.

Melting point The temperature at which a solid substance changes to a liquid state.

Metallic characteristics See metals.

Metalloids Elements that have properties of both metals and non-metals.

Metals Elements that are good conductors, malleable, and ductile.

Meteorites Part of a meteoroid that survives travel through Earth's atmosphere to land on Earth.

Meteors A phenomenon (a streak of light) in the sky at night results when a meteroid enters the Earth's atmosphere and air friction causes the meteroid to melt, vaporize, or explode. Commonly called a "shooting star."

Meteroid Any solid object moving in inter-planetary space that is smaller than a planet or asteroid but larger than a molecule.

Migration Moving from one region to another.

Mineral A naturally occurring, inorganic solid that has a definite composition and certain physical properties.

Mitochondria Organelle of a cell where much of the respiration occurs.

Mitosis A nuclear division that maintains original chromosome number.

Mixture Two or more substances that are not chemically combined and can be separated by physical means.

Moh's scale A scratch test for determining comparative hardness using ten standard minerals, from talc to diamond.

Molecular formula A chemical formula that specifies the actual number and type of atoms in a compound.

Molecule Two or more elements covalently bonded.

Monera A kingdom of prokaryotic bacteria, blue-green algae, and various primitive organisms.

Motion A natural event that involves the change in the position or location of an object.

Muscular system The muscles, cells, tissues, and organs that affect movement, also responsible for heat production in many homeotherms.

Mutation The appearance, deletion, or modification of an allele on a chromosome, resulting in a genetic change.

NASA National Aeronautics and Space Administration

Natural resources A deposit of naturally occurring material such as coal, wood, or water.

Natural selection The theory that organisms with favorable variations are better able to survive and reproduce than organisms not as well adapted.

Nervous system (1) Nerve cells and tissues, including the brain, which transmit nerve impulses; (2) network of cells specialized to carry information to and from all parts of the body.

Neutrons The particle of an atom which has a neutral charge.

Newtonian mechanics The science which deals with the effects of forces upon bodies or fluids at rest or in motion. It is based on the precepts of Sir Isaac Newton.

Niche The particular way in which a species functions in an ecosystem.

Nitrogen cycle The circulation of nitrogen through the soil, atmosphere, and organisms.

NOAA National Oceanic and Atmospheric Administration (USA)

Non-metals Elements that lack the physical and chemical properties of metals.

Nonstandard unit Unit of measurement expressed in terms of objects (such as paper clips, sticks of gum, shoes, etc.).

Non-vascular plant Plants lacking xylem and phloem.

Nuclear change (reaction) A reaction which affects the nucleus of an atom.

Nuclear dynamics Changes to stars caused by the nuclear fusion reactions which fuel them; these include changes in density, energy, pressure, temperature, mass, and size.

Nucleus (1) Part of a eukaryotic cell that contains all of the genetic information needed to perform the functions; (2) part of an atom that contains protons and neutrons.

Observe Use the senses and instruments to gather information.

Ocean trench A rift or canyon in the ocean floor caused by plate tectonics.

Ohm's Law The relationship between current, resistance, and potential difference in an electrical circuit. $E = IR$, in which E is potential difference, I is current, and R is resistance.

Opacity The degree to which light travels through an object.

Opaque Impervious to light, so that images cannot be seen through it.

Orbit A path described by one body in its revolution around another (as by the Earth around the sun); one complete revolution of a body describing such a path.

Order Taxonomic group containing one or more families.

Organ A part of the body that consists of different types of tissue and that performs a particular function.

Organelle A cell structure that carries out specialized functions.

Organism An individual constituted to carry on the activities of life.

Orientation The way something is positioned in space.

Orifice An opening to a cavity or passage of the body; a hole or aperture (e.g., mouth).

Osmosis The diffusion of a solvent (e.g., water) through a semi-permeable membrane.

Ozone depletion A decrease in stratospheric ozone resulting from the use of ozone-depleting chemicals (chloroflorocarbons, methyl bromide, etc.).

Parallel circuit Circuit that connects several objects in a way that the current for each object has its own path.

Parasitism A relationship between a parasite and its host.

Particle Any very small part of matter.

Passive transport Transport of a substance through a cell membrane without cellular energy (e.g., diffusion).

Pedigree A diagram that shows the occurrence of a genetic trait in several generations of a family.

Periodic table A chart that organizes all known elements into a grid of rows and columns arranged by increasing number of protons.

