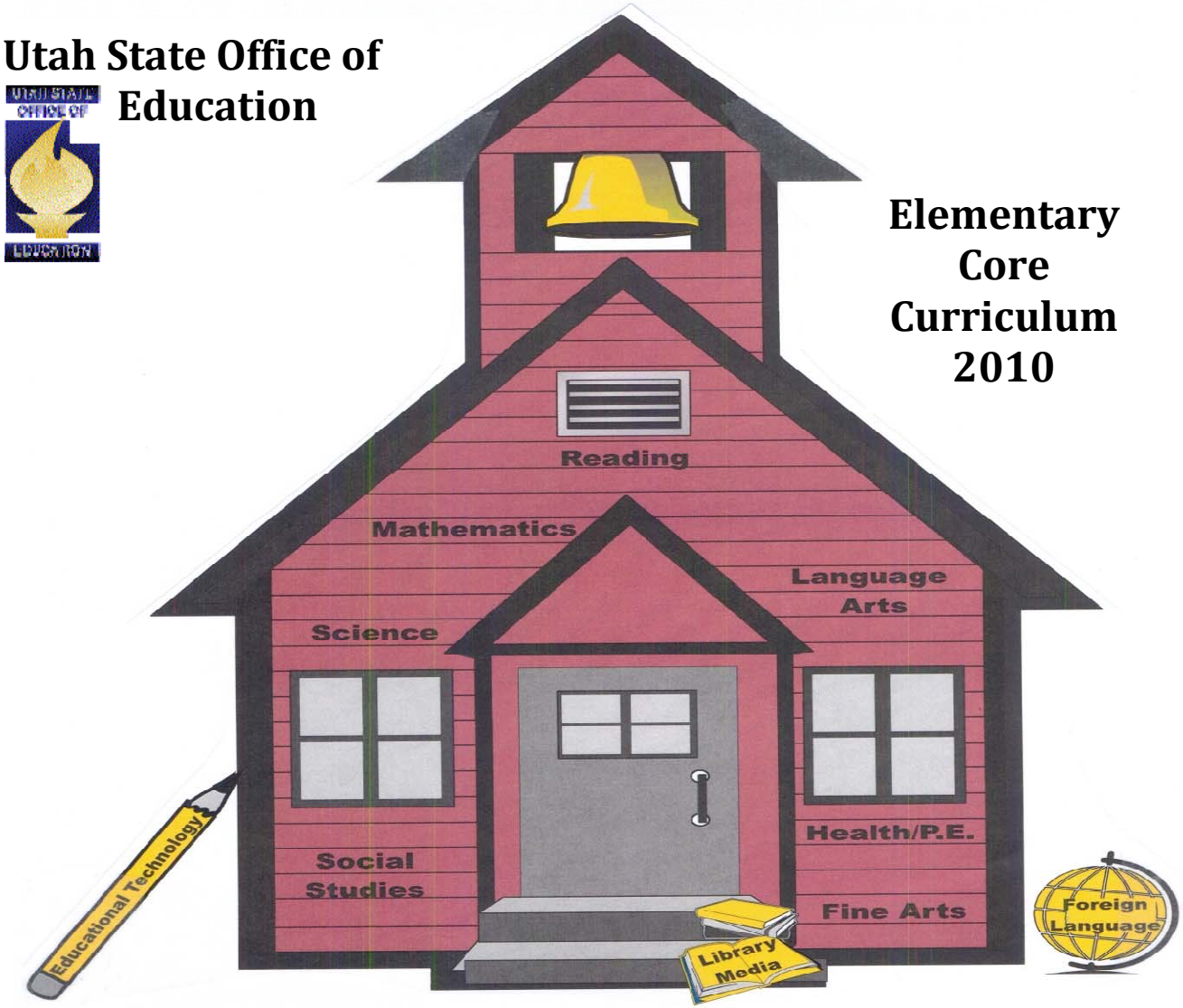
Utah State Office of Education

Elementary Core Curriculum 2010



K-2 Science Core Curriculum

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Utah Elementary Science Core Curriculum

Grades K-2

Introduction

Science is a way of knowing, a process for gaining knowledge and understanding of the natural world. The Science Core Curriculum places emphasis on understanding and using skills. Students should be active learners. It is not enough for students to read about science; they must do science. They should observe, inquire, question, formulate and test hypotheses, analyze data, report, and evaluate findings. The students, as scientists, should have hands–on, active experiences throughout the instruction of the science curriculum.

The K-2 Science Core describes what students should know and be able to do at the end of each of the K-2 grade levels. It was developed, critiqued, piloted, and revised by a community of Utah science teachers, university science educators, and State Office of Education specialists. Core Standards are supported by material research on science literacy and essential learning standards. The core concepts included in the Standards are those that are central to a discipline of science (i.e. Earth and Space Science, Physical Science, and Life Science), that are accessible to students starting in kindergarten, and have potential for sustained exploration across grades K-2 and beyond.

Literacy and Numeracy Connections

The K-2 Science Core supports literacy and numeracy learning for all students. The Guidance section contains suggested strategies that are connected to language arts and mathematical topics. These connections assist teachers with activities of reading, writing, speaking, presenting, calculating, graphing, and measuring in their science teaching. Teachers may integrate these activities into literacy or mathematics instructional blocks, facilitating not only the teaching of science in a full instructional schedule, but also increasing the literacy learning of many students by including non-fiction reading and writing in the literacy block. Science concepts can be taught in tandem with literacy skills through reading, speaking, and writing while students are involved in the scientific process. Mathematical understanding can also be enhanced by highlighting the application of mathematical concepts in scientific settings, such as using measurement concepts to weigh rocks or measure plants to investigate change over time.

Organization

The K-2 Core is arranged to help teachers organize and deliver instruction as follows:

Instructional Framework:

Describes how the core is organized to assist teachers in understanding and teaching scientific concepts through process skills, utilizing big ideas, and making application to technology and society.

Standards:

Standard 1: Is the intended learning outcomes standard. It contains three objectives: Processes of Science, Communication of Science, and the Nature of Science. Standard 1 is not a stand-alone piece of learning, but is designed to be integrated into the three content standards.

Standards 2, 3, and 4: Reflects the disciplines of science. These standards are consistent across all three grades. Each standard is further explicated by objectives and indicators.

Standard 2 is Earth and Space Science
Standard 3 is Physical Science
Standard 4 is Life Science

Science Content by Standard: Shows the learning progressions inherent in the core. The charts are organized by standard, each containing the objectives and indicators for each grade side by side.

Supplemental Materials: Includes a chart of supplemental materials for each objective within the core. The supplemental materials are color coded by standard: Earth and Space Science is green, Physical Science is blue, and Life Science is red. A **guide** for reading and using the materials with an explanation of each section of the sheet appears in Appendix B.

Appendices:

Appendix A: The Big Ideas for each standard organized by grade level.
Appendix B: How to read the supplemental materials charts.
Appendix C: Note, explanations, and research base.
Appendix D: References used in the development of the core.

K-2 Science Instructional Framework

Earth and Space Science
Earth Materials
Celestial Movement
Weather
(Standard 2)

Physical Science
Forces and Motion
Properties of Materials
(Standard 3)

Life Science
Changes in Organisms Over Time
Nature of Living Things
(Standard 4)

… taught through …

Processes of generating and communicating scientific evidence framed by Big Ideas
(Standard 1)

K-2 Standard 1 – Intended Learning Outcomes

The Processes of Science, Communication of Science, and the Nature of Science Students will be able to apply scientific processes, communicate scientific ideas effectively, and understand the nature of science.					
Standard 1 The Processes, Communication, and Nature of Science	**Indicator 1**	**Indicator 2**	**Indicator 3**	**Indicator 4**	**Indicator 5**
Objective 1. Generating Evidence: Using the processes of scientific investigation (i.e. framing questions, designing investigations, conducting investigations, collecting data, drawing conclusions)	Framing questions: Observe using senses, create a hypothesis, and focus a question that can lead to an investigation.	Designing investigations: Consider reasons that support ideas, identify ways to gather information that could test ideas, design fair tests, share designs with peers for input and refinement.	Conducting investigations: Observe, manipulate, measure, describe.	Collecting data: Deciding what data to collect and how to organize, record, and manipulate the data.	Drawing conclusions: Analyzing data, making conclusions connected to the data or the evidence gathered, identifying limitations or conclusions, identifying future questions to investigate.
Objective 2. Communicating Science: Communicating effectively using science language and reasoning	Developing social interaction skills with peers.	Sharing ideas with peers.	Connecting ideas with reasons (evidence).	Using multiple methods of communicating reasons/evidence (verbal, charts, graphs).	
Objective 3. Knowing in Science: Understanding the nature of science	Ideas are supported by reasons.	There are limits to ideas in science (i.e. what can be observed, measured, and verified).	Differences in conclusions are best settled through additional observations and investigations.	Communication of ideas in science is important for helping to check the reasons for ideas.	

Standard 1 is not to be taught as stand-alone content, but is integrated into the teaching of the Content Standards (Standards 2, 3, and 4)

Science Content by Standard – Standard 2

Standard 2 – Earth and Space Science

Students will gain an understanding of Earth and Space Science through the study of earth materials, celestial movement, and weather.

	Kindergarten	First Grade	Second Grade
Objective 1	Investigate non-living things.	Investigate the natural world including rock, soil and water.	Describe the characteristics of different rocks.
Indicators:	– Observe and record that big rocks break down into small rocks, e.g., boulders, rocks, pebbles, sand. – Demonstrate how water and wind move non-living things. – Sort, group, and classify Earth materials, e.g., hard, smooth, rough, shiny, flat.	– Observe, compare, describe, and sort components of soil by size, texture, and color. – Identify and describe a variety of natural sources of water, including streams, lakes, and oceans. – Gather evidence about the uses of rocks, soil, and water.	– Explain how smaller rocks come from the breakage and weathering of larger rocks. – Describe rocks in terms of their parts (e.g. crystals, grains, cement). – Sort rocks based upon color, hardness, texture, layering, particle size and type (i.e. igneous, metamorphic, sedimentary).
Objective 2	Observe and describe changes in day and night.	Observe and describe the changes and appearance of the sun and moon during daylight.	Observe and record recognizable objects and patterns in the night sky.
Indicators:	– Compare and contrast light and dark in a day-night cycle and identify the changes as a pattern. – Investigate, interpret, and explain to others that the sun provides heat and light to Earth. – Examine what happens when you block the sun's light. Explore shadows and temperature changes.	– Observe the sun at different times during the day and report observations to peers. – Observe and chart the moon when it is visible during the day.	– Observe, describe, and record patterns in the appearance and apparent motion of the moon in the night sky. – Observe and describe the number, arrangement and color/brightness of stars in the night sky.
Objective 3	Compare changes in weather over time.	Compare and contrast seasonal weather changes.	Observe, describe, and measure seasonal weather patterns and local variations.
Indicators:	– Observe and record that weather changes occur from day-to-day and weather patterns occur from season to season. – Communicate ways weather can affect individuals. – Describe, predict, and discuss daily weather conditions and how predicting the weather can improve our lives.	– Identify characteristics of the seasons of the year. – Identify characteristics of weather, e.g., types of precipitation, sunny, windy, foggy, and cloudy. – Observe and record weather information within each season.	– Compare and contrast the seasonal weather patterns during the school year. – Analyze and interpret data such as temperatures in different locations and different times.

Supplemental Materials for Standard 2 - Earth and Space Science

The materials on the following pages are supplemental to the core. Each objective in Standard 2 has a sheet of information vital to student learning of science and the scientific processes inherent in the core. They are intended to give guidance to the teacher on the following topics:

- The Big Ideas go beyond discrete facts or skills to focus on larger concepts, principles, or processes (Grant Wiggins and Jay McTighe*, Understanding by Design,* 1998, p. 10). Big Ideas are cumulative, meaning that students revisit ideas that are previously developed, but in more and more complex ways at each successive grade level. This allows teachers to anchor learning at the beginning of the grade level to "concepts and reasoning abilities that young children bring with them" (NRC, 2008).

- Indicators provide both Measureable Outcomes framed by Standard 1objectives and Big Ideas and measurable indicators of student content knowledge and scientific processing for teachers.

- Science language is the language that students should use when conversing on each objective within the standard. Students may not be expected to spell and read each and every term.

- Guidance for combining Content and Process are suggested strategies teachers may use to teach the core. One-letter abbreviations (L, M, A, S) are included to show how the science learning may be integrated into Language Arts, Mathematics, Arts, and Social Studies concepts. Science content should never be taught as content alone, but should be taught through the process of scientific practice, embedding content into inquiry, hands-on learning, experimentation, interpretation of evidence, and communication of findings. "When students engage in science as practice, they develop knowledge and explanations of the natural world as they generate and interpret evidence." *(Ready, Set, Science: Putting Research to Work in K-8 Science Classrooms, pg. 34)*

- According to the National Science Education Standards, it is important to help students "establish connections between the natural and designed worlds." Guidance for combining Science, Technology, and Society provide support to teachers in this area.

