# Elementary Science

## *Core Curriculum*

## Working Draft

## for comment

THE UNIVERSITY OF THE STATE OF NEW YORK

THE STATE EDUCATION DEPARTMENT

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# Elementary Science

## *Core Curriculum*

# PREFACE

**Why is there a Core Curriculum?**
The *Elementary Science Core Curriculum* has been written to assist teachers and supervisors as they prepare curricula, instruction, and assessment for the elementary-level (grades K, 1, 2, 3, and 4) content and skills of Standards 1, 2, 4, 6, and 7 of the New York State *Learning Standards for Mathematics, Science, and Technology.*

**What is the Core Curriculum?**
The *Learning Standards for Mathematics, Science, and Technology* identifies Key Ideas and Performance Indicators. Key Ideas are broad, unifying, general statements of what students need to know. The Performance Indicators for each idea are statements of what students should be able to do to provide evidence that they understand the Key Ideas. As part of this continuum, this Core Curriculum guide presents Major Understandings that give more specific detail to the concepts underlying each Performance Indicator.

**Features:**

- This Core Curriculum is not a syllabus.
- The focus is on conceptual understanding in the guide and is consistent with the approaches in the *National Science Education Standards* and *Benchmarks for Science Literacy: Project 2061.*
- This is a guide for the preparation of elementary-level curriculum, instruction, and assessment, the beginning stage in a K-12 continuum of science education.
- This Core Curriculum specifically addresses only the content and skills to be tested by State examinations.

**Applications of the Core Curriculum:** This Core Curriculum reflects only a portion of the content to be covered in an elementary science program. It is expected that additional content will be supplied locally. This Core reflects the content that must be addressed at the elementary level. Content in this document, especially the Major Understandings, can appear on State examinations. A Core Curriculum allows teachers the flexibility and professional freedom to expand upon and develop instruction that addresses the New York State *Learning Standards for Mathematics, Science, and Technology* at the appropriate level for their students. Since this Core contains less than 100 % of the content, the time required to teach can vary with the needs of individual students (especially in terms of remediation or acceleration).

The elementary science program should emphasize a hands-on and minds-on approach to learning. Students learn effectively when they are actively engaged in the discovery process, often working in small groups. Experiences should provide students with opportunities to interact as directly as possible with the natural world in order to construct explanations about their world. This approach will allow students to practice problem-solving skills, develop positive science attitudes, learn new science content, and increase their scientific literacy.

Children's natural curiosity leads them to explore the natural world. They should be provided opportunities to have direct experience with common objects, materials, and living things in their environments. Less important is the memorization of specialized terminology and technical details. Good instruction focuses on understanding important relationships, processes, mechanisms, and applications of concepts. Future assessments will test students' ability to explain, analyze, and interpret scientific processes and phenomena more than their ability to recall specific facts. It is hoped that the general nature of these statements will encourage the teaching of science for understanding, instead of for memorization. Teachers are encouraged to help their students find concepts that interconnect many of the Key Ideas to each other.

It is hoped that the units designed using this Core Curriculum will prepare our students to explore the most important ideas about our physical setting and our living environment. Scientifically literate students understand the basic concepts and processes and can apply them in real-life situations. The science educators throughout New York State who collaborated on the writing of this guide believe that curricula based on this guide will contribute to the scientific literacy of all students.

**Investigations:** Critical to understanding science concepts is the use of scientific inquiry to develop explanations of natural phenomena. Therefore, it is recommended that students have the opportunity to develop their skills of mathematical analysis, scientific inquiry, and engineering design through investigations on a regular basis in grades K, 1, 2, 3, and 4. Active investigations will nurture student curiosity and develop positive attitudes toward science which will last a lifetime.

# INQUIRY AND PROCESS SKILLS BASED ON ALL STANDARDS

It should be a goal of the instructor to foster the development of science process skills. The application of these skills allows students to investigate important issues in the world around them.

Inquiry-based units will include many or most of the following process skills. These process skills should be incorporated into students' instruction as developmentally appropriate.

