SCOPE & SEQUENCE CREATED BY TEACHERS FOR THE TEACHERS OF SRC

SANTA ROSA
COUNTY DISTRICT SCHOOLS

"Give the pupils something to do; not something to learn; and if the doing is of such a nature as to demand thinking; learning naturally results."
~John Dewey

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How to Use This Planning Tool

The Scope and Sequence has been created by the Math & Science Department and a team of SRC teachers to help planning meaningful instruction of science content. The progression of content, organized into units, is based upon the course description provided by the FLDOE and the team.

Format: Included is the **Benchmark**/standard from the FLDOE course description with the **Item Specifications**, which illustrate the fundamental knowledge and understanding needed for mastery, and the **Content Limits,** so that the teacher does not over-teach the standard.

Resources are also provided and differ depending on the grade level, as the emphasis in some grades is on writing, while others may be on reading. All resources, including the text, are considered part of the teacher's toolbox, and should be used appropriately to provide a hands-on, questioning, and science rich learning environment for the students.

The importance of Grade 4 Science instruction: The content of the Grade 4 Scope and Sequence is not just to be used for preparation for the Statewide Science Assessment. Rather, it is important to remember that the content covered in Grade 4 lays the foundational framework for future science study and is crucial to success in the middle and high school grades. In addition, science instruction utilizing the 5E and/or inquiry-based modes of instruction encourage independent, critical thinking and application.

NSTA states that "Elementary school students learn science best when—

a. they are involved in first-hand exploration and investigation and inquiry/process skills are nurtured.
b. instruction builds directly on the student's conceptual framework.
c. content is organized based on broad conceptual themes common to all science disciplines.
d. mathematics and communication skills are an integral part of science instruction.

Integration of Nature of Science standards: The Big Ideas focusing on the Nature of Science should be consistently fused with content units as appropriate for your students throughout the year. It is covered alone in the first unit but needs to be continually reinforced throughout the year. Know your Nature of Science Standards!

Table of Contents

Next Generation Sunshine State Standards

The Next Generation Sunshine State Standards for science are organized *by grade level* for grades K-8 and *by Bodies of Knowledge* for grades 9-12. Eighteen Big Ideas are encompassed in grades K-12 and build in rigor and depth as students advance.
Each grade level includes benchmarks from the four Bodies of Knowledge (Nature of Science, Life Science, Earth and Space Science, and Physical Science).

Fourth Grade Overview

Fourth Grade focuses instructional delivery for science within the following twelve (12) Big Ideas/Standards:
The concepts highlighted (and in italics) **are newly introduced this year. The other concepts were introduced in the 3rd grade.**

Nature of Science:

Big Idea 1 – The Practice of Science

- Seek reasons to explain differences in data
- Keeping records (charts/graphs)
- Infer based on evidence
- Empirical evidence
- Science involves creativity in designing experiments
- *Use of references with bibliographic information*
- *Not always "scientific method," but always observation + empirical evidence*
- *Science involves creativity in designing experiments*

Big Idea 2 – The Characteristics of Scientific Knowledge

- Science focuses on the natural world

Big Idea 3 – The Role of Theories, Laws, Hypotheses, and Models

- Science Speak is different from common usage
- Using models/models do not perfectly account for all observations
- *Types of models*

Earth and Space Science:

Big Idea 5 – Earth in Space and Time

- Stars/telescopes
- Sun
- Gravity is a force that can be overcome
- *Seasonal patterns of stars*
- *Phases of the Moon*
- *Rotation/revolution*
- *Earth/Sun/Moon system*
- *Effects of space research on economy (FL)*

Big Idea 6 – Earth Structures

- Sun heats Earth in day, Earth loses heat at night
- *Weathering/erosion (physical)*
- *Categories of rocks*
- *Physical properties of minerals*
- *Resources (FL)*
- *Telescopes/microscopes*

Physical Science:

Big Idea 8 – Properties of Matter

- Compare based on properties (adds hardness)
- Measure/compare temps of solids and liquids

- Measure/compare mass/volume
- *Odor/taste/attraction to magnets*
- *Properties/uses of water in each state*
- *Law of Conservation of Mass*
- *Magnets attract and repel other magnets*

Big Idea 9 – Changes in Matter

- Water changes state + terminology (melting, freezing, boiling, evaporation, condensation)
- *Chemical changes (decomposition, rusting, burning, cooking)*
- ***FOCUS:** decomposition and rusting*

Big Idea 10 – Forms of Energy

- Basic **forms** of energy (light, heat, sound, electrical, mechanical)
- Energy can cause/change motion
- **FOCUS**: light energy
- *Basic **forms** of energy (**adds:** energy of motion)*
- ***FOCUS:** sound energy (pitch)*
- *Wind/water are sources of energy and can be used to move objects*

Big Idea 11 – Energy Transfer and Transformation

- Light energy also gives off heat
- Friction produces heat
- *Heat flow/changes in temperature*
- *Conductors/insulators for **heat energy***

Big Idea 12 – Motion of Objects

- *Objects in motion has a positional/directional changes*
- *Speed of objects*

Life Science

Big Idea 16 – Heredity and Reproduction

- *Reproduction of flowering plants (pollination, fertilization, seed dispersal, germination)*
- *Inherited traits vs. characteristics based on environmental (plants and animals)*
- *Animal behaviors: inherited and learned*
- *Major stages in life cycles/* ***FOCUS:*** *FL plants/animals*
- *Complete/incomplete metamorphosis*
- *Flowering/non-flowering seed-bearing plants (flowers vs conifers or spore producers)*

Big Idea 17 – Interdependence

- Animals/plants response to changing seasons
- Plants use energy from sun to make own food (producers)
- *Seasonal changes in plants and animals: FL vs. other regions*
- *Flow of energy in a living system*
- *Animals are consumers*
- *Food chain*
- *How animals (including humans) impact the environment*

Santa Rosa County Science

Teacher's Suggested Instructional

4th Grade

1st Quarter	Week 1 – 3	Week 4 – 7	Week 8 - 9
	Nature of Science **Introduction to Science**	**Earth's Pattern's and Space**	**Earth's Features** **September 30-** **November 8**
	Embedded in text – as an introduction, teach basic skills, collaboration techniques, and team building exercises **Specific activities found in NOS Handbook at end of text**	**Topic 1 in text** Big Idea: Earth in Space & Time *Standards:* SC.4.E.5.1 (patterns in the sky); SC.4.E.5.2 (describe the shape of the Moon); **SC.4.E.5.3** (recognize revolution and rotation); **SC.4.E.5.4** (relate rotation of the Earth to patterns in the sky); ELABORATE: SC.4.E.5.5 (investigate & report on how space travel relates to FL) – **not assessed** (p.12-13)	**Topic 2 in text:** **Lessons 2-5** Big Idea: Earth's Structures *Standards:* **SC.4.E.6.1** (identify rocks); **SC.4.E.6.2** (identify properties of minerals); **SC.4.E.6.3** (recognize resources);

2nd Quarter	Week 10 – 13	Week 14 – 18
	Earth's Features	**Matter**
	Topic 2 in text: Lessons 2-5 continued **SC.4.E.6.4** (describe weathering & erosion); **SC.4.E.6.6** (identify Florida's resources) ELABORATE: SC.4.E.6.5 (investigate technology) Lesson 1	**Topic 3 in text: Lesson 1, 3 (portion only) and 4** Big Idea: Properties of and Changes in Matter *Standards:* **SC.4.P.8.1** (compare/contrast properties of solids, liquids & gases); **SC.4 P.8.4** (investigate & describe magnets); **SC.4.P.9.1** (identify changes in material – chemical changes) ELABORATE: SC.4.P.8.2 (identify common uses of water in its states) Lesson 2; SC.4.P.8.3 (Law of Conservation of Mass) Lesson 3