- A key for interpreting the abbreviations used in the supplementary materials is found at the bottom of the page.

Important Note: A guide for reading the supplementary materials is found in Appendix B.

Subject	Grade	Standard	Objective
Science	**K**	**2. Earth and Space Science**	**1. Investigate non-living things.**

Content Big Ideas	Standard 1 Big Ideas – Intended Learning Outcomes	Science, Technology, and Society Big Ideas
(E) Change is something that happens to many things. (E) Some changes are so slow or so fast that they are hard to see.	(PoS) People can often learn about things around them by just observing those things carefully (raise questions about the world around them, be willing to seek answers to some of those questions by making careful observations). (CoS) People are more likely to believe your ideas if you can give reasons for them (ask "How do you know?" in appropriate situations and attempt reasonable answers when others ask them the same questions). (NoS) When doing science activities, it is often helpful to work with a team and to share findings with others.	(T) People use appropriate tools and models to investigate the world. (A) People working alone or in groups often invent new ways to solve problems and get work done. (S) The tools and ways of doing things that people have invented affect all aspects of life.

Indicators: Measureable Outcomes framed by Standard 1 Big Ideas

Indicator 1. Observe and record that big rocks break down into small rocks, e.g., boulders, rocks, pebbles, sand and record the results of observations.
Indicator 2. Demonstrate how water and wind move non-living things.
Indicator 3. Sort, group, and classify Earth materials, e.g., hard, smooth, rough, shiny, flat.

Science language students should be able to use correctly: wind, rivers, soil, change.

Guidance for Combining Content and Process	Guidance for Combining Science, Technology, and Society
Suggested Strategies In small groups, have students build a sand structure of their choosing in a sensory table. Ask them to investigate the following questions (and others that you or your students choose): (PoS) (NoS) (CoS) • What happens to your sand structure when wind or water is applied? • Will water run up the sand hill in your sensory table? In small groups have the students simulate a rock breaking activity utilizing such materials as hard candy, bread, graham crackers, and soda crackers. Have the students break the objects in plastic bags by hitting them with whatever tools they choose. Then, the teacher conducts a rock breaking activity with rocks of varying hardness, e.g., granite, sandstone, mica. Connect the two activities Then ask them to investigate the following questions (and others that you or your students choose): (PoS) (NoS) (CoS) • What rocks (materials) break easily? • Do some rock (materials) break easier than others? Show pictures of landscapes (e.g., Goblin Valley, Arches, Natural Bridges). Have the students show examples of water changes and wind changes as they relate to the sensory table experience. (FA) (PoS) Collect examples of earth materials (e.g., soil, sand, rocks). Have the students investigate the following questions (and others that you or your students choose): (PoS) • Can you sort these earth materials? • In what different ways can you sort them? During literacy seat work time have students create word and picture reports of their findings on the above investigations. (L) (CoS)	(T) Students use age-appropriate tools for investigations (sensory table, safety goggles, magnifying glass) (A) Students should be able to see rocks as tools that can be used to hammer, sand, crush, and grind. (S) Rocks are used in many social applications like highways, dams, houses, apartments, and jewelry

Earth and Space Science	Curriculum Connections		Processes, Communication, and Nature of Science	Applications: Science, Technology, and Society
(E) Earth science	(M) Mathematics	(FA) Fine Arts	(PoS) Processes of science	(T) Tools of science
(SS) Space science	(L) Language Arts	(SS) Social Studies	(CoS) Communication of science	(A) Applications of science
			(NoS) Nature of science	(S) Implications of science for people

Subject	Grade	Standard	Objective
Science	**K**	**2. Earth and Space Science**	**2. Observe and describe changes in day and night.**

Content Big Ideas	Standard 1 Big Ideas – Intended Learning Outcomes	Science, Technology, and Society Big Ideas
(E) Change is something that happens to many things. (E) Some changes are so slow or so fast that they are hard to see.	(PoS) People can often learn about things around them by just observing those things carefully (raise questions about the world around them, be willing to seek answers to some of those questions by making careful observations). (CoS) People are more likely to believe your ideas if you can give reasons for them (ask "How do you know?" in appropriate situations and attempt reasonable answers when others ask them the same questions). (NoS) When doing science activities, it is often helpful to work with a team and to share findings with others.	(T) People use appropriate tools and models to investigate the world. (A) People working alone or in groups often invent new ways to solve problems and get work done. (S) The tools and ways of doing things that people have invented affect all aspects of life.

Indicators: Measureable Outcomes framed by Standard 1 Big Ideas

Indicator 1. Compare and contrast light and dark in a day-night cycle and identify the changes as a pattern.
Indicator 2. Investigate, interpret, and explain to others that the sun provides heat and light to Earth.
Indicator 3. Examine what happens when you block the sun's light. Explore shadows and temperature changes.

Science language students should be able to use correctly: pattern, change, heat, light, temperature, shadow.

Guidance for Combining Content and Process	Guidance for Combining Science, Technology, and Society
Suggested Strategies Have the student explore shadows moving as the light source moves. Investigate the following questions (and others that you or your students choose): (PoS) • How are shadows different at different times of the day? How can you use a camera to explore shadow movement? • What happens to a shadow as a light source (like a flashlight) moves? Investigate activities that can be done easier in the light than in the dark. Compare results (e.g., name writing, line up for recess, sleep, storytelling). (L) (PoS) Investigate how the Earth blocks the sun's light using a flashlight and a globe. (PoS) Have the students place an ice cube outside in the sunshine and another in the shade. Investigate: Does an ice cube melt faster in the shade or in sunlight? (PoS) During literacy seat work time have students create word and picture reports of their findings on the above investigations. (L) (CoS) (NoS)	(T) Students use age-appropriate tools to investigate (camera, flashlight, world globe, ice cube). (A) Some devices are made to use during the day, others to use at night. (S) Staying up all night is not healthy.

Earth and Space Science	Curriculum Connections		Processes, Communication, and Nature of Science	Applications: Science, Technology, and Society
(E) Earth science	(M) Mathematics	(FA) Fine Arts	(PoS) Processes of science	(T) Tools of science
(SS) Space science	(L) Language Arts	(SS) Social Studies	(CoS) Communication of science	(A) Applications of science
			(NoS) Nature of science	(S) Implications of science for people

Subject	Grade	Standard	Objective
Science	**K**	**2. Earth and Space Science**	**3. Compare the changes in weather over time.**

Content Big Ideas	Standard 1 Big Ideas – Intended Learning Outcomes	Science, Technology, and Society Big Ideas
(E) Change is something that happens to many things. (E) Some changes are so slow or so fast that they are hard to see.	(PoS) People can often learn about things around them by just observing those things carefully (raise questions about the world around them, be willing to seek answers to some of those questions by making careful observations). (CoS) People are more likely to believe your ideas if you can give reasons for them (ask "How do you know?" in appropriate situations and attempt reasonable answers when others ask them the same questions). (NoS) When doing science activities, it is often helpful to work with a team and to share findings with others.	(T) People use appropriate tools and models to investigate the world. (A) People working alone or in groups often invent new ways to solve problems and get work done. (S) The tools and ways of doing things that people have invented affect all aspects of life.

Indicators: Measureable Outcomes framed by Standard 1 Big Ideas

Indicator 1. Observe and record that weather changes occur from day-to-day and weather patterns occur from season to season.
Indicator 2. Communicate ways weather can affect individuals.
Indicator 3. Describe, predict, and discuss daily weather conditions and how predicting the weather can improve our lives.

Science language students should be able to use correctly: weather, partly cloudy, foggy, clear, fall, autumn, summer, spring, winter, predict, forecast.

Guidance for Combining Content and Process	Guidance for Combining Science, Technology, and Society
Suggested Strategies Utilize many creative ways to report and record the weather during class openers or other times (e.g., class forecaster, microphones, big weather glasses, use a box for a TV screen, use TV or newspaper weather forecast). (L) (FA) (CoS) Keep a record of the daily weather in the classroom (e.g., weather journal, charts, graphs, counting). Ask students to predict what the weather tomorrow (next week, etc) will be based on the patterns recorded. (L) (M) (PoS) (NoS) (CoS)	(T) Students use age appropriate tools to record and report the weather (e.g., weather journal, charts, graphs, microphone, simulated TV). (A) Students track the weather to predict future weather patterns. (S) Students understand how the weather affects every day life.

Earth and Space Science	Curriculum Connections		Processes, Communication, and Nature of Science	Applications: Science, Technology, and Society
(E) Earth science	(M) Mathematics	(FA) Fine Arts	(PoS) Processes of science	(T) Tools of science
(SS) Space science	(L) Language Arts	(SS) Social Studies	(CoS) Communication of science	(A) Applications of science
			(NoS) Nature of science	(S) Implications of science for people

Subject	Grade	Standard	Objective
Science	First	2. Earth and Space Science	1. Investigate the natural world including rocks, soil, and water.

Content Big Ideas	Standard 1 Big Ideas – Intended Learning Outcomes	Science, Technology, and Society Big Ideas
(E) The natural world is composed of different materials.	(PoS) People can often learn about things around them by just observing those things carefully, but sometimes they can learn more by doing something to the things and noting what happens (raise questions about the world around them, be willing to seek answers to some of those questions by making careful observations and trying things out). (CoS) When doing science activities, it is often helpful to work with a team and to share findings with others. In this sharing, describing things as accurately as possible is important in science because it enables people to compare their observations with those of others (draw pictures that correctly portray at least some features of the thing being described, describe and compare things in terms of number, shape, texture, size, weight, color, and motion). (NoS) When people give different descriptions of the same thing, it is usually a good idea to make some fresh observations instead of just arguing about who is right.	(T) People use appropriate tools and models to investigate the world. (A) People working alone or in groups often invent new ways to solve problems and get work done. (S) The tools and ways of doing things that people have invented affect all aspects of life.

Indicators: Measureable Outcomes framed by Standard 1 Big Ideas

Indicator 1. Observe, compare, describe, and sort components of soil by size, texture, and color.
Indicator 2. Identify and describe a variety of natural sources of water, including streams, lakes, and oceans.
Indicator 3. Gather evidence about the uses of rocks, soil, and water.

Science language students should be able to use correctly: clay, compare, contrast, data, evidence, silt, similarity, soil, sort, texture.

Guidance for Combining Content and Process	Guidance for Combining Science, Technology, and Society
Suggested Strategies Working in small groups students can observe and sort several samples of soil from different locations by size, texture, and color. Students can accurately record and label or graph their findings to discuss similarities and differences and be able to explain their findings with others. (L) (M) (PoS) (NoS) (CoS) Students can conduct a soil study by growing plants in different types of soil (silt, sand, clay, humus) and soil samples from various locations. (PoS) Using available resources (maps, globes, pictures, graphs, the internet) students can chart similarities and differences between streams, lakes, and oceans. They can describe the characteristics of each and share with others. (L) (M) (PoS) (CoS) Students can build models of streams, lakes, and oceans charting similarities and differences of water movement. (M) (FA) (CoS) Students can use informational text to gather information of the uses of rocks, soil, and water in their community and around the world. They can communicate their findings through reports, presentations, posters, etc. (L) (FA) (PoS) (CoS) (NoS)	(T) Students can use age-appropriate tools to investigate the natural world. (A) Students can evaluate soil properties and the impact on plant growth. (S) Students can explain how different kinds of soil can affect the production of food.

Earth and Space Science	Curriculum Connections		Processes, Communication, and Nature of Science	Applications: Science, Technology, and Society
(E) Earth science	(M) Mathematics	(FA) Fine Arts	(PoS) Processes of science	(T) Tools of science
(SS) Space science	(L) Language Arts	(SS) Social Studies	(CoS) Communication of science	(A) Applications of science
			(NoS) Nature of science	(S) Implications of science for people

Subject	Grade	Standard	Objective
Science	**First**	**2. Earth and Space Science**	**2. Observe and describe changes in the appearance of the sun and moon during daylight.**

Content Big Ideas	Standard 1 Big Ideas – Intended Learning Outcomes	Science, Technology, and Society Big Ideas
(SS) The sun can be seen only in the daytime and the moon can be seen sometimes during the day.	(PoS) People can often learn about things around them by just observing those things carefully, but sometimes they can learn more by doing something to the things and noting what happens (raise questions about the world around them, be willing to seek answers to some of those questions by making careful observations and trying things out). (CoS) When doing science activities, it is often helpful to work with a team and to share findings with others. In this sharing, describing things as accurately as possible is important in science because it enables people to compare their observations with those of others (draw pictures that correctly portray at least some features of the thing being described, describe and compare things in terms of number, shape, texture, size, weight, color, and motion). (NoS) When people give different descriptions of the same thing, it is usually a good idea to make some fresh observations instead of just arguing about who is right.	(T) People use appropriate tools and models to investigate the world. (A) People working alone or in groups often invent new ways to solve problems and get work done. (S) The tools and ways of doing things that people have invented affect all aspects of life.