Periodic trends Properties of elements that repeat when the elements are organized by increasing atomic number.

pH The negative of the common logarithm of the hydronium ion concentration of a solution.

Phase changes A change from one state (solid or liquid or gas) to another without a change in chemical composition.

Phosphorylation The process of going from a low energy phosphate to a higher energy phosphate (ADP to ATP) by the means of a proton-motive force.

Photosynthesis Synthesis of organic compounds (e.g., carbohydrates) using light energy, CO2, and water.

Phylum A major division of a biological kingdom, consisting of closely- related classes.

Physical attribute An attribute that can be described using senses.

Physical change A change in the form of a substance, but not in its chemical composition; chemical bonds are not broken in a physical change.

Physical properties Any characteristics of a material that can be observed without changing the identity of the material itself.

Pitch The high and low notes which result from the frequency of sound waves.

Plantae The kingdom of multi-cellular, eukaryotic, photosynthetic organisms.

Plate tectonics A model of the earth's dynamic motion characterized by a small number of semi-rigid plates which float on some viscous underlayer in the mantle.

Polarity (1) The orientation of the magnet or dry cell; (2) uneven distribution of charge on a covalent molecule.

Pollination The movement of pollen from a stamen to a pistil.

Polyatomic ion An ion made up of two or more atoms bonded together that acts as a single unit with a net charge.

Polygenic inheritance Traits that are controlled or influenced by several genes.

Potential difference The work needed to cause the motion of a unit electric charge between two points. V = W/q, in which V is potential difference, W is work, and q is charge.

Potential energy The energy an object has because of its composition or position.

Power The rate at which energy is transferred.

Precipitation A deposit on the Earth of hail, mist, rain, sleet, or snow.

Predict To state, tell about, or make known in advance, especially on the basis of special knowledge.

Prediction An indication in advance based on observation, experience, or scientific reason.

Principle A basic generalization that is accepted and that can be used as a basis for reasoning or conduct.

Probe Instrument used to take measurements supported by data-gathering software.

Projectile A propelled object that moves in a curved path.

Properties A characteristic trait or peculiarity, especially one serving to define or describe its possessor.

Protein synthesis The process by which the genetic code is used to produce proteins in a cell.

Protista The kingdom of mostly unicellular, eukaryotic organisms.

Prokaryote Organism that consists of a single cell that does not have membrane-bound organelles.

Proton The particle of an atom which has a positive charge.

Pseudo-science Any body of knowledge purported to be scientific or supported by science but which fails to comply with the scientific method.

Punnett square A grid system used in computing possible combinations of genes resulting from random fertilization.

Purebred Offspring of genetically pure parents that have identical alleles, e.g., tt, TT.

Qualitative Concerning the properties of matter than cannot be measured.

Quantitative Capable of being measured or expressed in numerical terms; concerning the amounts of matter present.

Radiation Transfer of energy in the form of waves.

Radioactive decay The spontaneous disintegration of a nucleus into a slightly lighter and more stable nucleus, accompanied by emission of particles, electromagnetic radiation, or both.

Reactivity Tendency of a substance to be involved in a chemical reaction.

Recycle To use again, especially to reprocess: recycle aluminum cans.

Reduce To bring down, as in extent, amount, or degree; diminish; use less.

Reflection (1) When a wave strikes an object and bounces off; (2) bouncing back of waves from a boundary of the medium.

Refraction The bending of waves. Change of direction of waves as they pass through the boundary between two media having different wave speeds.

Relative humidity The ratio of the amount of water vapor actually present in the air to the greatest amount possible at the same temperature.

Relative position The way in which an object is placed in relation to another object.

Remote sensing The measurement or acquisition of information about an object by a device not in physical contact with the object.

Renewable Relating to or being a commodity or resource, such as solar energy or firewood, that is inexhaustible or replaceable by new growth.

Replicable Capable of being reproduced or duplicated.

Replication Duplication, especially of DNA.

Reproductive system Cells, organs, and tissues involved in the production and maturation of gametes.

Repulsion A tendency of objects with like charges to increase their distance from one another.

Resistance The property of a conductor that opposes the passage of electric charge and produces heat. Resistance depends on the temperature, material, and dimensions of the conductor.

Resonance Vibration of a system at its natural frequency of vibration.

Respiration (1) The transformation of organic and inorganic molecules by organisms for the acquisition of energy and cellular building blocks; (2) the exchange of oxygen and carbon dioxide between cells and blood; (3) inhalation and exhalation of the lungs.