**Classifying** – arranging or distributing objects, events, or information representing objects or events in classes according to some method or system

**Communication** – giving oral and written explanations or graphic representations of observations

**Creating models** – displaying information, using multisensory representations

**Gathering and organizing data** – collecting information about objects and events which illustrate a specific situation

**Generalizing** – drawing general conclusions from particulars

**Identifying variables** – recognizing the characteristics of objects or factors in events that are constant or change under different conditions

**Inferring** – drawing a conclusion based on prior experiences

**Interpreting data** – analyzing data that have been obtained and organized by determining apparent patterns or relationships in the data

**Making decisions** – identifying alternatives and choosing a course of action from among the alternatives after basing the judgment for the selection on justifiable reasons

**Manipulating materials** – handling or treating materials and equipment safely, skillfully, and effectively

**Measuring** – making quantitative observations by comparing to a conventional standard (or extensions of the senses)

**Observing** – becoming aware of an object or event by using any of the senses (or extensions of the senses) to identify properties

**Predicting** – making a forecast of future events or conditions expected to exist

Note: As an example, these processes are applied in the three Key Ideas in Standard 1, which outline scientific inquiry. Inquiry may proceed in a cyclical pattern, with students moving from Key Idea 1 to Key Idea 3 and back to 1 again.

# STANDARD 1: Analysis, Inquiry, and Design

**Students will use mathematical analysis, scientific inquiry, and engineering design, as appropriate, to pose questions, seek answers, and develop solutions.**

## MATHEMATICAL ANALYSIS

### Key Idea 1:

**Abstraction and symbolic representation are used to communicate mathematically.**

**PERFORMANCE INDICATOR 1.1**

Use special mathematical notation and symbolism to communicate in mathematics and to compare and describe quantities, express relationships, and relate mathematics to their immediate environment.

Major Understandings:

1.1a Use plus, minus, greater than, less than, equal to, multiplication, and division signs.

1.1b Select the appropriate operation to solve mathematical problems.

1.1c Apply mathematical skills to describe the natural world.

### Key Idea 2:

**Deductive and inductive reasoning are used to reach mathematical conclusions.**

**PERFORMANCE INDICATOR 2.1**

Use simple logical reasoning to develop conclusions, recognizing that patterns and relationships present in the environment assist them in reaching these conclusions.

Major Understandings:

2.1a Explain verbally, graphically, or in writing the reasoning used to develop mathematical conclusions.

2.1b Explain verbally, graphically, or in writing patterns and relationships observed in the physical and living environment.

### Key Idea 3:

**Critical thinking skills are used in the solution of mathematical problems.**

**PERFORMANCE INDICATOR 3.1**

Explore and solve problems generated from school, home, and community situations, using concrete objects or manipulative materials when possible.

Major Understandings:

3.1a Use appropriate scientific tools (e.g., metric rulers, spring scale, pan balance, graph paper, thermometers [Fahrenheit and Celsius], graduated cylinder) to solve problems about the natural world.

## SCIENTIFIC INQUIRY

### Key Idea 1:

**The central purpose of scientific inquiry is to develop explanations of natural phenomena in a continuing, creative process.**

**PERFORMANCE INDICATOR 1.1**

Ask "why" questions in attempts to seek greater understanding concerning objects and events they have observed and heard about.

Major Understandings:

1.1a Observe and discuss objects and events and record observations.

1.1b Articulate appropriate questions based on observations.

**PERFORMANCE INDICATOR 1.2**

Question the explanations they hear from others and read about, seeking clarification and comparing them with their own observations and understandings.

Major Understandings:

1.2a Identify similarities and differences between explanations received from others or in print and personal observations or understandings.

**PERFORMANCE INDICATOR 1.3**

Develop relationships among observations to construct descriptions of objects and events and to form their own tentative explanations of what they have observed.

Major Understandings:

1.3a Clearly express a tentative explanation or description which can be tested.