3rd Quarter	Week 19 – 24	Week 25 – 28
	Energy & Motion and Human Uses of Energy	**Plants & Animals**
	Topic 4 and 5 in text (topic 5 is all review except for part of lesson 3. ***Maybe use lesson 4 or 5 but not both to teach SC.4.P.10.1 and SC.4.P.10.2 to help with time* Big Idea: Forms of Energy; Energy Transfer & Transformation and Motion of Objects *Standards:* **SC.4P.10.1** (observe & describe forms of energy); **SC.4.P.10.2** (investigate & describe that energy can cause motion or change); **SC.4.P.10.3** (investigate & explain sound); SC.4.P.12.1 (recognize how objects in motion react); SC.4.P.12.2 (investigate & describe how speed is determined); SC.4.P.11.2 (recognize how heat flows); **SC.4.P.11.2** (identify conductors); **SC.4.P.10.4** (describe air & water as energy sources)	**Topic 6 in text** Big Idea: Heredity & Reproduction Standard: **SC.4.L.16.1**(identify processes of sexual reproduction in plants); **SC.4.L.16.4** (compare/contrast life cycles in plants and animals including incomplete and complete metamorphosis); **SC.4.L.16.2** (inheritance and adaptations); **SC.4.L.16.3** (heredity and learning)

4th Quarter	Week 29 – 32	Week 33 – 38
	Living Things and the Environment	**ENRICHMENT**
	Topic 7 in text Big Idea: Interdependence Standards: **SC.4.L.17.1** (compare plants in FL to other regions in how they change seasonally); **SC.4.17.2** (how when animals eat plants they obtain the energy stored); **SC.4.17.3** (trace energy in a food chain); **SC.4.17.4** (how plants, animals (including humans) impact the environment)	**Catch-up** **(testing season)** ***Now is a good time to check and make sure there is full understanding/review all bold standards. These are the MUST TEACH standards for the FSSA 5th Grade Assessment**

"I Can" Statements

Topic 1
Lesson 1- I can... Show how Earth revolves around the sun and rotates on its axis. Explain how Earth's rotation is related to the apparent movement of the sun, moon, and stars.
Lesson 2- I can... See the star patterns in the sky stay the same but appear to change nightly and throughout the year. Explain how Earth's rotation is related to the apparent movement of the sun, moon, and stars.
Lesson 3- I can... Describe the phases of the moon. Explain how Earth's rotation is related to the apparent movement of the sun, moon, and stars.

Topic 2
Lesson 1- I can... Read maps to identify and compare Earth's surface features.
Lesson 2- I can... Identify patterns in Earth's surface features.
Lesson 3- I can... Describe how rocks and soil form. Identify the properties of minerals.
Lesson 4- I can... Use evidence to show how weathering and erosion change Earth's surface.

Topic 3
Lesson 1- I can... measure and compare objects and materials based on their physical properties. Demonstrate that magnets can attract magnetic materials and attract and repel other magnets.
Lesson 2- I can... Identify uses and properties of water as a solid, liquid, or gas.

Topic 4
Lesson 1- I can... explain what energy is and describe some forms of energy. Explain how moving objects, speed, and energy are related.
Lesson 3- I can... Give examples of energy being transferred from place to place. Explain that heat flows from hot objects to cold ones. Demonstrate that some materials are good conductors of heat and others are not.

Topic 5
Lesson 1- I can... Describe how natural resources are converted to energy and fuel.
Lesson 2- I can... Investigate how people extract and use natural resources. Give examples of nonrenewable energy sources.
Lesson 3- I can... Distinguish between renewable and nonrenewable resources. Give examples of renewable energy sources.
Lesson 4 (Earth Day)- I can... Describe how the use of different natural energy resources affects the local and global environments.

Topic 6
Lesson 1- I can...Identify different ways that flowering plants reproduce. Compare the life cycles of Florida plants.
Lesson 2- I can...Compare the life cycles of Florida animals.
Lesson 3- I can... Explain that plant and animal characteristics are inherited but sometimes can be affected by the environment.
Lesson 4- I can... Explain how animal behaviors are shaped by heredity and learning.

Topic 7
Lesson 1- I can... Explain how seasons affect plants and animals. List examples of ecosystems.
Lesson 2- I can... Explain that animals get energy from the plants and animals that they eat.
Lesson 3- I can... Describe how energy flows in food chains and food webs.
Lesson 4- I can... Explain how plants, animals, and humans can affect the environment.

Fourth Grade Suggested Scope and Sequence

NGSS Body of Knowledge: Nature of Science/Life Science
Unit of Study: The Practice of Science (3 weeks)

Prerequisite Learning: **Kindergarten – SC.K.N.1.1, SC.K.N.1.2, SC.K.N.1.3, SC.K.N.1.4, SC.K.N.1.5**
First Grade – SC.1.N.1.1, SC.1.N.1.2, SC.1.N.1.3, SC.1.N.1.4, SC.1.E.5.3
Second Grade – SC.2.N.1.1, SC.2.N.1.2, SC.2.N.1.3, SC.2.N.1.4, SC.2.N.1.5, SC.2.N.1.6
Third Grade – SC.3.N.1.1, SC.3.N.1.2, SC.3.N.1.3, SC.3.N.1.4, SC.3.N.1.5, SC.3.N.1.6, SC.3.N.1.7

Topics	Learning Targets/Skills	Standard(s)	Vocabulary
Introduction to Science **This is embedded in text and should be done as an introduction to skills needed in the science classroom.** **Specific NOS activities are found in the NOS handbook at the end of the text.**	*Explain that science does not always follow a rigidly defined method ("the scientific method") but that science does involve the use of observations and empirical evidence. Explain that science focuses solely on the natural world.* ***Students will:*** • **set up a science notebook** that will be used all year by students. • **explore** various fields of science realizing that not all scientists follow the scientific method (e.g., biologist vs. paleontologist or astronomer vs. botanist). • **explain** the role of a scientist (ask questions and find answers). • **explain** that science does involve the use of observations and evidence. • **define** science (study of the natural world through observation and evidence).	**SC.4.N.1.3** **SC.4.N.2.1**	**evidence** **experiment** **investigation** **observation** **science** **science notebook** **scientific method** **scientist**
Introduction to Science Process	*Keep records that describe observations made, carefully distinguishing actual observations from ideas and inferences about the observations.* **NOTE:** Begin recording observations of the moon's visible shape for the next unit. ***Students will:*** • **record** observations of an object and/or an event in a science notebook using a variety of data collection tools (e.g., diagrams, charts, graphs). • **make inferences** based on observations. • **distinguish** observations from inferences. • **communicate** observations and inferences (findings) with others in the classroom. **critique** each other's findings through engaging discussions. *Compare the observations made by different groups using multiple*	**SC.4.N.1.6**	**chart/data table** **diagrams** **findings** **graph** **inference** **observation** **communication**

	tools and seek reasons to explain the differences across groups. *Compare the methods and results of investigations done by other classmates.* ***Students will:*** • **identify** appropriate tools to use when making measurements. • **demonstrate** proper use of scientific tools to ensure accuracy of measurements. • **engage** in a common team investigation using metric measurement tools (e.g., beakers, graduated cylinders, ruler, meter stick, tape measure, thermometer, scale, gram weights). • **compare** the methods and results of other team investigations**.** • **formulate** opinions, new ideas, and conclusions based on team comparisons. • **seek** reasons to explain any differences that may have occurred. • **critique** others' work in a written manner to make recommendations of how to improve future investigations.	**SC.4.N.1.2** **SC.4.N.1.5**	**evidence** **flaw** **interpretation** **investigation** **metric** **prediction** **records** **scientific tools** • **beaker** • **graduated cylinder** • **hand lens** • **meter stick** • **ruler** • **scale** • **stopwatch** • **tape measure** • **thermometer** • **weights** **scientific method** • **question** • **research** • **hypothesis** • **experiment** ○ **materials** ○ **procedure** • **data** • **results** • **conclusion** **variable**
	Raise questions about the natural world, use appropriate reference materials that support understanding to obtain information (identifying the source), conduct both individual and team investigations through free exploration and systematic investigations and generate appropriate explanations based on those explorations.	**SC.4.N.1.7**	
	Recognize that science involves creativity in designing experiments. ***Students will:*** • **generate** testable questions about the world that can be answered through observation and investigation. • **research** topics related to the questions they generate (e.g., internet, leveled-readers, non- fiction resources, newspaper). • **form** a hypothesis based on research. • **investigate** student-generated questions, individually and in teams, through free exploration, experimentation (scientific method), or other types of investigations using appropriate science tools (metric measurement). • **form** conclusions based on data obtained during investigations. • **identify** any flaw(s) in the experimental design that may have affected the outcome.	**SC.4.N.1.4**	