Respiratory system The group of organs responsible for carrying oxygen from the air to the bloodstream and for expelling the waste product carbon dioxide.

Reuse Use again.

Revolution Movement of an object around another object.

Ribosomes A cell organelle composed of RNA and protein; the site of protein synthesis.

Rock An aggregate of one or more minerals and/or organic materials.

Rock cycle An inter-related sequence of events by which rocks are initially formed, altered, and re-formed as a result as magmatism, erosion, sedimentation, and metamorphism.

Rotation One full spin of an object around an axis.

Salinity A measure of the quantity of dissolved salts in solutions (e.g., sea water).

Saturated A solution that contains the maximum solute at a given temperature and pressure.

Scientific law A rule that describes but does not explain a pattern in nature and predicts what will happen under specific conditions.

Seasons Changes in average temperature and length of day that result from the tilt of Earth's (or any planet's) axis with respect to the plane of its orbit.

Seismic waves Waves produced due to the vibration of the Earth before, during, and after an earthquake.

Series circuit A circuit that connects several objects one after another so that the current flows in a single path.

Sex-linked trait A trait that is determined by a gene found on the X chromosome.

Sexual reproduction Reproduction where male and female gametes fuse to form a zygote.

Simple dominance The principle of genetics stating that when organisms pure for contrasting traits are crossed, all of their offspring will show the dominant trait.

Simple machine Machine made of one or two parts.

Single displacement reaction The chemical reaction when one element replaces another element in a compound.

Skeletal system The system which forms the rigid framework of organisms.

Solar eclipse Passage of the moon between the sun and Earth causing the moon to cast a shadow.

Solid Material with a definite shape and volume.

Solstice The two instances during the year in which the noon sun is directly overhead at 23.5 degrees South.

Solubility Amount of a substance that will dissolve in a solvent at a given temperature.

Solute The substance that is dissolved to form a solution.

Solvent The substance that dissolves a solute to form a solution.

Somatic cells Body cells, excluding gametes.

Source The point or part of a system where energy or mass is added to the system.

Space probes A rocket-propelled guided missile that can escape the Earth's atmosphere; makes observations of the solar system that cannot be made by terrestrial observation.

Species A fundamental category of taxonomic classification, ranking below a genus or subgenus and consisting of related organisms capable of interbreeding and producing fertile offspring.

Specific gravity The ratio of the density of a substance to the density of water.

Specific heat The amount of heat energy required to increase the temperature of one gram of a substance one degree Celsius.

Spectrometers Instruments that produce a spectrum of the light emitted or reflected by an object and contain a scale so that the energies (or wavelengths) of the photons making up the spectrum can be measured.

Speed The rate of motion.

Spontaneous generation The hypothesis that living organisms can arise from nonliving matter.

Static electricity The net build-up of charges in an object.

Static In a fixed or stable condition.

Stem cell An undifferentiated cell from which specialized cells develop.

Stoichiometry The study of the quantitative relationships between the amounts of reactants and products formed during a chemical reaction.

Streak The color of a mineral in its powdered form.

Subatomic Constituents of the atom.

Substances A material of a particular kind.

Symbiotic relationship An interactive association between two or more species living together; may be helpful to one and harmful to the other, may be helpful to one and neither helpful nor harmful to the other, or may be beneficial to both.

Synthesis reaction The chemical reaction when two or more substances combine, forming another substance.

System A group of structurally or functionally related parts.

Taxa A classification group or entity (singular- taxon).

Taxonomy The science of naming and classifying organisms.

Technology The body of knowledge available to a society that is of use in fashioning implements, practicing manual arts and skills, and extracting or collecting materials.

Texture The appearance and feel of a surface (e.g., the smooth texture of rocks).

Theory An explanation for some phenomenon that is based on observation, experimentation, and reasoning.

Thermometer An instrument for measuring temperature.

Tides The periodic rising and falling of the ocean resulting from lunar and solar gravitational forces acting upon the rotating Earth.

Tissue An aggregate of cells having a similar structure and function.

Topographical maps Maps that show geographical features.

Trait A distinguishing characteristic or quality of an organism.

Transcription Process by which messenger RNA is made from DNA.

Transform To change markedly the appearance or form of.

Translation Process by which the ribosome, m-RNA, and the t-RNA with its amino acid come together to form a polypeptide.

Translucent Allowing light to pass through, but only diffusely, so that objects on the other side cannot be clearly distinguished.