### Key Idea 2:

**Beyond the use of reasoning and consensus, scientific inquiry involves the testing of proposed explanations involving the use of conventional techniques and procedures and usually requiring considerable ingenuity.**

**PERFORMANCE INDICATOR 2.1**

Develop written plans for exploring phenomena or for evaluating explanations guided by questions or proposed explanations they have helped formulate.

Major Understandings:

2.1a Indicate materials to be used and steps to follow to conduct the investigation and describe how data will be recorded (journal, dates and times, etc.).

**PERFORMANCE INDICATOR 2.2**

Share their research plans with others and revise them based on their suggestions.

Major Understandings:

2.2a Explain the steps of a plan to others, actively listening to their suggestions for possible modification of the plan, seeking clarification and understanding of the suggestions and modifying the plan where appropriate.

**PERFORMANCE INDICATOR 2.3**

Carry out their plans for exploring phenomena through direct observation and through the use of simple instruments that permit measurement of quantities (e.g., length, mass, volume, temperature, and time).

Major Understandings:

2.3a Use appropriate "inquiry and process skills" to collect data.

2.3b Record observations accurately and concisely.

## Key Idea 3:

**The observations made while testing proposed explanations, when analyzed using conventional and invented methods, provide new insights into phenomena.**

**PERFORMANCE INDICATOR 3.1**

Organize observations and measurements of objects and events through classification and the preparation of simple charts and tables.

Major Understandings:

3.1a Accurately transfer data from science journal or notes to appropriate graphic organizer.

**PERFORMANCE INDICATOR 3.2**

Interpret organized observations and measurements, recognizing simple patterns, sequences, and relationships.

Major Understandings:

3.2a State, verbally or in writing, any inferences or generalizations indicated by the data collected.

**PERFORMANCE INDICATOR 3.3**

Share their findings with others and actively seek their interpretations and ideas.

Major Understandings:

3.3a Explain their findings to others, and actively listen to their suggestions for possible interpretations and ideas.

**PERFORMANCE INDICATOR 3.4**

Adjust their explanations and understandings of objects and events based on their findings and new ideas.

Major Understandings:

3.4a State, verbally or in writing, any inferences or generalizations indicated by the data, with appropriate modifications.

## ENGINEERING DESIGN

### Key Idea 1:

**Engineering design is an iterative process involving modeling and optimization finding the best solution within given constraints which is used to develop technological solutions to problems within given constraints.**

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**PERFORMANCE INDICATOR 1.1**

Describe objects, imaginary or real, that might be modeled or made differently and suggest ways in which the objects can be changed, fixed, or improved.

Major Understandings:

1.1a Identify a simple/common object which might be improved and state the purpose of the improvement.

1.1b Identify features of an object that help or hinder the performance of the object.

1.1c Suggest ways the object can be made differently, fixed, or improved.

**PERFORMANCE INDICATOR 1.2**

Investigate prior solutions and ideas from books, magazines, family, friends, neighbors, and community members.

Major Understandings:

1.2a Identify appropriate questions to ask about the design of an object.

1.2b Identify the appropriate resources to use to find out about the design of an object.

1.2c Describe prior designs of the object.

**PERFORMANCE INDICATOR 1.3**

Generate ideas for possible solutions, individually and through group activity; apply age-appropriate mathematics and science skills; evaluate the ideas and determine the best solution; and explain reasons for the choices.

Major Understandings:

1.3a List possible solutions, applying age-appropriate math and science skills.

1.3b Develop and apply criteria to evaluate possible solutions.

1.3c Select a solution and explain why it was chosen.

**PERFORMANCE INDICATOR 1.4**

Plan and build, under supervision, a model of the solution, using familiar materials, processes, and hand tools.

Major Understandings:

1.4a Create a grade-appropriate graphic or plan listing all materials needed, showing sizes of parts, indicating how things will fit together, and detailing steps for assembly.

1.4b Build a model of the object, modifying the plan as necessary.