Resource Alignment	Introduction to Science	Introduction to Science Process
Pearson Teacher's Edition	Science Tools/ Introduction/ Activities	
Content Limits for Standard	Items will not assess steps or order of scientific method.	Items will not require the identification or evaluation of a hypothesis. Items should not use the term *hypothesis*. Items will not require the design of a procedure. Items will not require mathematical computations. Items will not require the differentiation between outcome variables (dependent variables) and test variables (independent variables). Items will not assess the reason for differences in data across groups that are investigating the same problem. Items referring to conclusions will not require the formation of a conclusion. Items may use the terms *accurate* and/or *valid* in context but should not assess these terms or the difference between these terms
Daily & Key Questions	**What are qualitative observations?** qualitative observations describe the qualities of, or change in, an object or organism as detected by the observer's senses (sight, hearing, smell, taste, or touch); some qualitative observations include: shape, color, texture, pattern, movement, odor, taste, and sounds **What is quantitative data?** quantitative data is data in numbers, usually measurements with units; some examples of quantitative data are length, width, or height measurements in centimeters, meters or kilometers; mass measurements in grams or kilograms; liquid measurements in milliliters, liters, or kiloliters; temperature in degrees Celsius and Fahrenheit; and time in seconds, minutes and hours; quantitative data can also include numbers with units that result from mathematical calculations like volume, area, sum, or mean	**What is a testable question?** any question that can be answered by performing an experiment **How is an investigation different from experimentation?** an investigation is a procedure carried out to observe a response to a stimulus but is not a complete experiment; in an experiment, a procedure is carried out and repeated under controlled conditions to discover, demonstrate, or test a hypothesis; experiments include all the components of the scientific method including: identifying a problem, collecting background information, forming a hypothesis, designing an experiment, performing the experiment to test the hypothesis, observing, recording, and analyzing data, repeating the experiment to verify the outcome, drawing conclusions about the experiment from the analyzed data, communicating the results in a log or displaying the findings for a science fair, and explaining how it applies to real-life situations **What is an accurate observation?** an accurate observation is an observation that involves using all your senses (i.e., sight, smell, touch, hearing, and taste) and involves using scientific tools to examine the characteristics and properties of objects and events; accurate observations have complete and varied written descriptions and numeric data recorded with units of measurement

		What is comparing? comparing is identifying common (similar) and distinguishing characteristics among objects or events; a comparison is basically how objects or events are alike **What is contrasting?** contrasting is identifying uncommon (dissimilar) and distinguishing characteristics among objects or events; a contrast is basically how objects or events are different **What does science study?** the natural world **How are inferences and observations different?** an inference is an explanation that you figure out based on your past experiences and without observing something yourself; observations involve using your senses to describe the natural world; observations are often made during experiments and sometimes you get information about the world just by observing it and taking measurements **What is a variable?** a variable is any factor, condition, or event that can change in an experiment; before you begin any experiment you must identify the variable that can affect the results; you then need to decide which variable you want to control and which you want to vary (change); the only variables that should change are factor that will confirm or reject your hypothesis **What is a control?** any factors, conditions or events you keep the same (constant or fixed) in an experiment are called controls; the best experiments are designed so all the variables are controlled except the factors you think will confirm your hypothesis **What is a trial?** each set of repeated measurements in an experiment is called a trial; the more measurements (observations) you make, the more reliable your results; whenever possible, you should repeat an experiment several times with more than one set of test samples and then average the results; experiments with multiple trials and multiple samples that follow exactly the same experimental procedures in every trial are the most valid **How are predictions and hypotheses different?** a prediction is a guess about what will happen under certain conditions that is based on observations and research; you use your prior knowledge or experiences to predict what will happen; a hypothesis is an idea that can be tested by experimentation and observation; a hypothesis leads to new knowledge **What is a claim?** a claim is a deduction, pattern or observable finding from an activity, investigation or experiment

		What is evidence? evidence is the data gathered in an activity, investigation or experiment **How do you write a conclusion statement?** a conclusion is the justification that links a claim and evidence together; students should write a conclusion statement for each paired claim and evidence by combining the claim and the evidence that justifies it together using the conjunction because so that both make a compound sentence

Teacher Hints	• An interactive student notebook (ISN) is a compilation of student learning that provides a partial record of the instructional experiences a student has in the classroom. Some teachers use spiral-bound notebooks or composition books, while others use 3-ring binders to organize information. Since pages should not be taken out of the science notebook, careful consideration should be given to the type of notebook that is used. • Students notebooks are divided into two parts (the left side is for student output which may include preview and process entries; the right side is for teacher input which ensures all students have access to the same information. • Students are expected to realize that investigations do not always follow the scientific method (step-by-step experiments). Scientific investigations sometimes only involve observations, comparisons, or research (e.g., record observations of rocks and/or minerals, comparison of a solid and a liquid). • Throughout the school year, metric units of measure should be used in science.	• Students could prepare for the Earth's Movements (Weeks 4-7) learning targets by beginning each morning with work routines which include collecting data on seasons, star patterns, and moon phases. Students could take turns collecting different types of data during different times of the year. • Lessons should be structured to build background knowledge for topics to be covered in 4th grade. Topics should be varied and may include but should not be limited to the following: plants, rocks, minerals, magnets, Alka-Seltzer investigations, mystery bags, mystery photos. • Considerations may be given to utilizing activities and investigations that target traditionally low performing benchmarks with the focus of science process at this time of year. For example, students could prepare for a deeper understanding of Plant Life Cycles (Weeks 25 - 28) by growing seeds at this time to collect data and record observations on growth and possible seasonal changes that may occur. This information would be further utilized later during plant instruction. • During this time, teachers could select and use a variety of science tools to explore the scientific process. • Students should practice making and recording observations daily. Students naturally make observations with their eyes but may need to be reminded that observations should utilize all of their senses (e.g., "*I see bubbles forming when vinegar is mixed with baking soda. I hear bubbles fizzing when vinegar is mixed with baking soda."*). • An inference is a logical guess based on observations. It is arrived at based on the face value of the observations alone and is not the result of a systematic analysis or testing of the evidence (e.g., *"I infer that a chemical change is occurring when the vinegar and baking soda are combined."*) • Students need to make inferences based on evidence gathered during observations. Considerations should be made to practice this skill with each benchmark throughout the year to support student understanding. Connections to other core subjects may be referenced. • Teachers should lead students in the understanding that scientists do not only learn from doing hands-on

		investigations but also from reading non-fiction reference materials, such as, journals, newspapers, reference books etc.
		• Teachers should discuss the importance of researching a topic before forming a hypothesis or investigating.
		• Teachers need to engage students in a discussion about the importance of multiple trials and large experimental groups when conducting experiments.
		• Teachers should continue to model controlling variables and testing a control group for comparison purposes.
		• Teachers should organize common investigations so that students will be able to compare their results with the results of other groups. When differences arise, students should compare the tools and different methods that were used by each group to possibly explain the differences.
		• Teachers need to avoid referring to a hypothesis as being right or wrong when forming a conclusion. Instead, guide students to articulate that a hypothesis is either supported or not supported by the evidence (data) gathered.
		  • My hypothesis was supported by the evidence I collected. I thought _____ would occur because of my experimentation. I now know _____).
		  • My hypothesis was not supported by the evidence I collected. I thought _____ would occur, but it did not. Instead my evidence supports _____).
		• Science block offers students an opportunity to collect authentic data that should be accessed for instructional purposes during the Language Arts and Mathematics blocks as appropriate throughout the school year.