Transparent Allowing light to pass through with little or no interruption or distortion so that objects on the other side can be clearly seen.

Transverse waves A periodic disturbance in which particles of the medium move perpendicular to the line of propagation of the disturbance.

Unsaturated Solution that contains less than the maximum amount of solute dissolved in a solution at a given temperature.

USGS United States Geological Survey. The mission of the U.S. Geological Survey is to provide geologic, topographic, and hydrologic information that contributes to the wise management of the Nation's natural resources.

Vacuoles An organelle that stores water and other materials.

Valence number The electrons in an atom's outermost orbitals; determines the chemical properties of an element.

Van der Waals forces Accounts for the intermolecular forces of attraction between molecules.

Vapor Pressure A force exerted by gaseous molecules which are in equilibrium with a liquid or solid.

Variable One of the factors that can be altered in an investigation; subject to variation; changeable.

Vascular plant Any plant containing xylem and phloem.

Vector A physical quantity that has both a magnitude and a direction.

Velocity The speed and direction of a body.

Vertebrate Organism that has a spinal column.

Vibration A continuing periodic oscillation relative to a fixed reference point; a single complete oscillation.

Viscous, viscosity Used to describe a fluid that has a relatively high resistance to flow.

Volume (1) The amount of space an object occupies; (2) loudness or softness of a sound.

VSEPR theory Repulsion between the sets of valence-level electrons surrounding an atom causes these sets to be oriented as far apart as possible.

Waning moon The decrease of the moon's illuminated visible surface.

Water Cycle The sequence of conditions through which water passes from vapor in the atmosphere through precipitation upon land or water surfaces and ultimately back into the atmosphere as a result of evaporation and transpiration -- called also hydrological cycle.

Wave A disturbance or oscillation described in general by its amplitude, velocity, frequency, and phase.

Wave length The distance between successive crests, or successive troughs.

Waxing moon The increase of the moon's illuminated visible surface.

Weather The state of the atmosphere at a given time with respect to heat or cold, wetness or dryness, calm or storm, clearness or cloudiness. Changes in the atmosphere.

Weathering Physical disintegration and chemical decomposition of organic and rocky material upon exposure to atmospheric agents.

Weight The measure of the gravitational force acting on an object.

Work (1) The transfer of energy through motion; (2) the result of a force acting against resistance to produce motion. $W = Fd \cos q$, in which q is the angle between the force and the direction that the system moves.

Xylem Vascular tissue in plants that transports water and minerals from roots to leaves.

Phloem Vascular tissue in plants that transports dissolved sugars.

Zygote A cell that results from the fusion of gametes.

APPENDIX A
More About the South Dakota Science Revision Committee Members

Mary E. Ball, 7th - 8th Grade Science Educator, Sioux Falls School District 49-5
District Science Curriculum Member

Barbara Boone-Graves, 7th Grade Science Teacher, Sioux Falls School District 49-5
National Science Teachers' Association, Member
South Dakota Science Teachers' Association, Member
District Science Curriculum, Member
NASA NEW Teacher, 2002

Christina F. Bosse, High School Science Teacher, Langford School District 45-2
South Dakota Science Teachers' Association, Member

Sara Bradfeldt-Waring, Bilingual Grant Coordinator, Sioux Falls School District 49-5
Dakota TESL President
National TESOL Member

Janet Briggs, Center for the Advancement of Math and Science Education, Black Hills State University
NSF Grant Manager and Science Outreach Coordinator

Carolyn Burns, High School Science Instructor, Watertown School District 14-4
Adjunct Professor, Mt. Marty College, Watertown Branch
South Dakota Science Teachers' Association, President 1998 - 2000
South Dakota Science Teachers' Association, Distinguished Service Award, 2000
South Dakota Academy of Science, Physical Science Teacher of the Year, 1999

Karen Byrd, Kindergarten Teacher, Kadoka Elementary School, Kakoka School District 35-1
K-12 Gifted Endorsement
Black Hills Science Teacher, Member
Outstanding Community Service Award (Masonic)
Service to Community Youth Award (Lions)
Teacher of the Year Nominee

Faydra Christensen, 4th Grade Teacher, Webster Elementary, Yankton School District 63-3
South Dakota Science Teachers' Association, Member
Delta Kappa Gamma
Who's Who Among American Teachers
Yankton Education Association/South Dakota Education Association Member
Yankton Reading Council