**PERFORMANCE INDICATOR 1.5**

Discuss how best to test the solution; perform the test under teacher supervision; record and portray results through numerical and graphic means; discuss orally why things worked or didn't work; and summarize results in writing, suggesting ways to make the solution better.

Major Understandings:

1.5a Determine a way to test the finished solution or model.

1.5b Perform the test and record the results, numerically and/or graphically.

1.5c Analyze the results.

1.5d Suggest how to improve the solution or model, using oral, graphic, or written formats.

# STANDARD 4: The Living Environment

**Students will understand and apply scientific concepts, principles, and theories pertaining to the physical setting and living environment and recognize the historical development of ideas in science.**

## Key Idea 1:

**Living things are both similar to and different from each other and from nonliving things.**

Introduction: There are basic characteristics, needs, and functions common to all living things. Nonliving things are present in nature or are made by living things.

Younger students' ideas about the characteristics of organisms develop from their basic concepts of living and nonliving things. As students are given opportunities to observe and classify living and nonliving things, they should be reminded that living and nonliving things are sometimes given attributes they do not really have.

Understanding the variety and complexity of life and its processes can help children develop respect for their own and for all life. It should also lead them to better realize the value of all life on this fragile planet.

**PERFORMANCE INDICATOR 1.1** Describe the characteristics of and variations between living and nonliving things.

Major Understandings:

1.1a Animals need air, water, and food in order to live and thrive.

1.1b Plants require air, water, nutrients, and light in order to live and thrive.

1.1c Nonliving things can be human-created or naturally occurring.

1.1d Nonliving things do not live and thrive.

**PERFORMANCE INDICATOR 1.2** Describe the life processes common to all living things.

Major Understandings:

1.2a All living things grow, consume nutrients, breathe, reproduce, eliminate waste, and die.

## Key Idea 2:

**Organisms inherit genetic information in a variety of ways that result in continuity of structure and function between parents and offspring.**

Introduction: As students investigate the continuity of life, emphasis should be placed on how plants and animals reproduce their own kind. Most students know that offspring resemble their parents, yet they should understand that there are variations among the members of a population. Students can understand that individual organisms have specific traits. Students should recognize that there is a difference between acquired (or learned) and inherited characteristics.

The foundation can be developed for the idea that there is a reliable way to transfer genetic information from one generation to the next.

**PERFORMANCE INDICATOR 2.1** Recognize that traits of living things are both inherited and acquired or learned.

Major Understandings:

2.1a Some traits of living things have been inherited (e.g., color of flowers and number of limbs of animals).

2.1b Some characteristics result from an individual's interactions with the environment and cannot be inherited by the next generation (e.g., having scars; riding a bicycle).

**PERFORMANCE INDICATOR 2.2** Recognize that for humans and other living things there is genetic continuity between generations.

Major Understandings:

2.2a Plants and animals closely resemble their parents and other individuals in their species.

2.2b Plants and animals transfer genetic information to their offspring when they reproduce.

## Key Idea 3:

**Individual organisms and species change over time.**

Throughout time, plants and animals have adapted to meet their needs within their environment. In learning how organisms have been successful in their habitats, students should observe and record information about plants and animals. They should begin to recognize how differences among individuals within a species can help an organism or population to survive. Students at this level will identify the behaviors and physical adaptations that allow organisms to survive in their environment.

**PERFORMANCE INDICATOR 3.1** Describe how the structures of plants and animals complement the environment of the plant or animal.

Major Understandings:

3.1a Each animal has different structures that serve different functions in growth, survival, and reproduction.

- wings, legs, or fins enable some animals to seek shelter and to escape predators
- the mouth, including teeth, jaws, and tongue, enables some animals to eat and drink
- eyes, nose, ears, tongue, and skin of some animals enable the animals to sense their surroundings
- claws, shells, spines, feathers, fur, scales, and color of body covering enable some animals to protect themselves from predators and other environmental conditions, or enable them to obtain food
- some animals have parts that are used to produce sounds and smells to help the animal meet its needs
- the characteristics of some animals change as seasonal conditions change (e.g., fur grows and is shed to help regulate body heat; body fat as a form of stored food changes as the season changes)

**PERFORMANCE INDICATOR 3.1**

**continued**

3.1b Each plant has different structures that serve different functions in growth, survival, and reproduction.