Writing Connection	**Narrative:** Tell about a time when you used science to help you solve a problem.	**Expository:** Everyone is a scientist. Give three reasons explaining why you are a scientist.
Thinking Maps® & Foldables	Circle Map (What is Science?)	Bubble Map (Describe a scientist)

CPALMS	*Let's Go to a Party Puzzles* *http://www.cpalms.org/Public/PreviewResourceUrl/Preview/53300* *Introduction to the Nature Journal* *http://www.cpalms.org/Public/PreviewResourceUrl/Preview/25167*	*Use Those Tools* *http://www.cpalms.org/Public/PreviewResourceLesson/Preview/29823* *Rising Waters* *http://www.cpalms.org/Public/PreviewResourceUrl/Preview/23282*
Web Resources	Scholastic Study Jams: *Scientific Methods* Scholastic Study Jams: *Scientific Theory and Evidence* Brain Pop: *Scientific Inquiry*	Scholastic Study Jams: Tools of Measurement Scholastic Study Jams: Units of Measurement Scholastic Study Jams: Tell Temperature Brain Pop: *Scientific Inquiry* *Science Buddies*

Fourth Grade Suggested Scope and Sequence

NGSS Body of Knowledge: Earth/Space Science
Unit of Study: Earth's Patterns & Space

(4 weeks)

Prerequisite Learning: **Kindergarten –** SC.K.N.1.2, SC.K.N.1.4, **SC.K.E.5.2, SC.K.E.5.3, SC.K.E.5.4**
First Grade – SC.1.N.1.2
Second Grade – none
Third Grade – SC.3.N.3.2

Topics	Learning Targets/Skills	Standard(s)	Vocabulary
Earth's Movements: Stars	*Explain that models can be three-dimensional, two-dimensional, an explanation in your mind, or a computer model.* ***Students will:*** • **explain** that models can be three-dimensional, two-dimensional, a mental model (a picture in your mind), or a computer model. *Recognize that Earth revolves around the Sun in a year and rotates on its axis in a 24-hour day.* ***Students will:*** o **use a model** to demonstrate the difference between Earth's rotation and Earth's revolution. o **explain** that Earth rotates once on its axis in approximately a 24-hour period (day and night). **explain** that Earth revolves (orbits) around the sun once in a year (approximately 365 days).	**SC.4.N.3.1** **SC.4.E.5.3** Embedded Nature of Science SC.4.N.1.1 SC.4.N.1.4 SC.4.N.1.7 SC.4.N.3.1	**axis** **constellations** **day** **earth** **model** o **2-dimensional** o **3-dimensional** o **mental** o **computer** **night** **orbit** **revolution** **rotation** **seasons** **star pattern** **stars** **sun** **year**
	Investigate how technology and tools help to extend the ability of humans to observe very small things and very large things. ***Students will***: • **discuss the** types of investigations in which a microscope or hand lens might be used. • **research** the histories of the microscope and telescope reporting on what is learned. • **identify** the telescope and satellite as tools that have allowed scientists to see very large things, such as the Earth, the solar system, and parts of the universe**.**	**SC.4.E.6.5** Embedded Nature of Science SC.4.N.1.1	
	Relate that the rotation of Earth (day and night) and apparent movements of the sun, moon, and stars are connected. *Observe that the patterns of stars in the sky stay the same although they*	**SC.4.E.5.4** **SC.4.E.5.1**	

	appear to shift across the sky nightly, and different stars can be seen in different seasons. ***Students will:*** • **review** that the sun is the closest star to Earth. • **demonstrate** that the star patterns (constellations) in the sky do not move although they appear to shift across the sky nightly due to Earth's rotation. • **discuss** how different star patterns are high in the night sky in some seasons but dip below the horizon in other seasons (e.g., use models/ simulations of winter and summer skyline). • **explain** that Earth moves, but the sun and other stars remain fixed in the sky (do not move). • **explain** that Earth's rotation on its axis causes the sun/stars to appear as though they are moving across the sky.	Embedded Nature of Science SC.4.N.1.1 SC.4.N.1.3 SC.4.N.1.4 SC.4.N.1.6 SC.4.N.1.7 SC.4.N.3.1	
Earth's Movements: Moon	*Relate that the rotation of Earth (day and night) and apparent movements of the sun, moon, and stars are connected.* *Describe the changes in the observable shape of the moon over the course of about a month.* ***Students will:*** • **recognize** that the moon does not produce its own light; it reflects light from the sun. • **recognize** that the moon revolves around (orbits) Earth in about 28 days as Earth revolves around (orbits) the sun. • **describe** the changes (patterns) that occur to the observable shape of the moon over the course of about a month that have been recorded in a science notebook. • **predict** the changes in the observable shape of the moon starting at any point in the cycle. • **sequence** moon patterns. • **compare** observable shapes of the moon. • **explain** that the moon's physical shape does not actually change. • **explain** that Earth's rotation on its axis causes the moon to appear as though it is moves across the sky in the day or night sky *Investigate and report the effects of space research and exploration on the economy and culture of Florida.* ***Students will:*** • **read and discuss** how the effects of space research and exploration has created advances in science that have impacted the economy and culture of Florida (e.g., medical technology, transportation, agriculture, and industrial	**SC.4.E.5.4** **SC.4.E.5.2** Embedded Nature of Science SC.4.N.1.3 SC.4.N.1.6 Embedded Earth Science SC.4.E.5.4 **SC.4.E.5.5** Embedded Nature of Science SC.4.N.1.1	**moon** **moon's shapes** (observable) **space** **space exploration** **technology**

	productivity). • **research** products that were generated specifically for space but have nowfound purpose for public use (e.g., freeze-dried food, memory foam, mylar blanket).		

Resource Alignment	Earth's Movement (Stars and Moon)	
Pearson Teacher's Edition	Pages 6-11, 18-21, 24-27	
Pearson Student's Edition	Topic One, Lessons 1, 2 and 3	
Daily and Key Questions	**Why are the movements of the Sun, Earth, and stars important?** the observation that the Sun, Earth, Moon and stars are constantly in motion, all rotating and some orbiting around their more massive neighbors is important because by tracking their motions from Earth, man can measure time - in days, months and years, has learned what causes the seasons on Earth, and has developed a calendar predicting future events **What causes day and night on Earth?** the rotation of Earth on its axis causes day and night. Every 24 hours the Earth turns completely around once on its axis; from one position on Earth you spend about half that time turning into the Sun's light called "day" (daylight hours); the other half of that time you are turning away from the Sun's light into the darkness called "night" (nighttime hours) **How long does it take Earth to make one orbit around the sun?** the Earth revolves once around the Sun every 365¼ days; to adjust for the ¼ day on the calendar, every four years we add one extra day to the month of February; the year we add that day is called a "leap year." (If you were born on February 29, you would only have a 'birthday' every four years. Unfortunately, you will still be four years older.) **Why is the Moon visible at night?** the Moon is visible at night because the Moon is lit by sunlight that bounces off it; the light reaches Earth as reflected moonlight **Why does the Moon's appearance change over a month?** from night to night, the shape of the Moon looks different; the changes in how the Moon looks to people on Earth are called the moon's phases; the Moon doesn't really change shape as it is	**What are the moon's phases called and how do they appear from Earth?** the phases are new moon (the dark half of the moon you don't see), waxing crescent (sliver or crescent lit right), first quarter (right half lit), waxing gibbous (almost fully lit right, except left edge), full moon (fully lit), waning gibbous (almost fully lit left, except right edge), last quarter (left half lit), and waning crescent (sliver or crescent lit left) **What is a constellation?** a constellation is a very large group of bright stars that form a pattern in the night sky; the people of ancient times watched the night sky like we watch television today; they told stories and matched them to constellations in the night sky honoring their gods and fallen heroes **How have people used the constellations?** as the seasons changed, so did the constellations ancient people could see at night; these changes reminded them when to plant and harvest their crops; early explorers used the stars to navigate their ships at sea; today people are unaware of the changes that occur in the night sky because they cannot see most of the constellations due to bright street lighting which limits their view of the night sky **Why do the constellations change from season to season?** as the tilted Earth orbits the Sun, the seasons change and the view of the solar system from Earth changes revealing different constellations visible from each new point in the orbit **What is space exploration?** man's attempts to learn more about outer space and the objects in our solar system; man has explored space using both robotic probes and manned flight and exploration **How has space research and exploration effected the economy and culture of Florida?** known as the "Space Coast" both the climate and weather in South Florida makes it an idea location to assemble and launch the space crafts we use to study outer space; as a result