Science Curriculum Committee
District Wide Technology Committee

Kathy Christensen, 4th Grade Teacher, East Elementary, Spearfish School District 40-2
Master's Degree in Curriculum and Instruction in May 2003
Participated in the Fulbright Memorial Fund Master Teacher Program, 1999-2003
Active committee member of the K-12 Science Curriculum, 1975-Present
1996 Presidential Award for Excellence in Science
Spearfish Education Association/South Dakota Education Association Member
Lookout Reading Council, Member
Queen City Literacy Council, Member
Kappa Delta Pi, Member
Delta Kappa Gamma, Member
Philanthropic Education Organization Chapter N, Member

RoseMary Christenson, 8th Grade Earth Science Teacher, Brandon Valley School District 49-2
Brandon Valley Middle School Science Chairperson
Brandon Valley Teacher of the Year 2001
Who's Who in American Education
National Science Teachers' Association
South Dakota Middle Level Association
New Teacher Mentor

Michele Cork, 8th Grade Science Teacher, Sioux Falls School District 49-5
District Science Curriculum Committee Member
Who's Who in American Education
National Science Teachers' Association, Member

Julie Dahl, Center for the Advancement of Math and Science Education, Black Hills State University

Gay DeJong, 7th Grade Science Teacher, Sioux Falls School District 49-5
South Dakota Science Teachers' Association, Member
National Science Teachers' Association, Member

Mark Emry, 6th Grade Science Teacher, Sioux Falls School District 49-5 National Science Teachers' Association, Member

Ronald Frary, High School Science Teacher, Chamberlain School District 07-1
Who's Who in American Education
South Dakota Science Teachers' Association, Member

Tricia Gainey, 4th Grade Classroom Teacher, Meade School District 46-1
Northern Hills Reading Council, President
District Science Curriculum, Member

District Science Textbook Selection Committee
Black Hills Science Teacher (BLAHST), Member

Jon Gonsor, Science Instructor, T.F. Riggs High School, Pierre School District 32-2
National Honor Society "Teacher of the Year," T.F. Riggs High School
Pierre School District Professional Development Committee
Past President South Dakota Science Teachers' Association
Past Secretary South Dakota Science Teachers' Association
South Dakota Science Teachers' Association Service Award
Tandy Technology Scholars Outstanding Teacher
National Science Teachers' Association, Midwestern Area Convention Program Chairman
Who's Who In American Education
Past President Pierre Educational Association
Teacher of the Year Salem School District

Ken Graupmann, Science Teacher, Kadoka School District 35-1
Past President South Dakota Science Teachers' Association
Past President South Dakota Ornithologist Union
Past Chairman and Present Vice-chairman of the Jackson County Conservation District
1999 Estes/NSTA Space Teacher of the Year
South Dakota Science Teachers' Association
South Dakota Council of Teachers of Math
National Middle Level Science Teachers' Association
National Earth Science Teachers' Association
The Geological Society of America
The American Meteorological Society
National Science Teachers' Association, Middle Level Science Committee
National Science Teachers' Association, Science Scope Advisory Board and Manuscript Reviewer

Linda Heeren, 2nd Grade Teacher, Brandon Valley School District 49-2
Teacher of the Year Nominee, 1997 and 2001
New Teacher Mentor
Disney Hand Teacher Award Nominee, 2004-2005

Vennie Heibel, 8th Grade Science Teacher, Pierre Schools 32-2
Qwest Technology in Education Award Winner
South Dakota Science Teachers' Association, Presenter and Member
National Science Teachers' Association, Presenter and Member
Midwest Middle Level Educators' Association, Presenter and Member
District Curriculum Committee Member
District Staff Development Committee Member

Linda Johnson, 3rd – 4th Grade Special Education Teacher, Meade School District 46-1
District Special Education Curriculum Committee Member

Northern Hills Reading Council Chairperson
Who's Who in American Education

Donna Juffer-Williams, 7th Grade Life Science Instructor, Brandon Valley School District 49-2
Teacher of the Year Nominee, Brandon Valley School District
District Science Curriculum Member
New Teacher Mentor
South Dakota Science Teachers' Association, Member
National Science Teachers' Association, Member

Arne Lund, High School Science Teacher, Kadoka High School 35-1
South Dakota Science Teachers' Association, Member
Outstanding South Dakota Physical Science Teacher of the Year-2004
Capital Region Advisor for South Dakota Student Council Association
Student Council State Board-Advisors Representative-SDHSAA
Who's Who Among America's Teachers, Multiple Award Winner