- roots take in water and nutrients and help support the plant
- leaves help plants utilize sunlight to make food for the plant
- stems, stalks, trunks, and other similar structures provide support for the plant
- flowers are reproductive structures of plants that produce seeds
- seeds contain stored food that aids in germination and the growth of young plants

3.1c In order to survive in their environment, plants, and animals have adapted to that environment.

- seeds disperse by plant mechanisms and in a variety of ways that can include wind, water, and animals
- leaf, flower, stem, and root adaptations may include variations in size, shape, thickness, color, smell, and texture
- animal adaptations include coloration for warning or attraction, camouflage, defense mechanisms, movement, hibernation, migration

**PERFORMANCE INDICATOR 3.2**

Observe that differences within a species may give individuals an advantage in surviving and reproducing.

Major Understandings:

3.2a Individuals within a species may compete with each other for food, mates, space, water, and shelter in their environment.

3.2b All individuals have variations and because of these variations, individuals of a species may have an advantage in surviving and reproducing.

## Key Idea 4:

**The continuity of life is sustained through reproduction and development.**

It is essential for organisms to produce offspring for their species to continue. Patterns of reproduction, growth, and development of an organism are stages in its life cycle. Life cycle stages are sequential and occur throughout the life span of the organism. The characteristics of the cycle of life vary from organism to organism.

Note: Young children may have difficulty in recognizing the continuity of life. Using organisms with a short life cycle as examples will be important in getting the concept across. It is important for young children to observe life cycle changes in selected animals.

**PERFORMANCE INDICATOR 4.1**

Describe the major stages in the life cycles of selected plants and animals.

Major Understandings:

4.1a Plants and animals have life cycles. These may include beginning of life, developing into adults, reproducing as adults, and eventually dying.

4.1b Each kind of plant goes through its own stages of growth and development that may include seed, young plant, and mature plant.

**PERFORMANCE INDICATOR 4.1**

**continued**

4.1c The length of time from beginning of development to death of the plant is called its "life span."

4.1d Life cycles of some plants include changes from seed to mature plant.

4.1e Each generation of animals goes through changes in form from young to adult. This completed sequence of changes in form is called a "life cycle." Some insects change from egg to larva to pupa to adult.

4.1f Each kind of animal goes through its own stages of growth and development during its life span.

4.1g The length of time from an animal's birth to its death is called its life span. Life spans of different animals vary.

**PERFORMANCE INDICATOR 4.2**

Describe evidence of growth, repair, and maintenance, such as nails, hair, and bone, and the healing of cuts and bruises.

Major Understandings:

4.2a Growth is the process by which plants and animals increase in size.

4.2b Food supplies the energy and materials necessary for growth and repair.

## Key Idea 5:

**Organisms maintain a dynamic equilibrium that sustains life.**

Children need many opportunities to observe a variety of organisms for the patterns of similarities and differences of the life functions used to sustain life. All organisms carry out basic life functions in order to sustain life. These life functions include growth, consumption of nutrients, breathing, reproduction, and waste elimination. Children need many opportunities to observe and compare these similarities and differences in a variety of organisms. Specimens that could provide these opportunities may include guppies, mealworms, and gerbils, as well as fish, insects, mammals, birds, amphibians, reptiles, plants, and fungi.

**PERFORMANCE INDICATOR 5.1**

Describe basic life functions of common living specimens (guppies, mealworms, gerbils).

Major Understandings:

5.1a All living things grow, consume nutrients, breathe, reproduce, and eliminate waste.

5.1b An organism's external physical features enable it to carry out life functions in its particular environment.

**PERFORMANCE INDICATOR 5.2**

Describe some survival behaviors of common living specimens.