	always shaped like a ball; what does change is the part of the Moon that reflects light from the Sun to the Earth; the Moon goes through 8 different shapes or phases which then repeat about every 29½ days	our state has benefited from the jobs, merchandise, technology and tourism generated by the space programs
Content Limits for Standards	Items will assess a conceptual understanding of the apparent movements of the Sun, Moon, and stars and resulting patterns. Items will not assess the causes of moon phases. Items will not assess or use vocabulary associated with moon phases, such as *waning*, *waxing*, and *gibbous*. Items will not require the identification of specific constellations. Items will not require specific knowledge of quantitative astronomical data. Items will not assess the causes of seasons, directness of sunlight, or Earth's tilt. Items will not assess solar or lunar eclipses.	
Teacher Hints	• Waxing, waning, gibbous, and crescent moon terminology will not be assessed on FCAT 2.0. • Star patterns appear to translate (slide) across the sky nightly (and from season to season) without changing their shape or distance from one another. • Mental models can be taught by reading a descriptive paragraph about something vague or unfamiliar. Students listen first while forming a picture in their minds of what is being described. Next, they create a 2- or 3-dimensional representation of what they pictured. Share and compare with a partner. • Students will not be required to recognize or name constellations. • National Space Day is the first Friday in May. Try to plan activities for your class/school to recognize this day and use it as a form of review. • Use varied materials (video, books, visuals) to help students understand that star patterns appear to shift in the sky when it is Earth that is moving. Have students choose one star to look at each night (e.g., North Star) to observe it as it appears to shift in the sky. • A free planetarium for your computer can be found at http://www.stellarium.org/. • Emphasize that the moon does not actually change shape but only appears to. We see different amounts of the part that reflects the sun. • Students will be required to recognize the motion of rotation (the spinning of Earth or the moon on its axis) and revolution (one complete trip of Earth around the sun). • The following website will be helpful in tracking the shapes of the moon in a science notebook: www.stardate.org/nightsky/moon and http://www.moongiant.com/. • In addition to determining a missing observable shape of the moon within a given pattern, consider asking students to predict the observable shape that will occur in 1 week, 2 weeks, 3 weeks, and 4 weeks. • Connections may be made in science to patterning activities done in mathematics. For example, pattern changes of objects/numbers can be compared to pattern changes in observable shapes of the moon and patterns of stars/constellations. • The effects of space research and exploration on the economy and culture of Florida is an opportunity for integrating Social Studies and ELA.	
Formative Assessment Probes (Page Keeley)	**Volume 1: 2nd Ed.** #24, *Gazing at the Moon, p. 189* #25, *Going Through a Phase,* p. 197	**Volume 2** #23, *Darkness at Night,* p. 171 #24, *Emmy's Moon and Stars,* p. 177 #25, *Objects in the Sky,* p. 185
Writing Connection	**Research:** Research and report the effects of space research and exploration on the economy and the culture of Florida. **Fictional Narrative:** Everyone notices stars in the sky at night. Before you begin writing, imagine you had access to a time machine. Write a story about the stars you observe as you travel through time.	
Thinking Maps® & Foldables	Four-door Foldable (observable moon shapes) Double Bubble Map (rotation and revolution)	Bubble Map (moon's qualities)

CPALMS	*Earth in Motion: Seasons* *http://www.cpalms.org/Public/PreviewResourceUrl/Preview/4549* *Star Light, Star Bright* *http://www.cpalms.org/Public/PreviewResourceUrl/Preview/25274*	*Moon Phases* *http://www.cpalms.org/Public/PreviewResourceUrl/Preview/21207* *NASA Spinoff Website* *http://www.cpalms.org/Public/PreviewResourceUrl/Preview/17460*
Web Resources	Brain Pop: *Moon* Brain Pop: *Moon Phases* Brain Pop: *Constellations* *Earth Sun and Moon* *Earth, Sun and Moon - GAME* Pearson – "Patterns of Stars in Sky" (synthesize – Interactivity: Star Patterns) Study Jam – The moon Flocab – "Moon Phases" Quizizz – Earth's Movement; Cycles and Patterns, Stars, Constellations, and Seasons Classhook- Bill Nye: Outer Space MysteryScience, Mini Lessons: Why Does it Get Cold in Winter; Why Do Places Have Different Times Phet – Gravity and Orbits	*Oreo Cookie Activity* A2 Sci Rotation and Revolution Part 1 Video A2 Sci Rotation and Revolution Part 2 Video Why the Moon Appears to Change Study Jams "A Day on Earth" Spaceplace.nasa.gov (explore this site!) Quizlet – Patterns in the Sky; Earth's Movement Newsela – Exploring the Planets: Earth Discovery Education – Constellations; Our Home in Space; More Science Please: How Far to Stars; A Closer Look at Space: Sun and Stars
Books	*Sun* by Steve Tomecek (National Geographic Society, 2006) *Find the Constellations* by H.A. Rey (Houghton Mifflin, 2008)	

Fourth Grade Suggested Scope and Sequence

NGSS Body of Knowledge: Earth/Space Science
Unit of Study: Earth's Features (6 weeks)

Prerequisite Learning: **Kindergarten –** SC.K.N.1.2, SC.K.P.8.1
First Grade – SC.1.N.1.2**, SC.1.E.6.1, SC.1.E.6.2, SC.1.E.6.3,** SC.1.P.8.1
Second Grade – SC.2.E.6.1, SC.2.E.6.2, SC.2.E.6.3, SC.2.P.8.1
Third Grade – none

Topics	Learning Targets/Skills	Standard(s)	Vocabulary
Weathering/ Erosion	*Describe the basic differences between physical weathering (breaking down of rock by wind, water, ice, temperature change, and plants) and erosion (movement of rock by gravity, wind, water, and ice).* ***Students will:*** • **observe and record** evidence of physical weathering in nature (e.g., plant roots growing up through a sidewalk, cement cracking from weather changes). • **describe** causes of physical weathering occurs (wind, water, ice, temperature change, and plants). • **investigate** the processes of physical weathering (breaking down a rock) using a model. • **observe and record** evidence of erosion in a science notebook. • **describe** causes of erosion (gravity, wind, water, and ice). • **investigate** the processes of erosion (movement of rock) using a model. • **discuss** the cause/effect relationships for erosion and weathering. • **provide** examples of how physical weathering and the erosion processes change Earth's surface (constructive and destructive).	**SC.4.E.6.4** Embedded Nature of Science SC.4.N.1.1 SC.4.N.1.3 SC.4.N.1.4 SC.4.N.1.6 SC.4.N.1.7 SC.4.N.1.8 SC.4.N.3.1	**constructive** **destructive** **erosion** **processes** **weathering** o physical
Rocks/Minerals	***Students will:*** • **identify** the physical properties of common earth-forming minerals, including hardness, color, luster, cleavage, and streak color. • **Investigate and record** the physical properties of minerals using technology and tools when appropriate (hardness-glass plate or other minerals, streak color-streak plate or unglazed tile). • **explain** that investigations of minerals do not always follow the scientific method but do involve the use of observations and evidence. • **compare** observations made by other classmates explaining any differences in data. • **compare** minerals based on physical properties. • **explain** the role of minerals (e.g., clay, quartz, feldspar) and their importance in rock formation.	**SC.4.E.6.2** Embedded Nature of Science SC.4.N.1.1 SC.4.N.1.2 SC.4.N.1.3 SC.4.N.1.6	**classify** **mineral** **mineral properties** o color o cleavage/fracture o hardness o luster o streak **rocks** • igneous • metamorphic • sedimentary **technology tools**

	Identify the three categories of rocks: igneous, (formed from molten rock); sedimentary (pieces of other rocks and fossilized organisms); and metamorphic (formed from heat and pressure).
	