Indicators: Measureable Outcomes framed by Standard 1 Big Ideas

Indicator 1. Observe the sun at different times during the day and report observations to peers.
Indicator 2. Observe and chart the moon when it is visible during the day.

Science language students should be able to use correctly: identify, record, shadow.

Guidance for Combining Content and Process	Guidance for Combining Science, Technology, and Society
Suggested Strategies The students can observe the location of the sun at three different times each day during recess. Students can draw conclusions about the patterns and irregularities from their observations. Any observations made by students or groups that don't agree can be followed by continued observation. (L) (PoS) CoS) (NoS) The students can measure the size of their shadows during each recess and make comparisons between shadow measurements to sun locations charted earlier. (M) (PoS) Students can observe the moon over the period of four weeks. Students are empowered to decide what observations to make and chart the observations. During the sharing of observations, the teacher draws attention to the variety of the observations students made (shape, position, brightness, etc.). Students engage in a discussion about which observations were most useful in learning more about the moon. (M) (PoS) (CoS) NoS)	(T) Students can use age-appropriate tools to gather information about the sun and the moon. (A) Students can understand that the position of the sun correlates with the time of day. (S) Students can explain that people pattern their lives around the time of day.

Earth and Space Science	Curriculum Connections		Processes, Communication, and Nature of Science	Applications: Science, Technology, and Society
(E) Earth science	(M) Mathematics	(FA) Fine Arts	(PoS) Processes of science	(T) Tools of science
(SS) Space science	(L) Language Arts	(SS) Social Studies	(CoS) Communication of science	(A) Applications of science
			(NoS) Nature of science	(S) Implications of science for people

Subject	Grade	Standard	Objective
Science	First	2. Earth and Space Science	3. Compare and contrast the seasonal weather changes.

Content Big Ideas	Standard 1 Big Ideas – Intended Learning Outcomes	Science, Technology, and Society Big Ideas
(E) Seasonal weather changes occur each year.	(PoS) People can often learn about things around them by just observing those things carefully, but sometimes they can learn more by doing something to the things and noting what happens (raise questions about the world around them, be willing to seek answers to some of those questions by making careful observations and trying things out). (CoS) When doing science activities, it is often helpful to work with a team and to share findings with others. In this sharing, describing things as accurately as possible is important in science because it enables people to compare their observations with those of others (draw pictures that correctly portray at least some features of the thing being described, describe and compare things in terms of number, shape, texture, size, weight, color, and motion). (NoS) When people give different descriptions of the same thing, it is usually a good idea to make some fresh observations instead of just arguing about who is right.	(T) People use appropriate tools and models to investigate the world. (A) People working alone or in groups often invent new ways to solve problems and get work done. (S) The tools and ways of doing things that people have invented affect all aspects of life.

Indicators: Measureable Outcomes framed by Standard 1 Big Ideas

Indicator 1. Identify characteristics of the seasons of the year.
Indicator 2. Identify characteristics of weather, e.g., types of precipitation, sunny, windy, foggy, cloudy.
Indicator 3. Observe and record weather information within each season.

Science language students should be able to use correctly: data, foggy, globe, identify, map, models, precipitation, record, season, weather.

Guidance for Combining Content and Process	Guidance for Combining Science, Technology, and Society
Suggested Strategies The teacher can read literature about seasons and together with students, identify and chart the characteristics of each season. Encourage students to add information from their own background knowledge. As seasonal changes occur during the school year, the characteristics can be identified and new observations can be recorded on existing chart. (L) (CoS) Students can be introduced to weather by using a graphic organizer (What You Know, What You Want to Know, What You Have Learned [KWL Chart]). Student background knowledge can be used to complete the first two sections. Students can research literature on weather in order to complete the last section of the chart. (L) (CoS) Students can write, photograph, or draw pictures for a class/individual book that accurately portray the characteristics of weather. (L) (FA) (PoS) (CoS) Working as partners, students can keep a daily journal of the weather by drawing pictures and/or writing. Weekly class discussions on student findings will generate conclusions about how weather is affected by seasonal changes. Any observations made by students or groups that don't agree can be followed by continued observation. (L) (FA) (CoS) (NoS) A class graph can be recorded each day. (M)	(T) Students can use age-appropriate tools to better examine weather. (A) Students can determine how seasonal changes correlate with decisions about agricultural planting and harvesting. (S) Students can discuss and explain how the weather affects our daily lives.

Earth and Space Science	Curriculum Connections		Processes, Communication, and Nature of Science	Applications: Science, Technology, and Society
(E) Earth science	(M) Mathematics	(FA) Fine Arts	(PoS) Processes of science	(T) Tools of science
(SS) Space science	(L) Language Arts	(SS) Social Studies	(CoS) Communication of science	(A) Applications of science
			(NoS) Nature of science	(S) Implications of science for people

Subject	Grade	Standard	Objective
Science	**Second**	**2. Earth and Space Science**	**1. Describe the characteristics of different rocks.**

Content Big Ideas	Standard 1 Big Ideas – Intended Learning Outcomes	Science, Technology, and Society Big Ideas
(E) Chunks of rocks come in many sizes and shapes, from boulders to grains of sand and even smaller.	(PoS) When science investigation is done the way it was done before, we expect to get a very similar result. (NoS) Sometimes people aren't sure what will happen because they don't know everything that might have an effect. (CoS) When doing science activities, it is often helpful to work with a team and to share findings with others. All team members should reach their own individual conclusions, however, about what the findings mean.	(T) People use appropriate tools and models to investigate the world. (A) People working alone or in groups often invent new ways to solve problems and get work done. (S) Students understand that the tools and ways of doing things that people have invented affect all aspects of life.

Indicators: Measureable Outcomes framed by Standard 1 Big Ideas

Indicator 1. Explain how smaller rocks come from the breakage and weathering of larger rocks.
Indicator 2. Describe rocks in terms of their parts (e.g. crystals, grains, cement).
Indicator 3. Sort rocks based upon color, hardness, texture, layering, particle size and type (i.e., igneous, metamorphic, sedimentary).

Science language students should be able to use correctly: characteristics, weathering, texture, layering, particle, data, conclusions, properties.

Guidance for Combining Content and Process	Guidance for Combining Science, Technology, and Society
Suggested Strategies Students can conduct a simple experiment (making predictions, gathering data and forming conclusions) to determine how smaller rocks can form from the breakage of larger rocks. Students can share their findings in the form of posters, reports, journals, graphs, etc. (L) (M) (FA) (PoS) (CoS) Using age-appropriate tools (magnifying glass, water, sandpaper, hammer), students can examine rock samples and describe their parts. The products could include: drawings, charts, journals, or classroom books. (L) (M) (FA) (PoS) (CoS) Working in teams, students can sort rock samples based on their physical characteristics (color, hardness, texture, layering and particle size) and report their findings. (L) (PoS) (CoS)	(T) The students can use magnifiers to help see things they could not see without them. (A) The students can identify how the properties of rocks determine how people use them. (S) The students can explain how rocks are used by people every day and evaluate the positive and negative impacts these uses have on society.

Earth and Space Science	Curriculum Connections		Processes, Communication, and Nature of Science	Applications: Science, Technology, and Society
(E) Earth science	(M) Mathematics	(FA) Fine Arts	(PoS) Processes of science	(T) Tools of science
(SS) Space science	(L) Language Arts	(SS) Social Studies	(CoS) Communication of science	(A) Applications of science
			(NoS) Nature of science	(S) Implications of science for people

Subject	Grade	Standard	Objective
Science	**Second**	**2. Earth and Space Science**	**2. Observe and record the recognizable objects and patterns in the night sky.**

Content Big Ideas	Standard 1 Big Ideas – Intended Learning Outcomes	Science, Technology, and Society Big Ideas
(S) There are recognizable patterns among objects in the night sky.	(PoS) When science investigation is done the way it was done before, we expect to get a very similar result. (NoS) Sometimes people aren't sure what will happen because they don't know everything that might have an effect. (CoS) When doing science activities, it is often helpful to work with a team and to share findings with others. All team members should reach their own individual conclusions, however, about what the findings mean.	(T) People use appropriate tools and models to investigate the world. (A) People working alone or in groups often invent new ways to solve problems and get work done. (S) The tools and ways of doing things that people have invented affect all aspects of life.

Indicators: Measureable Outcomes framed by Standard 1 Big Ideas

Indicator 1. Observe, describe, and record patterns in the appearance and apparent motion of the moon in the night sky.
Indicator 2. Observe and describe the number, arrangement and color/brightness of stars in the night sky.

Science language students should be able to use correctly: arrangement, patterns, location, variations, constellations, moon phases.

Guidance for Combining Content and Process	Guidance for Combining Science, Technology, and Society
Suggested Strategies During a time when the moon is visible at night, students can keep a nightly journal recording the appearance and location of the moon in the sky for one week. The product can be the journal and reflective discussion/writings/opinions. (L) (PoS) (CoS) Students can make an observation of the night sky to record the estimated number of stars, the apparent color/brightness of the stars and the arrangement of stars in the sky. After making observations, students can discuss findings in groups and develop their conclusions about the patterns and variations of the stars in the sky. (L) (M) (PoS) (NoS)	(T) Students can use magnifiers (e.g. binoculars, telescopes) to help see things they could not see without them. (A) Students can explain how objects in the night sky are used for navigation (e.g. GPS, north star, star patterns). (A) Students can understand that space exploration has produced data to answer questions about the moon and stars. (S) Students can evaluate factors in the environment that might limit viewing of the night sky.

Earth and Space Science	Curriculum Connections		Processes, Communication, and Nature of Science	Applications: Science, Technology, and Society
(E) Earth science	(M) Mathematics	(FA) Fine Arts	(PoS) Processes of science	(T) Tools of science
(SS) Space science	(L) Language Arts	(SS) Social Studies	(CoS) Communication of science	(A) Applications of science
			(NoS) Nature of science	(S) Implications of science for people

Subject	Grade	Standard	Objective
Science	**Second**	**2. Earth and Space Science**	**3. Observe, describe and measure seasonal weather patterns and local variations.**

Content Big Ideas	Standard 1 Big Ideas – Intended Learning Outcomes	Science, Technology, and Society Big Ideas
(E) Some changes, such as changes in weather can vary based on season and location.	(PoS) When science investigation is done the way it was done before, we expect to get a very similar result. (NoS) Sometimes people aren't sure what will happen because they don't know everything that might have an effect. (CoS) When doing science activities, it is often helpful to work with a team and to share findings with others. All team members should reach their own individual conclusions, however, about what the findings mean.	(T) People use appropriate tools and models to investigate the world. (A) People working alone or in groups often invent new ways to solve problems and get work done. (S) The tools and ways of doing things that people have invented affect all aspects of life.

Indicators: Measureable Outcomes framed by Standard 1 Big Ideas

Indicator 1. Compare and contrast the seasonal weather patterns during the school year.
Indicator 2. Analyze and interpret data such as temperatures in different locations and different times.

Science language students should be able to use correctly: seasonal, variations, analyze, interpret, temperature, precipitation, thermometer, rain gauge, weather vane, data, conclusions, location, patterns.

Guidance for Combining Content and Process	Guidance for Combining Science, Technology, and Society
Suggested Strategies Students can record and interpret weather data using a graph with numbered axes for temperature and pictographs for precipitation (rainy/snowy), cloud cover (cloudy/sunny), and wind conditions (windy/not windy) if applicable. They can repeat data collection during each season and then compare and discuss the variations. (L) (M) (PoS) (CoS) (NoS) Students can conduct a simple experiment (making predictions, gathering data and forming conclusions) to determine the variations in temperature of various locations (grass/asphalt, sun/shade, your school/another area) and different times of day (morning/afternoon). The product could be a video mini-weather report, newspaper article, charts, graphs, or various kinds of computer presentations. (L) (M) (FA) (PoS) (CoS) (NoS) Student products could be a video mini-weather report, newspaper article, charts, graphs, various kinds of computer presentations, etc. (L) (M) (FA) CoS)	(T) Students can measure weather data using weather instruments such as a thermometer, rain gauge, and weather vane. (T) Students can gather and record weather data on paper or using the internet. (A) Students can evaluate the changes in our daily lives based on changes in the weather. (S) Students can evaluate the economic/agricultural impacts of extreme weather.

Earth and Space Science	Curriculum Connections		Processes, Communication, and Nature of Science	Applications: Science, Technology, and Society
(E) Earth science	(M) Mathematics	(FA) Fine Arts	(PoS) Processes of science	(T) Tools of science
(SS) Space science	(L) Language Arts	(SS) Social Studies	(CoS) Communication of science	(A) Applications of science
			(NoS) Nature of science	(S) Implications of science for people

Science Content by Standard – Standard 3

Standard 3 – Physical Science

Students will gain an understanding of Physical Science through the study of the forces of motion and the properties of materials.