Ramona Lundberg, 10th -12th Grade Science Teacher, Deuel School District 19-4
Presidential Award for Excellence in Mathematics and Science Teaching, 7-12 Science 2000
South Dakota Physical Science Teacher of the Year 2002
South Dakota Science Teachers' Association, Secretary 2002-present
South Dakota State Coordinator for Presidential Awards for Excellence in Science Teaching
National Science Education Leadership Association, Member

Jan Martin, Coordinator of Assessment and Evaluation, Todd County School District 66-1
National Science Teachers' Association, Member
American Educational Research Association, Member
Outstanding Research Paper, American Educational Research Association

Anita Miller, Middle School Science Teacher, Rapid City School District 51-4
District Science Curriculum
Revision Committee Member
National Science Teachers' Association, Member

Deb Nafziger, 6th Grade Teacher, Agar-Blunt-Onida School District 58-3

Sandy Nichols, 3rd Grade Teacher, Spearfish School District 40-2
2000 Spearfish Teacher of the Year
Who's Who Among America's Teachers
Master's Degree in Curriculum and Instruction 2002
Fulbright Memorial Fund Master Teacher Program 2002
District Science Curriculum Member

Linda O'Donnell, 7th – 8th Grade English and Science Teacher, 7th Grade Math Teacher, Lemmon School District 52-2
South Dakota Honored Women Educators, Member
South Dakota Science Teachers' Association, Member

Dr. Ben Sayler, Associate Professor of Physical Science and Mathematics and Director of the Center for the Advancement of Mathematics and Science Education, Black Hills State University.

Eileen Skyberg, 4th Grade Teacher, Brandon Valley School District 49–2
District Science Curriculum Member
Teacher of the Year Nominee
Who's Who in American Education

Cassie Soeffing, 6th Grade Classroom Teacher, Sioux Falls School District 49-5
District Science Curriculum Committee, Member
South Dakota Science Teachers' Association, Member
2004 Nominee for Presidential Award for Excellence in Mathematics and Science Teaching
2004 Bush Leadership Fellows program. Finalist.
2003, 2004 NASA Space Grant Fellow (SDSM&T)
2002 Toyota TAPESTRY Ambassador
2001 Eleanor Roosevelt Teacher Fellowship, American Association of University Women
2001 Toyota TAPESTRY
1998 Christa McAuliffe Fellowship, Council of Chief State School Officers
1997-2004 USGS EROS Data Center-Teacher Intern
1997 Pilot Teacher for (Upper Midwest Aerospace Consortium/Education Public Access Resource Center)
1996 US West Connecting Teachers with Technology Award

William Soeffing, PhD, Professor, Biology, University of Sioux Falls

James Stearns, High School Science, Math, and Computer Teacher, Groton Area School District 6-6
South Dakota Council of Teachers of Math, Member
South Dakota Science Teachers' Association, Member
South Dakota Science Teachers' Association, Newsletter, Co-editor
National Science Teachers' Association, Member

Sharla Steever, 3rd Grade Teacher, Hill City School District 51-2
National Board Certified Teacher in Middle Childhood (pending)
Mentor for teachers seeking National Board Certification
National Science Teachers' Association, Member
South Dakota Science Teachers' Association, Member

National Education Association, Member
South Dakota Education Association, Member

Sally Stoll, 7th Grade Science Teacher, Vermillion School District 13-1
2003 Presidential Award for Excellence in Mathematics and Science Teaching, 7-12 Science
National Science Teachers' Association, Member
South Dakota Science Teachers' Association, Member

Nancy Van Beek, Education Manager of the Washington Pavilion's Kirby Science Discovery Center
Iowa Department of Education Science Demonstration Site Teacher
Who's Who of American Teachers

Shirlee Weich, 2nd Grade Teacher, Plankinton School 1-1

Carolyn Westby, 1st - 3rd Grade Teacher, Holy Rosary School, Kranzburg, South Dakota

Pamela Zubke, 7th -12th Grade Science and Math Instructor, Waubay High School
South Dakota Science Teachers' Association, Newsletter Co-editor
National Science Teachers' Association, Member
District Curriculum Development Committee, Math Representative
Waubay Education Association, President

APPENDIX B
RESOURCES REFERENCED
BY THE SOUTH DAKOTA SCIENCE CONTENT
STANDARDS REVISION COMMITTEE

SD Content Standards for K-12 Science

South Dakota Science Standards, 1999

Other State Content Standards for K-12 Science

California State Science Content Standards: http://www.cde.ca.gov/be/st/ss/scmain.asp