	Students will:
	• **use** technology and tools to study and investigate samples of rocks.
	• **observe and identify** examples for each of the three categories of rocks (igneous, sedimentary, and metamorphic).
	• **construct** models for each of the three categories of rocks to include major details.
	• **explain,** pictorially and in words, the steps of the rock cycle.
	• **describe** how each category of rock is formed within the rock cycle.
	  ○ igneous – formed from molten rock
	  ○ sedimentary – formed with other pieces of rock and fossilized organisms
	  ○ metamorphic – formed from heat and pressure
	• **differentiate** between the three different categories of rocks based on how each is formed and/or their physical properties.
		SC.4.E.6.1
		
		Embedded Nature of Science SC.4.N.1.1 SC.4.N.3.1
		
		Embedded Earth Science SC.4.E.6.5	

Renewable/ Nonrenewable Resources	*Recognize that humans need resources found on Earth and that these are either renewable or nonrenewable.* ***Students will:*** • **define** *resources* as anything from the environment that meets our needs and wants. • **provide** examples of renewable resources (e.g., water, wind, solar, trees). • **provide** examples of nonrenewable resources (rocks, minerals, soil, and fossil fuels such as coal, oil, natural gas). • **identify** renewable and nonrenewable resources found on Earth that humans need and how they are used. • **distinguish** between renewable and nonrenewable resources found on Earth. • **explain** that nonrenewable resources exist in a fixed quantity in Earth and may be used up. *Identify resources available in Florida (water, phosphate, oil, limestone, silicon, wind, and solar energy).* ***Students will:*** • **identify** natural resources available in Florida (water, phosphate, oil, limestone, silicon, wind, and solar energy). • **distinguish** Florida's natural resources as renewable (water, wind, solar, trees) and nonrenewable (phosphate, oil, limestone, silicon).	**SC.4.E.6.3** Embedded Nature of Science SC.4.N.1.1 **SC.4.E.6.6** Embedded Nature of Science SC.4.N.1.1	**limestone** **oil** **phosphate** **resources** **-**nonrenewable -renewable **silicon** **solar** **water** **wind**

Resource Alignment	Weathering/Erosion	Rocks/Minerals	Renewable/Nonrenewable Resources
Pearson Teacher's Edition	76-85	66-73	86-93
Pearson Student's Edition	Topic 2, Lesson 4	Topic 2, Lesson 2 and 3	Topic 2, Lesson 5
Content Limits for Standard	Items may address but will not assess specific landforms resulting from physical weathering and erosion.	Items will not assess the identification of a specific mineral based on its properties. Items addressing common minerals are limited to quartz, feldspar, mica, calcite, talc, pyrite, and graphite. Items will not require the identification of specific mineral composition of any type of rock. Items will not require knowledge of Moh's hardness scale. Items will not assess the rock cycle.	Items assessing resources found in Florida are limited to water, phosphate, oil, limestone, silica, wind, and solar energy.
Daily & Key Questions	**How are weathering and erosion different?** weathering breaks down existing rock into minerals and sediments; erosion transports (moves) minerals and sediments from one place and builds it up in other places **What is deposition?** deposition occurs when moving water, ice, wind, or gravity drops a load of sediments and other materials in a new location; the newest layers are on the top	**What is a rock?** rocks are solid earth materials made of minerals; most rocks are a mixture of different minerals; sedimentary rocks may also contain the remains of living things **How are rocks classified?** rocks are classified into three groups based on how they form: igneous, sedimentary, or metamorphic rock. *Igneous rocks* form from high temperature molten magma deep in the Earth or lava on the Earth's surface. *Sedimentary rocks* form from pieces of rock, minerals, sediments, and the remains of living things that pile up in riverbeds, lake bottoms, or the ocean floor. *Metamorphic rocks* are existing rocks (igneous or sedimentary) that have been changed (reformed) by heat and pressure deep in the Earth's crust. **What are minerals?** a mineral is a naturally formed, solid substance that has never been alive or formed from a living thing; minerals have a crystal structure; a crystal structure has	What is a natural resource? a resource is any material that can be used to satisfy a need; natural resources can be divided into two groups: energy resources (e.g. sunlight, wind, moving water, fossil fuels) and material resources (e.g. minerals, plants, animals, rocks, soil) What are renewable resources? a renewable resource is a natural resource that can be replaced by nature, like food crops or solar energy What are non-renewable resources? natural resources that cannot be replaced once used, such as oil, coal, natural gas, and minerals What is conservation? conservation is the wise use of a natural resource; good conservation includes the careful and controlled use and maintenance of a resource that improves the quality of life for all the plants and animals that need the resource, not just the humans What are three ways people can conserve resources? 1) reduce the consumption of limited or nonrenewable resources by cutting back on their use

		a definite pattern in the way the particles in the mineral are arranged; a mineral has a crystal structure even if it does not have a crystal shape you can see **What are the common physical properties of Earth-formed minerals?** - color a mineral may be one color or many colors; you cannot identify a mineral by color alone, but color is helpful alone with other properties - luster describes how a mineral reflects light from its surface; some minerals are shinny like metal or glass, others are dull or waxy - hardness is the ability of a mineral to resist being scratched - cleavage is the tendency of a mineral to break along a flat surface - streak is the color of a mineral in powder form **What is the role of minerals in the formation of rocks?** rocks are a mixture of different minerals and sometimes organic materials	2) reuse materials made from natural resources when possible instead of throwing them away 3) recycle by recovering valuable waste products and using the recovered material to make new products. All three of these practices save resources, materials, and energy
Teacher Hints	*This will be the **first-time students will learn weathering/erosion concepts** that will not be repeated prior to taking the SSA Science Test* in grade 5 • Students will not be responsible for understanding chemical weathering. • Since students continue to confuse erosion and weathering, these concepts should be taught as two separate concepts. • Provide various examples of scenarios in which allow students to identify examples of surface changes in nature and identify the process that caused them utilizing conditions from natural weather phenomenon either on school grounds or from the media.	The following information pertains to the mineral portion of this topic: • Students should have multiple experiences with the physical properties (hardness, color, luster, cleavage, and streak color) used to identify minerals. • Students will not be responsible for identifying the Mohs scale or cleavage criteria. • Students will not be responsible for identifying minerals but will be responsible for identifying a physical property from its description. • Students will not be responsible for identifying minerals. • Students should use a hand lens to observe the minerals that comprise rocks (e.g., granite contains quartz, feldspar, and mica). • *The following minerals may be used on FCAT 2.0 Science Test and the district interim assessment: quartz,*	• *Consider the social studies implications of local landforms* and bodies of salt and fresh water and impact of these and other resources on local and state economy. • Examples of renewable resources may include: fresh water, fresh air, forests, agriculture (plants and animals), oils from seeds, sun (solar energy), wind (wind energy-turbines), water (hydro-powered), geothermal (heat from earth's interior), etc. • Examples of nonrenewable resources may include: fossil fuels, uranium, minerals. • Note that some examples of nonrenewable resources such as minerals (e.g., iron, copper, aluminum) or fossil fuels (i.e., petroleum, coal, natural gas), while continuously formed in nature, will eventually be depleted and cannot

		feldspar, mica, calcite, talc, pyrite, and graphite. • Students should be provided with scenarios that include natural rocks representing the various mineral properties. The following information pertains to the rock portion of this topic: • Rocks constantly change from one type to another. • Students will need to understand the formation of rocks through the rock cycle. (http://www.windows2universe.org/earth/geology/rocks_intro.html). • Igneous rocks are formed when hot melted rock, called magma, cools (e.g., granite, lava rock). • Sedimentary rocks are formed when pieces of other rocks and fossilized organisms are squeezed together (i.e., limestone, chalk). • Metamorphic rocks are formed from extreme heat and extreme pressure (e.g., slate, marble). • Students will not be responsible for memorizing names of rocks (e.g., granite, slate, quartzite). They will be responsible for identifying categories of rocks (igneous, sedimentary, and metamorphic) according to how they are formed. • Students should be able to identify the various stages of the rock cycle in a flow chart. • Use of videos and animations by students to observe and then explain how igneous, sedimentary, and metamorphic rocks are formed is encouraged. • Locations of available rock/mineral resources found in Florida can be discovered at http://www.dep.state.fl.us/geology/ge	be utilized by current consumers.