	Kindergarten	First Grade	Second Grade
Objective 1	Identify how non-living things move.	Analyze changes in the movement of non-living things.	Communicate observations about falling objects.
Indicators:	– Observe and record how objects move in different ways, e.g., fast, slow, zigzag, round and round, up and down, straight line, back and forth, slide, roll, bounce, spin, swing, float, and glide. – Compare and contrast how physical properties of objects affect their movement, e.g., hard, soft, feathered, round, square, cone, geometric shapes.	– Describe, classify, and communicate observations about the motion of objects, e.g., straight, zigzag, circular, curved, back-and-forth, and fast or slow. – Compare and contrast the movement of objects using drawings, graphs, and numbers. – Explain how a push or pull can affect how an object moves.	– Observe falling objects and identify things that prevent them from reaching the ground. – Communicate observations that similar objects of varying masses fall at the same rate.
Objective 2	Describe parts of non-living things.	Analyze objects and record their properties.	Compare and contrast the differences in how different materials respond to change.
Indicators:	– Describe how parts are used to build things and how things can be taken apart. – Explain why things may not work the same if some of the parts are missing.	– Sort, classify, and chart objects by observable properties, e.g., size, shape, color, and texture. – Predict measurable properties such as weight, temperature, and whether objects sink or float; test and record data. – Predict, identify, and describe changes in matter when heated, cooled, or mixed with water.	– Model physical changes of various materials. – Investigate and provide evidence that matter is not destroyed or created through changes.

Supplemental Materials for Standard 3 – Physical Science

The materials on the following pages are supplemental to the core. Each objective in Standard 3 has a sheet of information vital to student learning of science and the scientific processes inherent in the core. They are intended to give guidance to the teacher on the following topics:

- The Big Ideas go beyond discrete facts or skills to focus on larger concepts, principles, or processes (Grant Wiggins and Jay McTighe*, Understanding by Design,* 1998, p. 10). Big Ideas are cumulative, meaning that students revisit ideas that are previously developed, but in more and more complex ways at each successive grade level. This allows teachers to anchor learning at the beginning of the grade level to "concepts and reasoning abilities that young children bring with them" (NRC, 2008).

- Indicators provide both Measureable Outcomes framed by Standard 1objectives and Big Ideas and measurable indicators of student content knowledge and scientific processing for teachers.

- Science language is the language that students should use when conversing on each objective within the standard. Students may not be expected to spell and read each and every term.

- Guidance for combining Content and Process are suggested strategies teachers may use to teach the core. One-letter abbreviations (L, M, A, S) are included to show how the science learning may be integrated into Language Arts, Mathematics, Arts, and Social Studies concepts. Science content should never be taught as content alone, but should be taught through the process of scientific practice, embedding content into inquiry, hands-on learning, experimentation, interpretation of evidence, and communication of findings. "When students engage in science as practice, they develop knowledge and explanations of the natural world as they generate and interpret evidence." *(Ready, Set, Science: Putting Research to Work in K-8 Science Classrooms, pg. 34)*

- According to the National Science Education Standards, it is important to help students "establish connections between the natural and designed worlds." Guidance for combining Science, Technology, and Society provide support to teachers in this area.

- A key for interpreting the abbreviations used in the supplementary materials is found at the bottom of the page.

Important Note: A guide for reading the supplementary materials is found in Appendix B.

Subject	Grade	Standard	Objective
Science	**K**	**3. Physical Science**	**1. Identify how non-living things move.**

Content Big Ideas	Standard 1 Big Ideas – Intended Learning Outcomes	Science, Technology, and Society Big Ideas
(F) Things move in many different ways, such as straight, zig zag, round and round, back and forth, and fast and slow.	(PoS) People can often learn about things around them by just observing those things carefully (raise questions about the world around them, be willing to seek answers to some of those questions by making careful observations). (NoS) People are more likely to believe your ideas if you can give reasons for them (ask "How do you know?" in appropriate situations and attempt reasonable answers when others ask them the same questions). (CoS) When doing science activities, it is often helpful to work with a team and to share findings with others.	(T) People use appropriate tools and models to investigate the world. (A) People working alone or in groups, often invent new ways to solve problems and get work done. (S) The tools and ways of doing things that people have invented affect all aspects of life.

Indicators: Measureable Outcomes framed by Standard 1 Big Ideas

Indicator 1. Observe and record how objects move in different ways, e.g., fast, slow, zigzag, round and round, up and down, straight line, back and forth, slide, roll, bounce, spin, swing, float, and glide.

Indicator 2. Compare and contrast how physical properties of objects affect their movement, e.g., hard, soft, feathered, round, square, cone, geometric shapes.

Science language students should be able to use correctly: fast, slow, zigzag, round and round, up, down, straight line, back, forth, slide, roll, bounce, spin, swing, float, glide, push, pull.

Guidance for Combining Content and Process	Guidance for Combining Science, Technology, and Society
Suggested Strategies Have students build an incline ramp, have them place different items on the ramp and observe the movement as the objects go down the ramp. Use different shaped items, such as marbles, potatoes, geometric shapes, and cars. Ask the students to investigate the following questions (and others that you or your students choose): (PoS) • What are some of the ways that we can describe the movement of the objects? Can you predict which way an object will move? Have the students write their predictions in a journal. (L) • Which objects move faster down an incline ramp? Why do you think this? Predict which object would 'win' in a 'race' down the ramp. • How can you integrate measurement into these activities? Have students count how long it takes an object to move down the ramp and then make a graph for comparison. (M) (CoS) Have the students observe different objects moving through different mediums in the sensory table, as well as through the air. (Suggested mediums: water, rice, sand, clay) Ask the students to observe and record the movements of the objects. Ask them to investigate the following questions (and others that you or your students choose): (PoS) • How can objects (e.g., boats, balls, manipulatives) move in your sensory table (e.g., water, sand, rice)? Are some objects easier than others to move? • Does the shape of the object change the way it moves? Why do you think this?(FA)	(T) Discuss the use of technology in the process of science by pointing out the various tools used while learning this objective. Examples of tools are simple machines (ramp), rulers, stopwatches, Frisbee. (A)Explain the application of science by discussing how investigation into objects has led us to invent technology such as airplanes, cars, and bicycles. (S)Show that society has benefited from the use of science in studying how objects move in aerospace programs, athletics, and satellite technology.

Physical Science	Curriculum Connections		Processes, Communication, and Nature of Science	Applications: Science, Technology, and Society
(A) Atomic/Molecular	(M) Mathematics	(FA) Fine Arts	(PoS) Processes of science	(T) Tools of science
(F) Force and Motion	(L) Language Arts	(SS) Social Studies	(CoS) Communication of science	(A) Applications of science
			(NoS) Nature of science	(S) Implications of science for people

Subject	Grade	Standard	Objective
Science	**K**	**3. Physical Science**	**2. Describe parts of non-living things.**

Content Big Ideas	Standard 1 Big Ideas – Intended Learning Outcomes	Science, Technology, and Society Big Ideas
(A) Most things are made of parts.	(PoS) People can often learn about things around them by just observing those things carefully (raise questions about the world around them, be willing to seek answers to some of those questions by making careful observations). (NoS) People are more likely to believe your ideas if you can give reasons for them (ask "How do you know?" in appropriate situations and attempt reasonable answers when others ask them the same questions). (CoS) When doing science activities, it is often helpful to work with a team and to share findings with others.	(T) People use appropriate tools and models to investigate the world. (A) People working alone or in groups often invent new ways to solve problems and get work done. (S) The tools and ways of doing things that people have invented affect all aspects of life.

Indicators: Measureable Outcomes framed by Standard 1 Big Ideas

Indicator 1. Describe how parts are used to build things and how things can be taken apart.
Indicator 2. Explain why things may not work the same if some of the parts are missing.

Science language students should be able to use correctly: part, whole.

Guidance for Combining Content and Process	Guidance for Combining Science, Technology, and Society
Suggested Strategies Have students identify the parts of a specific object or area. Ask them to investigate the following questions (and others that you and your students choose): (PoS) • What things turn a room into a classroom? Does a classroom look different than your bedroom? What objects make the two rooms different? (SS) • Are all things made of parts? What things around you are made of parts? (FA) • Point out that the students' body is made of parts. Have the students make a presentation about what would happen if parts were missing.(L) (CoS) Have students work as a team to build an item from parts (Lego building, puzzle): (M) (PoS) • What happens if one of the parts of your team is missing? Will your structure look the same if one of the parts is missing? Have the students work as a team to take an item apart: (PoS) • How does knowing the parts of an item help you to take it apart? Have students work in the sensory table to explore a whole and its parts. For example have the students build science bottles with corn syrup, oil, and water. Have the students 'filter' out a mixture of rocks, sand, and water. (PoS)	(T) Magnifiers, tools for putting things together and taking things apart, e.g., hammer, screwdrivers. (A) Automobiles, computers, houses and other things are made of parts. (S) Things can be repaired using parts.

Physical Science	Curriculum Connections		Processes, Communication, and Nature of Science	Applications: Science, Technology, and Society
(A) Atomic/Molecular	(M) Mathematics	(FA) Fine Arts	(PoS) Processes of science	(T) Tools of science
(F) Force and Motion	(L) Language Arts	(SS) Social Studies	(CoS) Communication of science	(A) Applications of science
			(NoS) Nature of science	(S) Implications of science for people

Subject	Grade	Standard	Objective
Science	**First**	**3. Physical Science**	**1. Analyze changes in the movement of non-living things.**

Content Big Ideas	Standard 1 Big Ideas – Intended Learning Outcomes	Science, Technology, and Society Big Ideas
(F) Things move in many different ways, such as straight, zigzag, round and round, back and forth, and fast and slow. (F) The way to change how something is moving is to give it a push or pull.	(PoS) People can often learn about things around them by just observing those things carefully, but sometimes they can learn more by doing something to the things and noting what happens (raise questions about the world around them, be willing to seek answers to some of those questions by making careful observations and trying things out). (CoS) When doing science activities, it is often helpful to work with a team and to share findings with others. In this sharing, describing things as accurately as possible is important in science because it enables people to compare their observations with those of others (draw pictures that correctly portray at least some features of the thing being described, describe and compare things in terms of number, shape, texture, size, weight, color, and motion). (NoS) When people give different descriptions of the same thing, it is usually a good idea to make some fresh observations instead of just arguing about who is right.	(T) People use appropriate tools and models to investigate the world. (A) People working alone or in groups often invent new ways to solve problems and get work done. (S) The tools and ways of doing things that people have invented affect all aspects of life.

Indicators: Measureable Outcomes framed by Standard 1 Big Ideas

Indicator 1. Describe, classify, and communicate observations about the motion of objects, e.g., straight, zigzag, circular, curved, back-and-forth, and fast or slow.
Indicator 2. Compare and contrast the movement of objects using drawings, graphs, and numbers.
Indicator 3. Explain how a push or pull can affect how an object moves.

Science language students should be able to use correctly: motion, zigzag, bar graph, observe, describe.

Guidance for Combining Content and Process	Guidance for Combining Science, Technology, and Society
Suggested Strategies Teachers can guide students in brainstorming the ways to describe the motion of objects. Generate a list of the different ways objects move, use that list as a data collection sheet for each student. Teacher and students can locate and describe the movement of objects in and around the school and record on the data sheet. In groups students discuss their findings with peers. Any differences in observations can be resolved as the teacher helps student consolidate class data and bar graph the number of each of the different motions observed (e.g., 15 windows moving up and down, 10 doors moving back-and-forth, 2 fans moving in circular motion). (L) (M) (PoS) (CoS) (NoS)	(T) Students can use age-appropriate tools to learn more about movement. (A) Students can explain that motions can be predictable and useful in daily life or when creating tools. (S) Students understand that these principles affect many functions in day-to-day living, including transportation, how water gets to the home, etc.

Physical Science	Curriculum Connections		Processes, Communication, and Nature of Science	Applications: Science, Technology, and Society
(A) Atomic/Molecular	(M) Mathematics	(FA) Fine Arts	(PoS) Processes of science	(T) Tools of science
(F) Force and Motion	(L) Language Arts	(SS) Social Studies	(CoS) Communication of science	(A) Applications of science
			(NoS) Nature of science	(S) Implications of science for people

Subject	Grade	Standard	Objective
Science	**First**	**3. Physical Science**	**2. Analyze objects and record their properties.**

Content Big Ideas	Standard 1 Big Ideas – Intended Learning Outcomes	Science, Technology, and Society Big Ideas
(A) Objects can be described in terms of materials they are made from (clay, cloth, paper, etc.) and their physical properties (color, size, shape, weight, texture, flexibility, etc.).	(PoS) People can often learn about things around them just by observing those things carefully, but sometimes they can learn more by doing something to the things and noting what happens (raise questions about the world around them, be willing to seek answers to some of those questions by making careful observations and trying things out). (CoS) When doing science activities, it is often helpful to work with a team and to share findings with others. In this sharing, describing things as accurately as possible is important in science because it enables people to compare their observations with those of others (draw pictures that correctly portray at least some features of the thing being described, describe and compare things in terms of number, shape, texture, size, weight, color, and motion). (NoS) When people give different descriptions of the same thing, it is usually a good idea to make some fresh observations instead of just arguing about who is right.	(T) People use appropriate tools and models to investigate the world. (A) People working alone or in groups often invent new ways to solve problems and get work done. (S) Tools and ways of doing things that people have invented affect all aspects of life.