***Kentucky State Science Content Standards*:** http://www.education.ky.gov

Massachusetts State Science Content Standards:
http://www.doe.mass.edu/frameworks/scitech/2001/

Professional Publications

National Science Content Standards:
http://www.nap.edu/readingroom/books/nses/html/6a.html

Science Framework for the 1996 and 2000 National Assessment of Educational Progress. Washington, DC: National Assessment Governing Board. (2000)
http://www.nagb.org/pubs/96-2000science/toc.html

APPENDIX C
Annotated List of South Dakota Science Resources

South Dakota Agriculture in the Classroom. (2004) www.sdagclassroom.org.

South Dakota Agriculture in the Classroom strives to help teachers and students understand how food and fiber are produced and that agriculture has an essential role in maintaining a strong economy. Agriculture in the Classroom is a nationwide effort to integrate information about agriculture into existing elementary curriculum. In South Dakota, Agriculture in the Classroom is funded in part by the SD Department of Agriculture, support from state commodity groups, agribusinesses, and individuals, all committed to educating youth about South Dakota's #1 industry - agriculture. For more information contact South Dakota Agriculture in the Classroom at 1-800-573-2482, email sdagclassroom@iw.net.

Science Framework for the 1996 and 2000 National Assessment of Educational Progress. Washington, DC: National Assessment Governing Board. (2000) http://www.nagb.org/pubs/96-2000science/toc.html

This document contains the framework and rationale for assessing science achievement of students throughout the United States in 1996 and 2000. It provides a general overview of the National Assessment of Educational Progress (NAEP), describes the NAEP Science Framework adopted by the National Assessment Governing Board (NAGB), and reviews the process by which the Framework was developed.

National Science Education Standards. Washington, DC: National Academy of Sciences. (1996)

The National Science Education Standards present a vision of a scientifically literate populace. They outline what students need to know, understand, and be able to do to be scientifically literate at different grade levels. They describe an educational system in which all students demonstrate high levels of performance, in which teachers are empowered to make the decisions essential for effective learning, in which interlocking communities of teachers and students are focused on learning science, and in which supportive educational programs and systems nurture achievement. The *Standards* point toward a future that is challenging but attainable--which is why they are written in the present tense.

Benchmarks for Science Literacy. American Association for the Advancement of Science (AAAS) New York: Oxford University Press. (1994) http://www.project2061.org/publications/bsl/default.htm

Benchmarks for Science Literacy specifies how students should progress toward science literacy by outlining learning goals to be targeted at certain grade levels. These learning goals, or benchmarks, are statements of what all students should know or be able to do in science, mathematics, and technology by the end of grades 2, 5, 8, and 12.

Atlas of Science Literacy. American Association for the Advancement of Science (AAAS), New York: Oxford University Press, 1999. http://www.project2061.org/publications/atlas/default.htm

AAAS Atlas for Science Literacy consists of 49 strand maps that describe a progression of ideas and skills. The maps are designed to show: 1) coherent patterns and connections among ideas and skills, 2) students' understanding over time that lead to science literacy, 3) reference for integrating topics in logical and useful ways, and 4) grade-level match for a more diagnostic approach of developing assessment items.

Making Sense of Secondary science: Research into Children's Ideas. Driver, R., Squires, A., Rushworth, P., & Wood-Robinson, V., London and New York: Routledge. (1994)

When children begin secondary school they already have knowledge and ideas about many aspects of the natural world from their experiences both in primary classes and outside school. These ideas contribute to subsequent learning and research has shown that teaching is unlikely to be effective unless it takes learners' perspectives into account.

Children's Ideas in Science. Driver, R., Guesne, E., and Tiberghien, A. (Eds.) Milton Keynes, United Kingdom: Open Press. (1995)

Many children have ideas/concepts that differ from standard accepted science. These concepts are often resistant to change and persist despite exposure through teaching to the 'correct' explanations. This book documents and explores the ideas of school students (aged 10-16) about a range of natural phenomena such as light, heat, force and motion, the structure of matter and electricity. It also examines how students' conceptions change and develop with teaching.