Major Understandings:

5.2a Parts of some plants adapt to meet the immediate needs of the plant.

5.2b Parts of some animals change and meet the immediate needs of the animal.

5.2c Senses can provide essential information (regarding danger, food, mate, etc.) to animals about their environment.

5.2d Some animals, including humans, move from place to place to meet their needs.

5.2e Particular animal characteristics are influenced by changing environmental conditions including: fat storage in winter, coat thickness in winter, camouflage, shedding of fur.

5.2f Some animal behaviors are influenced by environmental conditions. These behaviors may include: nest building, hibernating, hunting, migrating, and communicating.

5.2g The health, growth, and development of organisms are affected by environmental conditions such as the availability of food, air, water, space, shelter, heat, and sunlight.

5.2h Plants adapt to their environment when conditions change. For example, the leaves of some green plants change position as the direction of light changes; the parts of some plants undergo seasonal changes that enable the plant to grow; seeds germinate, and leaves form and grow.

**PERFORMANCE INDICATOR 5.3**

Describe the factors that help promote good health and growth in humans.

Major Understandings:

5.3a Humans need a variety of healthful foods, exercise, and rest in order to grow and maintain good health.

5.3b Good health habits include hand washing and personal cleanliness; avoiding harmful substances (including alcohol, tobacco, illicit drugs); eating a balanced diet; engaging in regular exercise.

## Key Idea 6:

**Plants and animals depend on each other and their physical environment.**

Plants and animals interact in a number of ways that affect their survival. The survival of plants and animals varies, in response to their particular environment. As the physical environment changes over time, plants and animals change.

Young children should focus on simple, observable associations of organisms with their environments. Their studies of interactions among organisms within an environment should start with relationships they can directly observe.

Note: Although the concept of plants making their own food may be difficult for elementary students to grasp, they should understand that the Sun is the ultimate source of energy for life and physical cycles on Earth.

**PERFORMANCE INDICATOR 6.1**

Describe how plants and animals, including humans, depend upon each other and the nonliving environment.

Major Understandings:

6.1a All animals depend on plants. Some animals eat plants for food. Other animals (predators) eat animals (prey).

6.1b An organism's pattern of behavior is related to the nature of that organism's environment, including the kinds and numbers of other organisms present, the availability of food and other resources, and the physical characteristics of the environment.

6.1c When the environment changes, some plants and animals survive and reproduce, and others die or move to new locations.

**PERFORMANCE INDICATOR 6.2**

Describe the relationship of the Sun as an energy source for living and nonliving cycles.

Major Understandings:

6.2a Plants are producers that manufacture food by utilizing energy from the Sun, air, and water. Plants provide the basic food supply for themselves and for animals.

6.2b Animals are consumers because they depend on plants and/or other animals for food.

6.2c Animals that eat plants for food may in turn become food for other animals. This sequence is called a "food chain."

6.2d Decomposers are plants or animals that play a vital role in recycling nutrients.

6.2e Heat energy from the Sun powers the water cycle (see Physical Science Key Idea 2) by changing the form of water to and from ice, liquid, and water vapor.

## Key Idea 7:

**Human decisions and activities have had a profound impact on the physical and living environments.**

Humans are dependent upon and have an impact on their environment. Students should recognize how human decisions cause environmental changes to occur.

Students should be given opportunities to identify and investigate the factors that positively or negatively affect the physical environment and its resources.

**PERFORMANCE INDICATOR 7.1**

Identify ways in which humans have changed their environment and the effects of those changes.

Major Understandings:

7.1a Humans depend on their natural and constructed environments.

7.1b Over time humans have changed their environment by producing food, creating shelter, using energy, manufacturing goods, developing means of transportation, and carrying out other activities.

7.1c Humans, as individuals or communities, change environments in ways that can be either helpful or harmful for themselves and other organisms.