Indicators: Measureable Outcomes framed by Standard 1 Big Ideas

Indicator 1. Sort, classify, and chart objects by observable properties, e.g., size, shape, color, and texture.
Indicator 2. Predict measurable properties such as weight, temperature, and whether objects sink or float; test and record data.
Indicator 3. Predict, identify, and describe changes in matter when heated, cooled, or mixed with water.

Science language students should be able to use correctly: sort, predict, classify, solid, liquid, dissolve, matter, property, mix.

Guidance for Combining Content and Process	Guidance for Combining Science, Technology, and Society
Suggested Strategies Using various objects and simple tools such as a magnifier ruler, scale, and thermometer, students work in groups to classify and arrange objects by at least 2 observable attributes (e.g., size, shape, color, texture) or properties so that similarities and differences become apparent. Chart and discuss findings. (L) (M) (PoS) (CoS) Students determine whether objects sink or float by placing various objects in water (e.g., rocks, pumice stone, pumpkins, clay boats), (PoS) Students develop their own defining characteristics of solids, liquids, and gases by manipulating a variety of examples. For instance, students are given five different liquids (e.g., water, oil, dish soap, milk, soda) to construct their characteristics. Students can construct the characteristics of a gas by using balloons, straws, simple gliding machines, and fans. (PoS) Students can observe, test, and describe how water and other materials change from liquid to solid and back again (e.g., observe that liquids left in an open container decrease in amount over time, but the amount in a closed container does not). (PoS) (CoS)	(T) Students can use age-appropriate tools to analyze properties of objects. (A) Students can explain that objects have different uses because of their properties. (A) Students can understand that certain objects are recyclable because of their properties. (A) Students can influence the amount of items recycled. (S) Students can have a direct impact on the environment.

Physical Science	Curriculum Connections		Processes, Communication, and Nature of Science	Applications: Science, Technology, and Society
(A) Atomic/Molecular	(M) Mathematics	(FA) Fine Arts	(PoS) Processes of science	(T) Tools of science
(F) Force and Motion	(L) Language Arts	(SS) Social Studies	(CoS) Communication of science	(A) Applications of science
			(NoS) Nature of science	(S) Implications of science for people

Subject	Grade	Standard	Objective
Science	**Second**	**3. Physical Science**	**1. Communicate observations about falling objects.**

Content Big Ideas	Standard 1 Big Ideas – Intended Learning Outcomes	Science, Technology, and Society Big Ideas
(F) Things near the earth fall to the ground unless something holds them up.	(PoS) When science investigation is done the way it was done before, we expect to get a very similar result. (NoS) Sometimes people aren't sure what will happen because they don't know everything that might have an effect. (CoS) When doing science activities, it is often helpful to work with a team and share findings with others. All team members should reach their own individual conclusions, however, about what the findings mean.	(T) People use appropriate tools and models to investigate the world. (A) People working alone or in groups often invent new ways to solve problems and get work done. (S) The tools and ways of doing things that people have invented affect all aspects of life.

Indicators: Measureable Outcomes framed by Standard 1 Big Ideas

Indicator 1. Observe falling objects and identify things that prevent them from reaching the ground.
Indicator 2. Communicate observations that similar objects of varying masses fall at the same rate.

Science language students should be able to use correctly: communicate, observations, identify, demonstrate, investigate, data, conclusions, motion, weightlessness, prevent, various.

Guidance for Combining Content and Process	Guidance for Combining Science, Technology, and Society
Suggested Strategies In small groups, students can make and communicate observations about falling objects. (L) (PoS) (CoS) Students can name and/or develop things which prevent objects from reaching the ground. (FA) (PoS) (CoS) Students can conduct simple experiments (make predictions, gather data, and draw conclusions) to investigate the rate of falling for similar objects of varying masses (large rock/small rock, full bottle/empty bottle). The products could include: prediction charts, journals, etc. (L) (M) (PoS) (CoS) (NoS)	(T) Falling objects can be videotaped and then viewed in slow motion. (A) Students can describe the effects of weightlessness in space (i.e. viewing NASA videos). (S) Students can evaluate the positive and negative impacts of gravity on their daily life.

Physical Science	Curriculum Connections		Processes, Communication, and Nature of Science	Applications: Science, Technology, and Society
(A) Atomic/Molecular	(M) Mathematics	(FA) Fine Arts	(PoS) Processes of science	(T) Tools of science
(F) Force and Motion	(L) Language Arts	(SS) Social Studies	(CoS) Communication of science	(A) Applications of science
			(NoS) Nature of science	(S) Implications of science for people

Subject	Grade	Standard	Objective
Science	**Second**	**3. Physical Science**	**2. Compare and contrast how different materials respond to change.**

Content Big Ideas	Standard 1 Big Ideas – Intended Learning Outcomes	Science, Technology, and Society Big Ideas
(A) Things can be done to materials to change some of their properties, but not all materials respond the same way to what is done to them.	(P) When science investigation is done the way it was done before, we expect to get a very similar result. (N) Sometimes people aren't sure what will happen because they don't know everything that might have an effect. (C) When doing science activities, it is often helpful to work with a team and to share findings with others. All team members should reach their own individual conclusions, however, about what the findings mean.	(T) People use appropriate tools and models to investigate the world. (A) People working alone or in groups often invent new ways to solve problems and get work done. (S) The tools and ways of doing things that people have invented affect all aspects of life.

Indicators: Measureable Outcomes framed by Standard 1 Big Ideas

Indicator 1. Model physical changes of various materials.
Indicator 2. Investigate and provide evidence that matter is not destroyed or created through changes.

Science language students should be able to use correctly: demonstrate, physical, matter, data, conclusions, investigate, mass.

Guidance for Combining Content and Process	Guidance for Combining Science, Technology, and Society
Suggested Strategies Students can investigate that materials can be changed by cutting, folding, sanding, tearing, melting, heating and cooling. Products could include T-chart, Venn diagram, before/after pictures, before/during/after journal entries, etc. (L) (M) (FA) (PoS) (CoS) Students can conduct a simple experiment (make predictions, gather data, draw conclusions) to investigate that making physical changes does not create or destroy matter by measuring mass before and after change. Materials that might be used could include: paper (whole piece/shredded), aluminum foil (sheet/crumpled), crayon (whole/melted/shavings), clay (lump/formed), paper clips (loose/chain), pipe cleaners (straight/formed), etc. Students can communicate observations and justifications of their conclusions. (L) (M) (PoS) CoS) (NoS)	(T) Students can use age-appropriate tools during investigations (scales, scissors, etc.). (T) Teachers can use necessary tools such as heating devices, cameras, overhead, etc. (A) Students can explain the role of physical changes in the process of recycling. (S) Students can evaluate the positive and negative aspects of recycling.

Physical Science	Curriculum Connections		Processes, Communication, and Nature of Science	Applications: Science, Technology, and Society
(A) Atomic/Molecular	(M) Mathematics	(FA) Fine Arts	(PoS) Processes of science	(T) Tools of science
(F) Force and Motion	(L) Language Arts	(SS) Social Studies	(CoS) Communication of science	(A) Applications of science
			(NoS) Nature of science	(S) Implications of science for people

Science Content by Standard – Standard 4

Standard 4 – Life Science

Students will gain an understanding of Life Science through the study of changes in organisms over time and the nature of living things.

	Kindergarten	First Grade	Second Grade
Objective 1	**Investigate living things.**	**Communicate observations about the similarities and differences between offspring and between populations.**	**Tell how external features affect an animals' ability to survive in its environment.**
Indicators:	– Construct questions, give reasons, and share findings about all living things. – Compare and contrast young plants and animals with their parents. – Describe some changes in plants and animals that are so slow or so fast that they are hard to see (e.g., seasonal change, "fast" blooming flower, slow growth, hatching egg).	– Communicate observations about plants and animals, including humans, and how they resemble their parents. – Analyze the individual similarities and differences within and across larger groups.	– Compare and contrast the characteristics of living things in different habitats. – Develop, communicate, and justify an explanation as to why a habitat is or is not suitable for a specific organism. – Create possible explanations as to why some organisms no longer exist, but similar organisms are still alive today.
Objective 2	**Describe the parts of living things.**	**Living things change and depend upon their environment to satisfy their basic needs.**	**Identify basic needs of living things (plants and animals) and their abilities to meet their needs.**
Indicators:	– Differentiate between the five senses and related body parts. – Identify major parts of plants, e.g., roots, stem, leaf, flower, trunk, branches. – Compare the parts of different animals, e.g., skin, fur, feathers, scales; hand, wing, flipper, fin.	– Make observations about living things and their environment using the five senses. – Identify how natural earth materials (e.g., food, water, air, light, and space), help to sustain plant and animal life. – Describe and model life cycles of living things.	– Communicate and justify how the physical characteristics of living things help them meet their basic needs. – Observe, record, and compare how the behaviors and reactions of living things help them meet their basic needs. – Identify behaviors and reactions of living things in response to changes in the environment including seasonal changes in temperature and precipitation.

Supplemental Materials for Standard 4 – Life Science

The materials on the following pages are supplemental to the core. Each objective in Standard 4 has a sheet of information vital to student learning of science and the scientific processes inherent in the core. They are intended to give guidance to the teacher on the following topics:

- The Big Ideas go beyond discrete facts or skills to focus on larger concepts, principles, or processes (Grant Wiggins and Jay McTighe*, Understanding by Design,* 1998, p. 10). Big Ideas are cumulative, meaning that students revisit ideas that are previously developed, but in more and more complex ways at each successive grade level. This allows teachers to anchor learning at the beginning of the grade level to "concepts and reasoning abilities that young children bring with them" (NRC, 2008).

- Indicators provide both Measureable Outcomes framed by Standard 1objectives and Big Ideas and measurable indicators of student content knowledge and scientific processing for teachers.

- Science language is the language that students should use when conversing on each objective within the standard. Students may not be expected to spell and read each and every term.

- Guidance for combining Content and Process are suggested strategies teachers may use to teach the core. One-letter abbreviations (L, M, A, S) are included to show how the science learning may be integrated into Language Arts, Mathematics, Arts, and Social Studies concepts. Science content should never be taught as content alone, but should be taught through the process of scientific practice, embedding content into inquiry, hands-on learning, experimentation, interpretation of evidence, and communication of findings. "When students engage in science as practice, they develop knowledge and explanations of the natural world as they generate and interpret evidence." *(Ready, Set, Science: Putting Research to Work in K-8 Science Classrooms, pg. 34)*

- According to the National Science Education Standards, it is important to help students "establish connections between the natural and designed worlds." Guidance for combining Science, Technology, and Society provide support to teachers in this area.

- A key for interpreting the abbreviations used in the supplementary materials is found at the bottom of the page.

Important Note: A guide for reading the supplementary materials is found in Appendix B.

Subject	Grade	Standard	Objective
Science	**K**	**4. Life Science**	**1. Investigate living things.**

Content Big Ideas	Standard 1 Big Ideas – Intended Learning Outcomes	Science, Technology, and Society Big Ideas
(CT) Change is something that happens to many things. (CT) Some changes are so slow or so fast that they are hard to see.	(PoS) People can often learn about things around them by just observing those things carefully (raise questions about the world around them, be willing to seek answers to some of those questions by making careful observations). (NoS) People are more likely to believe your ideas if you can give reasons for them (ask "How do you know?" in appropriate situations and attempt reasonable answers when others ask them the same questions). (CoS) When doing science activities, it is often helpful to work with a team and to share findings with others.	(T) People use appropriate tools and models to investigate the world. (A) People working alone or in groups often invent new ways to solve problems and get work done. (S) The tools and ways of doing things that people have invented affect all aspects of life.

Indicators: Measureable Outcomes framed by Standard 1 Big Ideas

Indicator 1. Construct questions, give reasons, and share findings about living things.
Indicator 2. Compare and contrast young plants and animals with their parents.
Indicator 3. Describe some changes in plants and animals that are so slow or fast that they are hard to see, e.g., "slow" growth, seasonal change, "fast" blooming flower, hatching egg.

Science language students should be able to use correctly: living vs. non-living things, change, grow.