		ologictopics/minerals.htm#Mine. Information on this website can be referenced during the following Unit of Study (Renewable/Nonrenewable Resources) as well.	
Formative Assessment Probes (Page Keeley)	Volume 1: 2nd Ed. #22, *Beach Sand,* p. 173 #23, *Mountain Age,* p. 181 Volume 2 #22, *Mountaintop Fossil,* p. 165	Volume 2 #20, *Is It a Rock?* (version 1), p. 151 #21, *Is It a Rock?* (version 2), p. 157	
Writing Connection	Fictional Narrative: Saving the Sand Dunes: Pretend that you have been given the job of saving the sand dunes at the beach from being eroded. Write a story about trying to save the sand dunes. Expository: Think about the impact erosion and weathering has on our environment. Write an essay explaining why it is important for scientists to study weathering and erosion.	Fictional Narrative: All rocks are formed in different ways. Think about the three different rocks and how they are formed. Pretend that you are one type of rock and write a story describing how you were formed.	Expository: Renewable and nonrenewable resources are important in our daily lives. Choose 1 resource and explain why it would be hard to live without it. Narrative: Imagine a world where our nonrenewable resources were all gone. Write a story about how you would live without these precious resources. What changes would you have to make to survive? Persuasive: Nonrenewable resources are important to our daily lives. Persuade your friends or family members why it is important to conserve these resources. Research: Write a report about one natural Florida resource (phosphate, limestone, or clay). Describe how the resource is obtained and the process it undergoes to be used.
Thinking Maps® & Foldables	Circle map (weathering) Double Bubble map (weathering and erosion) Shutter-fold book foldable (weathering) Four-door diorama foldable (erosion) Pyramid foldable (weathering/erosion)	Double Bubble map (igneous, sedimentary, and metamorphic) Flow map – how rocks are formed Three-tab book foldable (igneous, sedimentary, and metamorphic) Layered-look book foldable (properties of minerals) Tree map (renewable/nonrenewable) Two-Tab book foldable (renewable and nonrenewable resources)	
CPALMS	*Weathering* *http://www.cpalms.org/Public/PreviewResourceUrl/Preview/56982* *Looking At Weathering and Erosion* *http://www.cpalms.org/Public/PreviewResourceUrl/Preview/24857*	*Save our Sand - An Engineer Design Challenge* *http://www.cpalms.org/Public/PreviewResourceLesson/Preview/30463* *Cemented Together* *http://www.cpalms.org/Public/PreviewResourceLesson/Preview/28743* *What Kind of Rock – Expository Writing*	*Find WHAT in Florida?* *http://www.cpalms.org/Public/PreviewResourceLesson/Preview/46510*

		http://www.cpalms.org/Public/PreviewResourceUpload/Preview/20707	
Web Resources	*Brain Pop: Earth System* *Weathering and Erosion - Part 1 Video* *Weathering and Erosion Game Show Review* Study Jams – Weather & Erosion DE – "Weather & Erosion"	Scholastic Study Jams: *Minerals* Scholastic Study Jams: *Igneous Rocks* Brain Pop: *Earth System* Happy Scientist: *Rocks* *Rocks and Minerals Video* *Types of Rocks and Rock Cycles* *Rocks* Study Jams – video for each type of rocks and minerals Discovery Ed video – Types of Rocks	Scholastic Study Jams: *Natural Resources* Neo K12 – *Natural Resources* Big Idea 7: Earth Provides Resources Video Study Jams – "Natural Resources" General Resources for Topic 2 Brainpop – Rock Cycle; Weathering, Types of Rocks, Mineral Identification SuperTeacherWorksheets – Types of Rocks Quizziz – Rocks; Weathering Classhook – Bill Nye Weathering Erosion MysteryScience – Full Lesson Birth of Rocks; Mini Lesson 'Why Does This Rock Look Like a Sponge Quizlet – Weathering Erosion; Florida Natural Resources Newsela – How Does Erosion Happen; Earth's Systems: Natural Resources
Books	*Be a Geologist:* Gareth Stevens Publishing *Earth's Treasures: Rocks and Minerals* PowerKids Press *What are Minerals?* Crabtree		

Fourth Grade Suggested Scope and Sequence

NGSS Body of Knowledge: Physical Science
Unit of Study: Matter (5 weeks)

Prerequisite Learning: **Kindergarten – SC.K.P.8.1, SC.K.P.9.1, SC.K.P.13.1,** SC.K.E.5.1
First Grade – SC.1.P.8.1, SC.1.P.13.1, SC.1.E.5.2, SC.1.E.5.3
Second Grade – SC.2.P.8.1, SC.2.P.8.2, SC.2.P.8.3, SC.2.P.8.6, SC.2.P.9.1, SC.2.P.13.1, SC.2.P.13.2, SC.2.P.13.3, SC.2.P.13.4
Third Grade – SC.3.P.8.1, SC.3.P.8.2, SC.3.P.8.3, SC.3.P.9.1, SC.3.E.5.4

Topics	Learning Targets/Skills	Standard(s)	Vocabulary
Properties of Matter	*Measure and compare objects and materials based on their physical properties including: mass, shape, volume, color, hardness, texture, odor, taste, attraction to magnets.* ***Students will:*** • **compare** objects based on observable and measurable physical properties (shape, color, hardness, texture, odor, taste, attraction to magnets, mass, volume, temperature). • **investigate and explain** that all matter has the following measurable properties: volume (takes up space) and mass (weight). • **record and compare** the mass and volume of solid and liquid matter using metric units. • **record and compare** the volume of regular- and irregular-shaped solids using the water displacement method. • **display** data appropriately in charts, tables, and graphs. • **compare** measurement data with other lab groups checking for accuracy. • **explain** any differences that may have occurred across groups. *Identify properties and common uses of water in each of its states.* ***Students will:*** • **investigate and describe** properties of <u>water</u> in all three states. • **identify** common uses of <u>water</u> in all three states. • **explain** the importance of <u>water</u> to life on Earth.	**SC.4.P.8.1** Embedded Nature of Science SC.4.N.1.1 SC.4.N.1.2 SC.4.N.1.5 SC.4.N.1.6 **SC.4.P.8.2** Embedded Nature of Science SC.4.N.1.1 SC.4.N.1.7	**mass** **matter** **physical properties** ○ observable ○ measurable **states of matter** ○ solid ○ liquid ○ gas **temperature** **volume**

Changes in Matter	*Identify some familiar changes in materials that result in other materials with different characteristics, such as decaying animal or plant matter, burning, rusting, and cooking.* ***Students will:*** • **identify** familiar physical changes in matter in which the objects' properties are retained (e.g., cutting, tearing, crumpling, folding, melting, freezing, dissolving). • **identify** familiar chemical changes in matter that result in a new substance with new properties (e.g., burning, frying, rusting, grilling, toasting, decaying plant and animal matter). • **record** observations of physical and chemical changes in a science notebook. • **make inferences** about observations made of physical and chemical changes. • **describe** observable signs that a chemical change may exhibit (smell, color, heat, fizzing sound, and substance given off)..	**SC.4.P.9.1** Embedded Nature of Science SC.4.N.1.1 SC.4.N.1.3 SC.4.N.1.6	**chemical change** **physical change**
Magnets	*Identify some familiar changes in materials that result in other materials with different characteristics, such as decaying animal or plant matter, burning, rusting, and cooking.* ***Students will:*** • **identify** familiar physical changes in matter in which the objects' properties are retained (e.g., cutting, tearing, crumpling, folding, melting, freezing, dissolving). • **identify** familiar chemical changes in matter that result in a new substance with new properties (e.g., burning, frying, rusting, grilling, toasting, decaying plant and animal matter). • **record** observations of physical and chemical changes in a science notebook. • **make inferences** about observations made of physical and chemical changes. • **describe** observable signs that a chemical change may exhibit (smell, color, heat, fizzing sound, and substance given off).	**SC.4.P.8.4** Embedded Nature of Science SC.4.N.1.1 SC.4.N.1.4 SC.4.N.1.5 SC.4.N.1.6 SC.4.N.1.7 SC.4.N.1.8	**attract** **magnet** **magnetic** **magnetic field** **north pole (N)** **repel** **south pole (S)**

Resource Alignment	Properties of Matter SC.4.P.8.1 and SC.4.P.8.2	Changes in Matter SC.4.P.9.1	Magnets SC.4.P.8.4
Pearson Teacher's Edition	p. 108-117	p. 137-141	p. 109-111, 116-117
Pearson Student's Edition	Topic 3 Lesson 1, 2 and 3	Topic 3, Lesson 4	Topic 3 Lesson 1