# STANDARD 4: The Physical Setting

**Students will understand and apply scientific concepts, principles, and theories pertaining to the physical setting and living environment and recognize the historical development of ideas in science.**

## Key Idea 1:

**The Earth and celestial phenomena can be described by principles of relative motion and perspective.**

The universe is made up of many different objects. Students should observe and describe the motions of the Sun, moon, and stars. The movement of these objects through space can be traced and measured over various time segments.

By keeping daily records, students will learn to identify sequences of changes and look for patterns; this skill will be useful throughout their study of the natural world. Younger students should draw what they see. Older students should be encouraged to keep journals and use instruments to measure and record their observations.

Note: Students at this age are concrete thinkers. Drawing models that show size and position and discussing phenomena based on gravity are too abstract and may lead to misconceptions.

**PERFORMANCE INDICATOR 1.1**

Describe patterns of daily, monthly, and seasonal changes in their environment.

Major Understandings:

1.1a Natural cycles and patterns include:

- Earth spinning around once every 24 hours (rotation), resulting in day and night
- Earth moving in a path around the Sun (revolution), resulting in one Earth year
- the length of daylight and darkness varying with the seasons
- weather changing from day to day and through the seasons
- the appearance of the Moon changing as it moves in a path around Earth to complete a single cycle

1.1b Humans organize time into units based on natural motions of Earth:

- second, minute, hour
- week, month

1.1c The Sun and other stars appear to move in a recognizable pattern both daily and seasonally.

## Key Idea 2:

**Many of the phenomena that we observe on Earth involve interactions among components of air, water, and land.**

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The water cycle, weather, erosion, deposition, and extreme natural events involve interactions among air, water, and land. Students should observe and describe naturally occurring changes in their world involving these phenomena. They can also investigate these phenomena in classroom experiments.

Young students should be engaged in observation of their immediate surroundings with emphasis on recognizing change around them. As students mature, they can begin to recognize cycles and identify the processes and natural events which are causing the changes they are observing.

**PERFORMANCE INDICATOR 2.1**

Describe the relationship among air, water, and land on Earth.

Major Understandings:

2.1a Weather is the condition of the outside air at a particular moment.

2.1b Weather can be described and measured by:

- temperature
- wind speed and direction
- form and amount of precipitation
- general sky conditions (cloudy, sunny, partly cloudy)

2.1c Water is recycled by natural processes on Earth.

- evaporation: changing of water (liquid) into water vapor (gas)
- condensation: changing of water vapor (gas) into water (liquid)
- precipitation: rain, sleet, snow
- runoff: water flowing on the Earth's surface
- groundwater: water that moves downward into the ground

2.1d Erosion and deposition result from the interaction among air, water, and land.

- interaction between air and water breaks down earth materials
- pieces of earth material may be moved by air, water, wind, and gravity
- pieces of earth material will settle or deposit on land or in the water in different places
- soil is composed of broken-down pieces of living and nonliving earth material

2.1e Extreme natural events (floods, fires, earthquakes, etc.) may have positive or negative impacts on living things.

## Key Idea 3:

**Matter is made up of particles whose properties determine the observable characteristics of matter and its reactivity.**

Students should describe, categorize, compare, and measure observable properties of matter and objects. Students' initial efforts in performing these processes may yield simple descriptions and sketches, which may lead to increasingly more detailed drawings and richer verbal descriptions. Things can be done to materials to change their properties, but not all materials respond the same way to what is done to them. Younger students emphasize physical properties while older students will recognize chemical changes. Appropriate tools can aid students in their efforts.

Note: At this level, students should observe and describe physical properties of matter.

**PERFORMANCE INDICATOR 3.1** Observe and describe properties of materials, using appropriate tools.

Major Understandings:

3.1a Matter takes up space and has mass.

3.1b Matter has properties (color, hardness, odor, sound, taste) that can be observed through the senses.

3.1c Objects have properties (length, width, volume, size, shape, mass or weight, temperature, texture, and reflectiveness) that can be observed and measured. Two objects cannot occupy the same place at the same time.

3.1d Measurements can be made with standard and nonstandard units.