Guidance for Combining Content and Process	Guidance for Combining Science, Technology, and Society
Suggested Strategies Have students sort representations of or actual living and non-living things. Ask these and other related questions: (PoS) • Can you sort living and non-living things by observed characteristics of each item? (M) • How would you define an object as living? What are the characteristics that are similar between living things? Have students identify living things in their environment that change. Ask them to investigate the following questions (and others that you or your students choose): (PoS) (CoS) • How could you determine the change made in a plant? In an animal? Can you measure changes in organisms?(M) • Do plants and animals change as they grow? Describe the differences between a young plant/animal and an adult plant/animal. These differences could be shown in the form of a graph (M), a drawing (FA), or a written description (L). Allow the students to share their findings with other groups. Create a class chart showing the findings of each group (L). Compare described changes with changes that the students have observed in their environment. (PoS) (CoS) (NoS)	(T) Point out the various tools used while learning this objective. Examples of tools are a magnifying glass, ruler, camera, binoculars. (A)Discuss how through investigating living things we have been able to invent technology and understand environments required for living. (S)Show that society has benefited from the use of science in studying living and non-living things. Examples are wildlife conservation issues, needs of living things including medical applications and environmental concerns.

Life Sciences	Curriculum Connections		Processes, Communication, and Nature of Science	Applications: Science, Technology, and Society
(CT) Changes over time	(M) Mathematics	(FA) Fine Arts	(PoS) Processes of science	(T) Tools of science
(N) Nature of Living Things	(L) Language Arts	(SS) Social Studies	(CoS) Communication of science	(A) Applications of science
			(NoS) Nature of science	(S) Implications of science for people

Subject	Grade	Standard	Objective
Science	**K**	**4. Life Science**	**2. Describe the parts of living things.**

Content Big Ideas	Standard 1 Big Ideas – Intended Learning Outcomes	Science, Technology, and Society Big Ideas
(N) Most things are made of parts. (CT) Change is something that happens to many things.	(PoS) People can often learn about things around them by just observing those things carefully (raise questions about the world around them, be willing to seek answers to some of those questions by making careful observations). (NoS) People are more likely to believe your ideas if you can give reasons for them (ask "How do you know?" in appropriate situations and attempt reasonable answers when others ask them the same questions). (CoS) When doing science activities, it is often helpful to work with a team and to share findings with others.	(T) People use appropriate tools and models to investigate the world. (A) People working alone or in groups often invent new ways to solve problems and get work done. (S) The tools and ways of doing things that people have invented affect all aspects of life.

Indicators: Measureable Outcomes framed by Standard 1 Big Ideas

Indicator 1. Differentiate between the five senses and related body parts.
Indicator 2. Identify major parts of plants, e.g., roots, stem, leaf, flower, trunk, branches.
Indicator 3. Compare the parts of different animals, e.g., skin, fur, feathers, scales; hand, wing, flipper, fin.

Science language students should be able to use correctly: living vs. non-living things, senses, sight, taste, touch, smell, sound, bitter, sweet, salty.

Guidance for Combining Content and Process	Guidance for Combining Science, Technology, and Society
Suggested Strategies Have students identify the major parts of plants. Ask them to investigate using the following questions (and others that you or your students choose): (PoS) (CoS) • How many different types of plants can we find in the schoolyard? What do they have in common? What is different? • Do all plants have similar parts? How might these differences help/hurt the plant in its environment? Have students take measurements as part of their observations of different plants and their parts(M), and then ask them to discuss why one plant may have larger leaves than another.(L) (PoS) (CoS) (NoS) Have students compare/contrast the differences and similarities between animal structures. Ask them to investigate using the following questions (and others that you or your students choose): (FA) (PoS) (CoS) (NoS) • Do all animals look the same? What are the major differences between specific types of animals?(ex. Compare a duck to a snake to a dog) • How could you use your five senses to help identify the differences/similarities between animals? • What body parts do all animals have? How do animals use their body parts to make observations about their environment? (ex. Snakes use their tongues to 'taste' the air, bats use their hearing to 'see' where they are going)	(A) By investigating parts of living things scientists and doctors have learned how to repair or replace some of the parts. (S) Improved living. (T) Discuss the use of technology in the process of science by pointing out the various tools used while learning this objective. Examples of tools are a magnifying glass, video, camera, and computers. (S)Show that society has benefited from the use of science in studying living things. By understanding the needs of living things we have improved living and cutting edge medical applications.

Life Sciences	Curriculum Connections		Processes, Communication and Nature of Science	Applications: Science, Technology, and Society
(CT) Changes over time	(M) Mathematics	(FA) Fine Arts	(PoS) Processes of science	(T) Tools of science
(N) Nature of Living Things	(L) Language Arts	(SS) Social Studies	(CoS) Communication of science	(A) Applications of science
			(NoS) Nature of science	(S) Implications of science for people

Subject	Grade	Standard	Objective
Science	**First**	**4. Life Science**	**1. Communicate observations about the similarities and differences between offspring and between populations.**

Content Big Ideas	Standard 1 Big Ideas – Intended Learning Outcomes	Science, Technology, and Society Big Ideas
(CT) All kinds of living things have offspring, usually with two parents involved. (CT) Offspring are very much alike, but not exactly, like their parents and like one another. (CT) Some animals and plants are alike in the way they look and things they do, and others are very different from one another.	(PoS) People can often learn about things around them by just observing those things carefully, but sometimes they can learn more by doing something to the things and noting what happens (raise questions about the world around them, be willing to seek answers to some of those questions by making careful observations and trying things out). (CoS) When doing science activities, it is often helpful to work with a team and to share findings with others. In this sharing, describing things as accurately as possible is important in science because it enables people to compare their observations with those of others (draw pictures that correctly portray at least some features of the thing being described, describe and compare things in terms of number, shape, texture, size, weight, color, and motion). (NoS) When people give different descriptions of the same thing, it is usually a good idea to make some fresh observations instead of just arguing about who is right.	(T) People use appropriate tools and models to investigate the world. (A) People working alone or in groups often invent new ways to solve problems and get work done. (S) Students understand that tools and ways of doing things that people have invented affect all aspects of life.

Indicators: Measureable Outcomes framed by Standard 1 Big Ideas

Indicator 1. Communicate observations about plants and animals, including humans, and how they resemble their parents.
Indicator 2. Analyze the individual similarities and differences within and across larger groups.

Science language students should be able to use correctly: populations, similarities, differences.

Guidance for Combining Content and Process	Guidance for Combining Science, Technology, and Society
Suggested Strategies Students can create a family tree poster with photographs or drawings (FA). Working in groups, students can identify similarities and differences in characteristics when comparing offspring to parents and siblings to siblings. (FA) (SS) (CoS) (NoS) Using two different kinds (e.g., White pumpkin, Cinderella pumpkin) of pumpkins (or other faster growing vegetable), students can investigate the relationship of seeds to pumpkins by dissecting seeds, planting seeds, and producing pumpkins. Students can compare the original pumpkins (parent) to the new pumpkins (offspring) to determine which offspring belongs to which parent. Record similarities and differences between generations as well as between the two different kinds. (L) (M) (PoS) (CoS) (NoS) Students can collect and analyze the different characteristics (e.g., eye color, hair color, skin color, height, and handedness) within and across classes. The students can graph and interpret the characteristics. (M) (PoS) (CoS) (NoS)	(T) Students can use age-appropriate tool to better observe populations. (A) Students can identify their inherited characteristics. (S) Students understand that offspring may or may not look like their parents.

Life Sciences	Curriculum Connections		Processes, Communication, and Nature of Science	Applications: Science, Technology, and Society
(CT) Changes over time	(M) Mathematics	(FA) Fine Arts	(PoS) Processes of science	(T) Tools of science
(N) Nature of Living Things	(L) Language Arts	(SS) Social Studies	(CoS) Communication of science	(A) Applications of science
			(NoS) Nature of science	(S) Implications of science for people

Subject	Grade	Standard	Objective
Science	**First**	**4. Life Science**	**2. Observe how living things change and depend upon their environment to satisfy their basic needs.**

Content Big Ideas	Standard 1 Big Ideas – Intended Learning Outcomes	Science, Technology, and Society Big Ideas
(N) Most living things need water, food, and air. (N) Plants and animals need to take in water, and animals need to take in food. In addition, plants need light. (N) Animals eat plants and other animals for food.	(PoS) People can often learn about things around them by just observing those things carefully, but sometimes they can learn more by doing something to the things and noting what happens (raise questions about the world around them, be willing to seek answers to some of those questions by making careful observations and trying things out). (CoS) When doing science activities, it is often helpful to work with a team and to share findings with others. In this sharing, describing things as accurately as possible is important in science because it enables people to compare their observations with those of others (draw pictures that correctly portray at least some features of the thing being described, describe and compare things in terms of number, shape, texture, size, weight, color, and motion). (NoS) When people give different descriptions of the same thing, it is usually a good idea to make some fresh observations instead of just arguing about who is right.	(T) People use appropriate tools and models to investigate the world. (A) People working alone or in groups often invent new ways to solve problems and get work done. (S) Students understand that tools and ways of doing things that people have invented affect all aspects of life.

Indicators: Measureable Outcomes framed by Standard 1 Big Ideas

Indicator 1. Make observations of living things and their environment using the five senses.
Indicator 2. Identify how natural earth materials, e.g., food, water, air, light, and space, help to sustain plant and animal life.
Indicator 3. Describe and model life cycles of living things.

Science language students should be able to use correctly: life cycle, offspring, need, environment, investigate.

Guidance for Combining Content and Process	Guidance for Combining Science, Technology, and Society
Suggested Strategies Students can conduct simple experiments/investigations related to plant needs by changing one variable at a time (food, air, water, light, or place to grow). (M) (PoS) Using various resources (e.g., books, movies, internet, live specimens) research the life cycle of living things such as butterflies, frogs, chickens, beans, and/or pumpkins. Students can then create their own representations of what they have learned. (L) (FA) (CoS)	(T) Students can use age-appropriate tools to investigate livings things. (A) Students can explain that all living things follow a cycle. (S) Students understand that when basic needs are not met the life cycle is shortened.

Life Sciences	Curriculum Connections		Processes, Communication, and Nature of Science	Applications: Science, Technology, and Society
(CT) Changes over time	(M) Mathematics	(FA) Fine Arts	(PoS) Processes of science	(T) Tools of science
(N) Nature of Living Things	(L) Language Arts	(SS) Social Studies	(CoS) Communication of science	(A) Applications of science
			(NoS) Nature of science	(S) Implications of science for people

Subject	Grade	Standard	Objective
Science	**Second**	**4. Life Science**	**1. Relate how external features affect an animal's ability to survive in its environment.**

Content Big Ideas	Standard 1 Big Ideas – Intended Learning Outcomes	Science, Technology, and Society Big Ideas
(CT) Different plants and animals have external features that help them thrive in different kinds of places. (CT) Living things are found everywhere in the world. There are different kinds of living things in different places. (CT) Some kinds of living things that once lived on earth have completely disappeared, although they were something like others that are alive today.	(PoS) When science investigation is done the way it was done before, we expect to get a very similar result. (NoS) Sometimes people aren't sure what will happen because they don't know everything that might have an effect. (CoS) When doing science activities, it is often helpful to work with a team and to share findings with others. All team members should reach their own individual conclusions, however, about what the findings mean.	(T) People use appropriate tools and models to investigate the world. (A) People working alone or in groups often invent new ways to solve problems and get work done. (S) The tools and ways of doing things that people have invented affect all aspects of life.

Indicators: Measureable Outcomes framed by Standard 1 Big Ideas

Indicator 1. Compare and contrast the characteristics of living things in different habitats.
Indicator 2. Develop, communicate, and justify an explanation as to why a habitat is or is not suitable for a specific organism.
Indicator 3. Create possible explanations as to why some organisms no longer exist, but similar organisms are still alive today.

Science language students should be able to use correctly: characteristics, environments, habitats, justify, compare, contrast, extinct, desert, ocean, rainforest, tundra.

Guidance for Combining Content and Process	Guidance for Combining Science, Technology, and Society
Suggested Strategies Using cooperative learning structures, students can explore the characteristics of living things in various environments (i.e. desert, rainforest, tundra, oceans) and communicate their findings through charts, posters, journals, books, etc. (L) (M) (FA) (SS) (NoS) (CoS) Students can classify and sort plants and animals into habitats and justify their reasoning through classroom discussion. Suggested questions for discussion: Are any similar plant or animal structures seen in different environments? Which plant or animal has the most unique structures? (PoS) (CoS) (NoS) Using a variety of informational texts on extinct animals (e.g., mammoth, sabertooth tiger, dodo bird, megatooth shark), students can compare and contrast these extinct animals with similar animals that are alive today and share plausible explanations for their extinctions through charts, journals, discussions, etc. (L) (FA) (M) (PoS) (CoS)	(T) Teachers can use a variety of media including the internet to find pictures of plants and animals in their environment. (A) Students can explain how living things depend on the health of their habitats, which need to be protected. (A) Students can research endangered species. (S) Students can discuss adaptations that plants and animals make in order to live in their specific environment.