Vital Connections: Children, Science, and Books. Saul, W. and Jagusch, S.A. (Eds). Papers from a 1986 Symposium sponsored by the Children's Literature Center (Library of Congress). Portsmouth, NH: Heinemann. (1991)

Vital Connections is an outgrowth of a symposium sponsored by the Children's Literature Center of the Library of Congress to highlight issues surrounding the use of science trade books in classrooms and libraries. It includes essays for children by science writers, critical responses, and discussions of classroom and libraries, by editors, teachers, and educational researchers. The Authors section includes Patricia Lauber, Laurence Pringle, Seymour Simon, Vicki Cobb, Jean Craighead George, and Ira Flatow. One of the critical responses is an interview with Barbara Fenton, science book editor.

Taking the Plunge. How to Teach Primary Science More Effectively. Harlen, W. (Ed). Oxford: Heinemann Educational Books. (1998)

This book for primary teachers is designed to illustrate how they can teach science more effectively. Chapters deal with features of science instruction that are known to concern

many teachers. Topics include helping children make a start in primary school science; handling student questions; encouraging children to record their work; helping them to raise questions, to observe, to plan investigations, and to communicate; and taking into account children's own ideas.

The Teaching Of Science In Primary Schools (3rd Ed.) Harlen, W., London: David Foulton Publishers. (2000)

The overall aim of the book is to help teachers to develop children's understanding through enquiry. The topics covered include: how teachers can help children to construct ideas; the importance and meaning of progression in learning science; formative assessment as part of teaching and learning; the opportunities provided by using computers and ICT; making the best use of practical activities; the role of language and discussion; and the value of helping children to reflect on how they are approaching problems.

Teaching and Learning and Assessing Science 5–12 (3rd Ed.) Harlen, W. London: Paul Chapman. (2000)

The opening chapters show how children learn, and discuss the nature of the goals of teaching science to children aged 5 - 12. The author provides a theoretical rationale for why science should be taught in particular ways, and ideas and examples of how to do it. A key feature of Teaching and Learning and Assessing Science 5-12 is the attention given to assessment, particularly assessment that has a formative role in teaching and learning. Research shows that improving formative assessment can raise the standard of children's achievement.

The New Science Literacy: Using Language Skills To Help Students Learn Science. Thier, W. (with Daviss, B.) Portsmouth, NH: Heinemann. (2002)

Thier and Daviss provide clear guidance on linking science and language instruction to simultaneously strengthen students' mastery of both disciplines. Designed for science educators in grades four-through-ten, the manual contains specific strategies, techniques, sample classroom-based activities, and lists of student performance expectations to help educators fuse science and language experiences. The text seeks to enhance all aspects of literacy--reading, writing, speaking, listening, and media analysis--and places language literacy in the context of inquiry-based, activity-oriented science.

Science Workshop: Reading, Writing, and Thinking Like A Scientist (2nd Ed.). Reardon, J., Pearce, C., Dieckman, D. & Neutze, D., Portsmouth, NH: Heinemann. (2002)

Practical suggestions, strategies and materials. Living examples demonstrate how a science workshop fosters authentic inquiry across the curriculum, and supports a classroom where choice and interaction thrive. *Science Workshop* takes inquiry-based science to a level that empowers children to be scientists for the rest of their lives

Teaching Reading in Science. Barton, M. L., & Jordan, D. L. A supplement to teaching reading in the content areas: Teachers Manual (2nd Ed.). Aurora, CO: Mid-continent Research for Education and Learning. (2001)

This publication addresses both general reading skills and those specific skills needed for readers of science text.

The United States Geological Survey (USGS) National Center for Earth Resources Observation and Science: http://edc.usgs.gov

The EROS staff manages and distributes archived images to scientists, policy makers, and educators worldwide that use them in the study of natural hazards, environmental change, economic development, and conservation issues. Researchers at EROS also use powerful computer systems to process and analyze satellite data in new ways. Every advance enhances our understanding of the Earth, how it changes over time, and the implications of those changes for people and ecosystems worldwide.

Designing Mathematics or Science Curriculum Programs: A Guide for Using Mathematics and Science Education Standards. National Research Council (NRC). Washington, DC: National Academy Press. (1999)

With the publication of the National Science Education Standards and the National Council of Teachers of Mathematics Curriculum and Evaluation Standards for School Mathematics, a clear set of goals and guidelines for achieving literacy in mathematics and science was established. Designing Mathematics or Science Curriculum Programs has been developed to help state- and district-level education leaders create coherent, multi-year curriculum programs that provide students with opportunities to learn both mathematics and science in a connected and cumulative way throughout their schooling.