3.1e The material(s) an object is made up of determine some specific properties of the object (sink/float, conductivity, magnetism). Properties can be observed or measured with tools such as hand lenses, metric rulers, thermometers, balances, magnets, circuit testers, and graduated cylinders.

3.1f Objects and/or materials can be sorted or classified according to their properties.

3.1g Some properties of an object are dependent on the conditions of the present surroundings in which the object exists. For example:

- temperature - hot or cold
- lighting - shadows, color
- moisture - wet or dry

**PERFORMANCE INDICATOR 3.2** Describe chemical and physical changes, including changes in states of matter.

Major Understandings:

3.2a Matter exists in three states: solid, liquid, gas.

- solids have a definite shape and volume
- liquids do not have a definite shape but have a definite volume
- gases do not hold their shape or volume

3.2b Temperature can affect the state of matter of a substance.

3.2c Changes in the properties or materials of objects can be observed and described.

## Key Idea 4:

**Energy exists in many forms, and when these forms change energy is conserved.**

Students should understand that energy exists in a variety of forms. Students should observe the results of simple energy transformations from one form to another in their physical environment. The safe use and respect of various energy forms should be stressed in the classroom.

Note: Attempting to understand heat and its difference from temperature is too abstract a concept for elementary students. Energy is a subject that is difficult for children to understand. Students cannot hold it in their hands and, with the exception of light, they cannot see it.

**PERFORMANCE INDICATOR 4.1** Describe a variety of forms of energy (e.g., heat, chemical, light) and the changes that occur in objects when they interact with those forms of energy.

Major Understandings:

4.1a Energy exists in various forms: heat, electric, sound, chemical, mechanical, light.

4.1b Energy can be transferred from one place to another.

4.1c Some materials transfer energy better than others (heat and electricity).

4.1d Energy and matter interact: water is evaporated by the Sun's heat; a bulb is lighted by means of electrical current; a musical instrument is played to produce sound.

4.1e Electricity travels in a closed circuit.

4.1f Heat can be released in many ways, for example, by burning, rubbing (friction), or combining one substance with another.

4.1g Interactions with forms of energy can be either helpful or harmful.

**PERFORMANCE INDICATOR 4.2** Observe the way one form of energy can be transfered into another form of energy present in common situations (e.g., mechanical to heat energy, mechanical to electrical energy, chemical to heat energy).

Major Understandings:

4.2a Everyday events involve one form of energy being changed to another.
- animals convert food to heat and motion
- the Sun's energy warms the air and water

4.2b Humans utilize interactions between matter and energy.
- chemical to electrical, light and heat (battery and bulb)
- electrical to sound (doorbell or buzzer)
- mechanical to sound (musical instruments)

## Key Idea 5:

**Energy and matter interact through forces that result in changes in motion.**

Students' understanding of the world in which they live may begin when they can describe relative positions between objects observable in their world. Exploring the observable effects of gravity and of magnetism may help children develop an understanding of the reason for the direction of an object's motion. Manipulation and application of simple tools and machines may help students learn about the relationships between forces and motion.

**PERFORMANCE INDICATOR 5.1**

Describe the effects of common forces (pushes and pulls) of objects, such as those caused by gravity, magnetism, and mechanical forces.

Major Understandings:

5.1a The position of an object can be described by locating it relative to another object or the background (e.g., on top of, next to, over, under, etc.).

5.1b The position or direction of motion of an object can be changed by pushing or pulling.

5.1c The force of gravity pulls objects toward the center of Earth.

5.1d The amount of change in the motion of an object is affected by friction.

5.1e Magnetism is a force that may attract or repel certain materials.

5.1f Mechanical energy may cause change in motion through the application of force and through the use of simple machine such as gears, pulleys, levers, and inclined planes.

**PERFORMANCE INDICATOR 5.2**

Describe how forces can operate across distances.

Major Understandings:

5.2a The force of gravity and magnetism on objects decreases as distance increases.

5.2b The forces of gravity and magnetism can affect objects through gases, liquids, and solids.