Life Sciences	Curriculum Connections		Processes, Communication and Nature of Science	Applications: Science, Technology, and Society
(CT) Changes over time	(M) Mathematics	(FA) Fine Arts	(PoS) Processes of science	(T) Tools of science
(N) Nature of Living Things	(L) Language Arts	(SS) Social Studies	(CoS) Communication of science	(A) Applications of science
			(NoS) Nature of science	(S) Implications of science for people

Subject	Grade	Standard	Objective
Science	**Second**	**4. Life Science**	**2. Identify basic needs of living things (plants and animals) and their abilities to meet their needs.**

Content Big Ideas	Standard 1 Big Ideas – Intended Learning Outcomes	Science, Technology, and Society Big Ideas
(N) Living things have parts that function to meet their basic needs. (N) Senses can warn individuals about danger; muscles help them to fight, hide, or get out of danger. (N) Living things not only need water, food, air, and waste removal, but also a particular range of temperatures in their environment.	(PoS) When science investigation is done the way it was done before, we expect to get a very similar result. (NoS) Sometimes people aren't sure what will happen because they don't know everything that might have an effect. (CoS) When doing science activities, it is often helpful to work with a team and to share findings with others. All team members should reach their own individual conclusions, however, about what the findings mean.	(T) People use appropriate tools and models to investigate the world. (A) People working alone or in groups often invent new ways to solve problems and get work done. (S) The tools and ways of doing things that people have invented affect all aspects of life.

Indicators: Measureable Outcomes framed by Standard 1 Big Ideas

Indicator 1. Communicate and justify how the physical characteristics of living things help them meet their basic needs.
Indicator 2. Observe record and compare how the behaviors and reactions of living things help them meet their basic needs.
Indicator 3. Identify behaviors and reactions of living things in response to changes in the environment including seasonal changes in temperature and precipitation.
Science language students should be able to use correctly: physical characteristics, behaviors, reaction, environment, seasonal, temperature, precipitation, migration, hibernation, dormancy.

Guidance for Combining Content and Process	Guidance for Combining Science, Technology, and Society
Suggested Strategies Students can conduct a simple experiment (e.g., making predictions, gathering data, and drawing conclusions) to investigate how water is transported throughout a plant. Some examples could include: celery or carnations in colored water. Students share findings using diagrams, journals, charts, etc. (L) (FA) (M) (PoS) (CoS) Working in groups, students can compare and contrast the behaviors that animals use to meet their needs (i.e. feeding patterns, building nests, protections, communication). They can communicate and justify their conclusions in the form of class discussion, journals, posters, reports, etc. (L) (FA) (M) (PoS) (CoS) (NoS) Working in groups, students can compare and contrast the behaviors that plants use to meet their needs (i.e. growing towards the sunlight, flowers/nectar for pollination, seed dispersal methods, toxins). They can communicate and justify their conclusions in the form of class discussion, journals, posters, reports, etc. (L) (FA) (M) (PoS) (CoS) (NoS) Students can sort various plants and animals according to how they respond to seasonal changes in temperature and precipitation (example categories might include: hibernate, migrate, go dormant, die, other, etc.). Once the sort is completed, students can communicate and justify the placement of the various living things into their categories during a class discussion. (L) (PoS) (CoS) (NoS)	(T) Teachers can use the Internet to find pictures of plants and animals. (T) Students can use magnifiers to help see things they could not see without them. (T) Students can use instruments to help make observations about habitat components. For example, data can be collected from a fish tank to assess the environmental health (dissolved oxygen, pH, nitrogen content). (S) Students can discuss how their basic needs are met in their environment (i.e. air, food, water, waste removal, etc.).

Life Sciences	Curriculum Connections		Processes, Communication and Nature of Science	Applications: Science, Technology, and Society
(CT) Changes over time	(M) Mathematics	(FA) Fine Arts	(PoS) Processes of science	(T) Tools of science
(N) Nature of Living Things	(L) Language Arts	(SS) Social Studies	(CoS) Communication of science	(A) Applications of science
			(NoS) Nature of science	(S) Implications of science for people

Appendix A
Big Ideas - Kindergarten

Standard 1 **The Processes (PoS), Communication (CoS), and Nature (NoS) of Science (Intended Learning Outcomes).**	**Standard 2** **Earth (E) and Space Science (S)**	**Standard 3** **Physical Science** **Atomic-molecular theory of matter (A) and Newtonian laws of force and motion (F)**	**Standard 4** **Life Science** **Changes in organisms over time (CT) and The nature of living things (N).**
(P) People can often learn about things around them by just observing those things carefully. Raise questions about the world around them, be willing to seek answers to some of those questions by making careful observations. (N) People are more likely to believe your ideas if you can give reasons for them. Ask "How do you know?" in appropriate situations and attempt reasonable answers when others ask them the same questions. (C) In doing science, it is often helpful to work with a team and to share findings with others.	(E) Change is something that happens to many things. (E) Some changes are so slow or so fast that they are hard to see.	(F) Things move in many different ways, such as straight, zig zag, round and round, back and forth, and fast and slow. (A) Most things are made of parts.	(N) Most things are made of parts. (CT) Change is something that happens to many things.

Earth and Space Science	**Physical Science**	**Life Science**	**Processes, Communication, and Nature of Science**	**Applications: Science, Technology, and Society**
(E) Earth science (SS) Space science	(A) Atomic/molecular (F) Force and motion	(CT) Changes over time (N) Nature of Living Things	(PoS) Processes of science (CoS) Communication of science (NoS) Nature of science	(T) Tools of science (A) Applications of science (S) Implications of science for people

Appendix A (continued)
Big Ideas – First Grade

Standard 1 **The Processes (PoS), Communication (CoS), and Nature (NoS) of Science (Intended Learning Outcomes).**	**Standard 2** **Earth (E) and Space Science (S)**	**Standard 3** **Physical Science** **Atomic-molecular theory of matter (A) and Newtonian laws of force and motion (F)**	**Standard 4** **Life Science** **Changes in organisms over time (CT) and the nature of living things (N).**
(P) People can often learn about things around them by just observing those things carefully, but sometimes they can learn more by doing something to the things and noting what happens (raise questions about the world around them, be willing to seek answers to some of those questions by making careful observations and trying things out). (C) In doing science, it is often helpful to work with a team and to share findings with others. In this sharing, describing things as accurately as possible is important in science because it enables people to compare their observations with those of others (draw pictures that correctly portray at least some features of the thing being described, describe and compare things in terms of number, shape, texture, size, weight, color, and motion). (N) When people give different descriptions of the same thing, it is usually a good idea to make some fresh observations instead of just arguing about who is right.	(E) The natural world is composed of different materials. (S) The sun can be seen only in the daytime and the moon can be seen sometimes during the day. (E) Seasonal weather changes occur each year.	(F) Things move in many different ways, such as straight, zig zag, round and round, back and forth, and fast and slow. (F) The way to change how something is moving is to give it a push or pull. (A) Objects can be described in terms of the materials they are made of (clay, cloth, paper, etc.). and their physical Properties (color, size, shape, weight, texture, flexibility, etc.).	(CT) Offspring are very much alike, but not exactly, like their parents and like one another. (CT) There is a variation among individuals of one kind within a population. (CT) Some animals and plants are alike in the way they look and things they do, and others are very different from one another. (N) Most living things need water, food, and air. (CT) All kinds of living things have offspring, usually with two parents involved. (N) Plants and animals need to take in water, and animals need to take in food. In addition, plants need light. (N) Animals eat plants and other animals for food.

Earth and Space Science	**Physical Science**	**Life Science**	**Processes, Communication, and Nature of Science**	**Applications: Science, Technology, and Society**
(E) Earth science (SS) Space science	(A) Atomic/molecular (F) Force and motion	(CT) Changes over time (N) Nature of Living Things	(PoS) Processes of science (CoS) Communication of science (NoS) Nature of science	(T) Tools of science (A) Applications of science (S) Implications of science for people

Appendix A (continued)
Big Ideas – Second Grade

Standard 1 **The Processes (PoS), Communication (CoS), and Nature (NoS) of Science (Intended Learning Outcomes).**	**Standard 2** **Earth (E) and Space Science (S)**	**Standard 3** **Physical Science** **Atomic-molecular theory of matter (A) and Newtonian laws of force and motion (F)**	**Standard 4** **Life Science** **Changes in organisms over time (CT) and the nature of living things (N).**
(P) When science investigation is done the way it was done before, we expect to get a very similar result. (N) Sometimes people aren't sure what will happen because they don't know everything that might have an effect. (C) In doing science, it is often helpful to work with a team and to share findings with others. All team members should reach their own individual conclusions, however, about what the findings mean.	(E) Chunks of rocks come in many sizes and shapes, from boulders to grains of sand and even smaller (S) There are recognizable patterns among objects in the night sky. (E) Some changes, such as changes in weather can vary based on season and location.	(F) Things near the earth fall to the ground unless something holds them up. (A) Things can be done to materials to change some of their properties, but not all materials respond the same way to what is done to them.	(N) All living things need water, food, air, waste removal, and a particular range of temperatures in their environment. (N) Animals, including humans, have parts that help them seek, find, and take in food when they feel hunger—eyes and noses for detecting food, legs to get it, arms to carry it away and a mouth to eat it. (N) Senses can warn individuals about danger; muscles help them to fight, hide, or get out of danger. (CT) Some kinds of living things that once lived on earth have completely disappeared, although they were something like others that are alive today. (CT) Different plants and animals have external features that help them thrive in different kinds of places. (CT) Living things are found almost everywhere in the world. There are somewhat different kinds in different places.

Earth and Space Science	**Physical Science**	**Life Science**	**Processes, Communication, and Nature of Science**	**Applications: Science, Technology, and Society**
(E) Earth science (SS) Space science	(A) Atomic/molecular (F) Force and motion	(CT) Changes over time (N) Nature of Living Things	(PoS) Processes of science (CoS) Communication of science (NoS) Nature of science	(T) Tools of science (A) Applications of science (S) Implications of science for people

Appendix B
What Students Should Understand, Do, and Know

By the end of Kindergarten students should be able to:

Understand:

- People can learn about things around them by just observing those things carefully.
- People are more likely to believe your ideas if you can give reasons for them.
- It is often helpful to work in a team and share findings with each other.
- Change happens to many things.
- Some changes are so slow or so fast that they are hard to see.
- Things move in many different ways.
- Most things are made of parts.

Do:

- Observe the world around them and report on their observations.
- Demonstrate scientific processes, e.g., how wind and water move non-living things.
- Sort, group, and classify different materials.
- Compare and contrast, e.g., light and dark, physical properties of objects and how they affect their movement, the parts of different animals
- Investigate, interpret, and explain to others.
- Examine scientific phenomena, e.g., what happens when you block the sun's light.
- Communicate and share findings with others, e.g. ways weather can affect individuals
- Describe and discuss the world around them based on their observations and records e.g., weather conditions and how predicting the world around them can improve our lives.
- Conduct simple experiments and explain their findings, e.g., why things may not work the same if some of the parts are missing.
- Construct questions, give reasons, and share findings with others.

Know:
• Big rocks break down into small rocks. • Water and wind move non-living things. • Earth materials can be sorted, grouped, and classified based on their properties. • Light and dark in a day-night cycle form a pattern. • Weather changes occur from day to day. • Weather patterns occur from season to season. • Weather changes affect individuals in different ways. • Objects move in different ways, e.g., fast, slow, zigzag, round and round, straight line, back and forth, slide, roll, bounce, spin, swing, float, glide. • Different objects move in different ways. • Parts are used to build things and things can be taken apart. • Things may not work the same if some of the parts are missing. • Young plants and animals change over time as they grow into adults. • The relationship between body parts and the five senses. • Major parts of plants, e.g., roots, stem, leaf, flower, trunk, branches. • Major parts of different animals, e.g., skin, fur, feathers, scales, hand, winds, flippers, fins.

Appendix B (continued)
What Students Should Understand, Do, and Know

By the end of First Grade students should be able to:

Understand:

- People can often learn about things around them by just observing those things carefully, but sometimes they can learn more by doing something to the things and noting what happens.
- In doing science, it is often helpful to work with a team and to share findings with others. In this sharing, describing things as accurately as possible is important in science because it enables people to compare their observations with those of others .
- When people give different descriptions of the same thing, it is usually a good idea to make some fresh observations instead of just arguing about who is right.
- The natural world is composed of different materials.
- The sun can be seen only in the daytime and the moon can be seen sometimes during the day.
- Seasonal weather changes occur each year.
- Things move in many different ways, such as straight, zig zag, round and round, back and forth, and fast and slow.
- The way to change how something is moving is to give it a push or pull.
- Objects can be described in terms of the materials they are made of (clay, cloth, paper, etc.). and their physical Properties (color, size, shape, weight, texture, flexibility, etc.).
- Offspring are very much alike, but not exactly, like their parents and like one another.
- There is a variation among individuals of one kind within a population.
- Some animals and plants are alike in the way they look and things they do, and others are very different from one another.
- Most living things need water, food, and air.
- All kinds of living things have offspring, usually with two parents involved.
- Plants and animals need to take in water, and animals need to take in food. In addition, plants need light.
- Animals eat plants and other animals for food.

Do:

- Observe, compare, describe, sort, and chart objects by observable characteristics.
- Identify and describe scientific properties, e.g. water source, characteristics of seasons of the year, characteristics of weather, how animals and plants sustain life.
- Record weather information during each season.
- Gather evidence and report their findings.
- Observe, describe, and record scientific phenomena, e.g., changes in the appearance of the sun and moon during daylight, weather information within each season.
- Compare and contrast properties of scientific phenomena, e.g., seasonal weather pattern, the movement of objects
- Use drawing, graphs, and numbers to communicate findings.
- Predict, test, record data, and describe experimental results.
- Analyze similarities and differences between and within groups.
- Use the five senses to make observations in nature.
- Describe and model life cycles.
- Communicate and share findings with others.
- Conduct simple experiments and explain their findings.
- Construct questions, give reasons, and share findings with others.

Know:

- The components of soil have size, texture, and color.
- Water has a variety of natural sources including streams, lakes, and oceans.
- Rocks, soils, and water have many uses.
- The sun changes in location and appearance during the daytime.
- The moon can be seen in the daytime and varies in location and appearance.
- The characteristics of the seasons of the year.
- The characteristics of different types of weather, e.g., types of precipitation, sunny, foggy, and cloudy.
- Objects can move in many different ways, e.g., straight, zigzag, circular, curved, back-and-forth, fast and slow.
- A push or pull can affect how an object moves.
- Objects have observable properties that can be used in their classification.
- Objects have measureable properties such as weight and temperature.
- Objects will sink or float depending on their observable and/or measurable properties.
- Matter may change when heated, cooled, or mixed with water.

- Both plant and animal offspring have similarities with their parents.
- There may be both similarities and differences within and across larger groups.
- They can use their five senses to observe living things and their environments.
- Plants and animals use earth materials to sustain life.
- Living things have life cycles.

Appendix B (continued)
What Students Should Understand, Do, and Know

By the end of Second Grade students should be able to:

Understand:

- When science investigation is done the way it was done before, we expect to get a very similar result.
- Sometimes people aren't sure what will happen because they don't know everything that might have an effect.
- It is often helpful to work with a team and to share findings with others. All team members should reach their own individual conclusions, however, about what the findings mean.
- Chunks of rocks come in many sizes and shapes, from boulders to grains of sand and even smaller.
- There are recognizable patterns among objects in the night sky.
- Some changes, such as changes in weather can vary based on season and location.
- Things near the earth fall to the ground unless something holds them up.
- Things can be done to materials to change some of their properties, but not all materials respond the same way to what is done to them.
- All living things need water, food, air, waste removal, and a particular range of temperatures in their environment.
- Animals, including humans, have parts that help them seek, find, and take in food when they feel hunger—eyes and noses for detecting food, legs to get it, arms to carry it away and a mouth to eat it.
- Senses can warn individuals about danger; muscles help them to fight, hide, or get out of danger.
- Some kinds of living things that once lived on earth have completely disappeared, although they were something like others that are alive today.
- Different plants and animals have external features that help them thrive in different kinds of places.
- Living things are found almost everywhere in the world. There are somewhat different kinds in different places.

Do:

- Explain weathering and breakage of rocks.
- Describe, classify, and communicate scientific ideas, e.g., ,rocks in terms of their parts, stars in the night sky,
- Observe, compare, describe and sort objects by their characteristics and properties, e.g., color, hardness, texture, layering, particle size
- Observe, describe, record, and compare patterns in nature.
- Compare and contrast, e.g., seasonal weather patterns, characteristics of living things in various habitats

- Observe and identify scientific phenomena, e.g., observe falling objects and identify things that prevent them from reaching the ground.
- Communicate about their observations, e.g., similar objects of varying masses fall at the same rate.
- Model changes in various materials, e.g., physical changes
- Analyze and interpret data, e.g. temperatures in different locations and different times,
- Investigate and provide evidence to others.
- Develop, communicate, and justify a scientific explanation, e.g., why a habitat is or is not suitable for a specific organism, how the physical characteristics of living things help them meet their basic needs.
- Create possible explanations for natural phenomena, e.g., why some organisms no longer exist but similar organisms are still alive today. Identify responses of living things to their environment.
- Communicate and share findings with others.
- Conduct simple experiments and explain their findings.
- Construct questions, give reasons, and share findings with others.

Know:

- Smaller rocks come from the breakage and weathering of larger rocks.
- Rocks have parts that can be used in their classification.
- Rocks can be sorted by their color, hardness, texture, layering, and particle size.
- Changes in the moon's appearance and apparent motion can be described in terms of patterns.
- Stars have brightness and color differences and can be described by their arrangement.
- The seasons of the year have discernible patterns.
- Temperatures can and do change based on location and time.
- Objects close to the earth fall toward it but can be stopped before reaching the ground.
- Similar objects of varying masses will fall at the same rate.
- Physical changes can occur to earth materials.
- Matter is not destroyed or created through changes.
- Living things in different habitats have characteristics that can be compared and contrasted .
- Different habitats are suitable for different organisms.
- Some organisms that once lived on the earth no longer exist though similar organisms are still on the earth.
- The physical characteristics of living things along with their behaviors and reactions help them to meet their basic needs.
- The behaviors and reactions of living things can and do change in response to changes in the environment including seasonal changes.

Appendix C
How to Read the Supplemental Materials

Each Objective in the Core is a separate section, and has three different tables.

The first table serves as a header, identifying the Subject, Grade, Standard, and Objective. Below is a sample.

Subject	Grade	Standard	Objective
Science	**K**	**2. Earth and Space Science**	**1. Investigate non-living things.**

The second table contains the Big Ideas for Content, Standard 1 (Intended Learning Outcomes—ILOs), and Science, Technology, and Society Applications. There are one- and two-letter abbreviations bracketed in parentheses to help the reader track what is in that Objective. The key for these abbreviations is found below. At the bottom of the second table is a valuable guide to **key vocabulary** in the Objective, called "Science language students should be able to use correctly."

Content Big Ideas	Standard 1 Big Ideas – Intended Learning Outcomes	Science, Technology, and Society Big Ideas
Earth and Space Science (E) Earth science (SS) Space science **Physical Science** (A) Atomic/molecular (F) Force and motion **Life Science** (CT) Changes over time (N) Nature of Living Things	(PoS) Processes of science (NoS) Nature of science (CoS) Communication of science	(T) Tools of science (A) Applications of science (S) Implications of science for people

Indicators: Intended Learning Outcomes framed by Standard 1 Big Ideas
Indicator 1 **Indicator 2** **Science language students should be able to use correctly:**

The third table contains guidance for the actual teaching of the Objective, broken down into two sections. The first contains specific teaching ideas for combining the Content standard and the Process standard (from Standard 1) with curriculum connections to other subjects. The second contains ideas for extending the objective into questions about how it may impact technology, how it may actually be used in the workplace or industry, and how use of this content affects people in their day-to-day lives.

Guidance for Combining Content and Process	Guidance for Combining Science, Technology, and Society

A key to the one- and two-letter abbreviations is at the bottom of each page.

Appendix D
Notes, Explanations and Research Base

The following information applies to all three grades—Kindergarten, First, and Second.

1. **Standard 1 is not a stand-alone piece of learning, but is designed to be integrated into the three content standards (Standards 2, 3, and 4).** The three strands of science learning included in Standard 1 are
   1) Processes of Science,
   2) Communication of Science, and
   3) Nature of Science.

   Teaching these process-oriented standards (Standard 1) is done most effectively while teaching the content-oriented standards (Standards 2, 3, and 4).

   Standard 1 contains three Objectives. The first is from the National Research Council (NRC) definition of Inquiry [science process], the second "Communication of Science," and the third the "Nature of Science". When students learn through *engaging in the processes of science*, they become aware of and adept at "the processes embraced by science that allow us to extract explanation from evidence" (Johnston, 2008, p.12). Through learning science in community, through open and sustained communication, students gain deeper understandings of "norms for presenting scientific arguments . . . [and] practice productive social interactions with peers" (NRC, 2008, p.21) so that they are motivated and develop attitudes supportive of active involvement in the science classroom.

   Finally, through reflecting deeply on how science knowledge is developed, students learn about the Nature of Science. The Nature of Science (NOS) "refers to . . . science as a way of knowing or the values and beliefs inherent to the development of scientific knowledge" (Lederman, 1992). Lederman (1998) explains the nuanced differences between science processes and the nature of science "Although these aspects of science overlap and interact in important ways, it is nonetheless important to distinguish the two. Scientific processes are activities related to collecting and analyzing data, and drawing conclusions (AAAS, 1990, 1993; NRC, 1996). For example, observing and inferring are scientific processes. On the other hand, the NOS refers to the epistemological [ways of knowing] underpinnings of the activities of science. As such, realizing that observations are necessarily theory-laden [or based on previous ideas] and are constrained by our perceptual apparatus [senses] belongs within the realm of the NOS". While each objective within Standard 1 has indicators describing scientific processes, communication and nature of

science understandings that cut across all learning in grades K-2, Standard 1 is NOT taught in isolation, but instead is embedded in the teaching of Standards 2, 3, and 4.

2. **The content learning of the K-2 Science Core is found in Standards 2, 3 and 4. Standard 2 is Earth and Space Science, Standard 3 is Physical Science, and Standard 4 is Life Science.** As mentioned previously, Standard 1 is a framework, considered the vehicle through which deep foundational understandings about Standard 1 as well as Standards 2, 3, and 4 is developed. Standards 2, 3, and 4 are derived from the American Association for the Advancement of Science's Atlas (maps) of science literacy (AAAS, 2001) and learning progression research (Catley, Lehrer, and Reiser, 2005; Plummer, 2008; Smith, Wiser, Anderson, and Krajcik, 2006) regarding how teachers can facilitate students leveraging previously acquired rich experiential understandings of the natural world to develop conceptual understandings supportive of future learning. The core concepts included in Standards 2-4 are those that are central to a discipline of science (i.e. Earth and Space Science, Physical, and Life Science), that are accessible to students in some form starting in kindergarten, and that have potential for sustained exploration across grades K-2 and beyond. Those considered important in Earth and Space Science for K-2 students are foundational features or principles about the earth and patterns of motion of the Sun, Moon, and stars (celestial motion). Those considered central to Physical Science are foundational to students understanding of atomic-molecular theory of matter and Newtonian laws of force and motion. Finally, those considered foundational to students understanding of life science are changes in organisms over time and the nature of living things. The specific grade level appropriate concepts for Standards 2-4 are outlined in the following Big Ideas for each grade level.

3. **Science, Technology and Society (STS):**
   "The primary goal of science is to understand the natural and human-designed worlds. Science refers to certain processes used by humans for obtaining knowledge about nature, and to an organized body of knowledge about nature obtained by these processes. Science is a dynamic and creative activity with a long and interesting history. Many societies have contributed to the development of scientific knowledge and understanding…Scientists continuously assess and judge the soundness of scientific knowledge claims by testing laws and theories, and modifying them in light of compelling new evidence or a re-conceptualization of existing evidence.

   "Technology involves the development and use of materials, tools, and processes for solving human problems and helping to satisfy human needs and desires. Many of the products of technology help humans accomplish tasks that would otherwise be very difficult or impossible to carry out. Although technology provides many benefits, it also produces associated costs and risks. Science often uses and requires tools and processes developed by technology, and conversely, technology often employs

principles, laws, theories, and processes developed by science. SCCAO and STAO/APSO, "Position Paper: The Nature of Science" (2006), pp. 1–2.

As can be seen from these two descriptions science and technology are inextricably linked. But, according to the National Science Education Standards, it is important to help students "establish connections between the natural and designed worlds and provide students with opportunities to develop decision-making abilities. STS is included in the K-2 core, not as a stand-alone standard, but as guidance for teachers to help students engage the learning in Standards 2-4. STS guidance at each grade level focuses on the 1) Tools (T) used in 'doing science', 2) Applications (A) of science to enhance technology or of technology to enhance the processes of science, and 3) Implications (S) of science and technological applications in students lives (e.g., benefits, constraints, consequences, risks).

4. **Objectives are selected to support the teaching of Big Ideas** in science, which are organized by Standard. Big ideas "go beyond discrete facts or skills to focus on larger concepts, principles, or processes" (Grant Wiggins and Jay McTighe, *Understanding by Design,* 1998, p. 10). Big Ideas are cumulative, meaning that students revisit ideas that are previously developed, but in more and more complex ways at each successive grade level. This allows teachers to anchor learning at the beginning of the grade level to "concepts and reasoning abilities that young children bring with them" (NRC, 2008).

5. **Indicators are selected as the Measureable Outcomes of each objective**. They describe measureable, observable actions that not only show content mastery but also mastery of the scientific processes in Standard 1. Indicators are not intended to reflect all the learning that an objective implies. They support both the content standard Big Ideas and the Standard 1 Big Ideas.

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Appendix E
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