Content Limit for Standards	Items will not address or assess particle behavior in each state of matter or between states of matter. Items will not address or assess the water cycle. Items may refer to common tools used to measure basic properties of solids, liquids, and gases but will not assess specific knowledge of the tools. Items will not assess the difference between weight and mass. Items will not assess unit of measure. Items will not require unit conversions to compare data. Items will not address or assess density as a property.	Items will not assess particle motion in changes of states of matter.	Students will identify and/or describe examples of magnetic attraction and repulsion. Items assessing familiar forces are limited to pushes, pulls, friction, gravity, and magnetic force. Items that assess magnetic attraction will not use the context of separating mixtures and solutions.
Daily & Key Questions	**What is mass and volume?** mass and volume are properties of matter; mass is the amount of matter an object contains, and volume is the amount of space it takes up; mass is measured in grams (g) and kilograms (kg), and volume is measured in cubic centimeters (cm3), cubic meters (m3), or milliliters (mL), Liters (L) and kiloliters (kL) **What is density?** density is a property of matter; it compares the mass (amount of matter) per volume (amount of space) in an object **How are solids, liquids, and gases different?** solids have a definite volume and shape; liquids have a definite volume but no definite shape, so they take the shape of their container; gases have no definite volume or shape; the motion of particles in matter determines its physical state or phase (if it's a solid, liquid or gas) and temperature **How are density and buoyancy related?** buoyancy is the ability of matter to float or sink in a liquid (or gas); objects denser than water sink. If a solid is denser than fresh water (1.0g/cm3), it will sink; if a solid's mass can be spread out over more surface, lowering its mass per unit volume below water (0.99 g/cm3 or lower), it will float **Will the weight of an object equal the sum of all its disassembled parts?** the weight of an object will equal the sum of all its disassembled parts only when all the parts are weighed together, and no parts are missing	**What is a physical change?** changes from one form to another without turning into a new substance **What evidence indicates a physical change has happened?** the object (substance) changed, but what it is made from did not **What is a chemical change?** a chemical change is when one or more substances change into one or more new substances **What evidence may indicate a chemical change has happened?** the properties of the new substances are different form the properties of the original substances	**What is a magnet?** a tool that pulls (attracts) iron and a few other magnetic materials **What is magnetism?** the pull between an object and a magnet creates a force called magnetism **How do magnets react with other magnets?** magnets can push or pull on other magnets; when magnets push away or repel, they do so because they are aligned so that similar poles (North-North or South-South) are facing each other; two magnets pull together or attract when two unlike poles (North-South) are aligned

	What are the physical properties and states of water? water is a colorless, odorless, tasteless, liquid. Water occurs naturally on Earth as a liquid (water), solid (ice, snow, sleet) and gas (water vapor) **Why is water important?** without water there would be no life on Earth		
Teacher Hints	• Physical properties of matter are observable and measurable. • Density is no longer instructed at the elementary level. • Students should have a good working knowledge of mass/weight and volume and be presented with various situations in which mass and volume must be calculated. • Mass is the amount of matter in an object. Mass and weight are the same on Earth. At this grade level, mass and weight will be used interchangeably. • Water displacement is a technique used to measure the volume of an object by calculating how much water it displaces (pushes aside) when placed into a sample of water. • Students should comfortably make the following associations: **Property Tool Unit of Measure** Mass (weight) balance, digital scale g, kg Volume beaker, graduated cylinder mL, L Temperature thermometer ˚C, ˚F	• Although students have had exposure to physical changes in previous grade levels, this is their first exposure to chemical changes (e.g., when baking soda (solid) is mixed with vinegar (liquid), carbon dioxide (gas) is produced in the form of bubbles. Carbon dioxide has different properties than either baking soda or vinegar). • Another example of a chemical change is: iron nails exposed to oxygen forms rust. Rust is a completely different substance than iron or oxygen. • Students should make comparative observations between original matter and that which has undergone a change (e.g., a new iron nail and a rusted iron nail, a new candle and one that is burning, fresh and decaying leaves, bread that is not toasted and toasted) and engage in discussions to share their observations and listen to the thinking of their classmates.	• Explore contact and non-contact forces with the use of various magnets. • Since some magnets do not label the north and south poles, this is an opportunity to explore the properties of magnets. • Magnetism is a property of matter. Magnets are tools that help to determine an object's magnetic property. • Given a few objects, explore whether the objects are magnetic or are magnets themselves. • Earth's magnetism will not be assessed.
Formative Assessment Probes (Page Keeley)	**Volume 1- 2nd Ed.** #10, *Is It Matter,* p. 79 #5, *Ice Cubes in a Bag,* p. 45 #6, *Lemonade,* p. 53 #7, *Cookie Crumbles,* p. 61 #8, *Seedlings in a Jar,* p. 67 **Volume 2** #1, *Comparing Cubes,* p. 19 #4, *Solids and Holes,* p. 41	**Volume 1- 2nd Ed.** #9, *Is It Melting?,* p. 73 #12, *The Rusty Nails,* p. 93 **Volume 2** #5, *Turning the Dial,* p. 47 #6, *Boiling Time and Temperature,* p.53 #7, *Freezing Ice,* p. 59	
Writing Connection	**Narrative:** Write a story that tells of your adventures in Matter Land as you set out to find all three states of matter. **Expository:** Solids, liquids, and gases are all around us. Tell about a place you have visited where all three states of matter are found.	**Journal Entry:** Explain the difference between physical and chemical change.	**Journal Entry:** Explain what objects are attracted to magnets. Describe why this occurs.

Thinking Maps® & Foldables	Bubble map (matter) Two-door foldable (mass/volume)	Double-Bubble map (chemical/physical change)	Tree map (magnetism)
CPALMS	*Properties of Matter: Mass, Shape, Volume* *http://www.cpalms.org/Public/PreviewResourceLesson/Preview/29483* *Volume Lesson* *http://www.cpalms.org/Public/PreviewResourceLesson/Preview/27411* *Observing Physical Change* *http://www.cpalms.org/Public/PreviewResourceUpload/Preview/13484* *Water Cycle* *http://www.cpalms.org/Public/PreviewResourceUpload/Preview/57443* *Exploring Water* *http://www.cpalms.org/Public/PreviewResourceUpload/Preview/13485* *Water Troubles* *http://www.cpalms.org/Public/PreviewResourceLesson/Preview/47950*	*Did it Change?* *http://www.cpalms.org/Public/PreviewResourceLesson/Preview/28739* *Holey Rusted Metal* *http://www.cpalms.org/Public/PreviewResourceLesson/Preview/46542*	*Magnetic Personality* *http://www.cpalms.org/Public/PreviewResourceLesson/Preview/29684* *Magnetism and Magnetic Properties* *http://www.cpalms.org/Public/PreviewResourceLesson/Preview/21266*
Web Resources	Scholastic Study Jams: *Properties of Matter* Scholastic Study Jams: *Solids, Liquids, Gases* Brain Pop: *States of Matter* Study Jams – "Properties of Matter" Phet – Magnet and Compass Journeys Text (Magazine) – Power Magnet Phet – States of Matter Discovery Education Exploration – Measuring Matter	Scholastic Study Jams: *Changes of Matter* Brain Pop: *Matter Changing States* *Virtual Lab*	Brain Pop: Magnetism Pete's Power Points: Magnets Magnet Game Study Jams – "Electromagnets"
Books	*Investigating Matter* Lerner Publishing Group *What Is Matter?* Britannica Educational *Splat! Wile E. Coyote Experiments with States of Matter* Capstone Paperback *Changing Matter: Understanding Physical and Chemical Changes* Rourke *States of Matter in the Real World* ABDO Paperback		

Fourth Grade Suggested Scope and Sequence

NGSS Body of Knowledge: Physical Science
Unit of Study: Energy & Motion & Human Uses of Energy (6 weeks)

Prerequisite Learning: **Kindergarten – SC.K.P.10.1, SC.K.P.12.1, SC.K.P.13.1**
First Grade – SC.1.P.12.1, SC.1.P.13.1
Second Grade – SC.2.P.10.1, SC.2.P.13.1, SC.2.P.13.4
Third Grade – SC.3.P.10.1, SC.3.P.10.2, SC.3.P.10.3, SC.3.P.10.4, SC.3.P.11.1, SC.3.P.11.2, SC.3.E.6.1

Topics	Learning Targets/Skills	Standard(s)	Vocabulary
Forms of Energy	*Observe and describe some basic forms of energy, including light, heat, sound, electrical, and the energy of motion.* ***Students will:*** • **observe and describe** some basic forms of energy, including light, heat, sound, electrical, and the energy of motion (mechanical). • **identify** examples of these energy forms in their life and in the natural world. • **compare and contrast** these types of energy. • **review** how light travels in a straight path until interrupted by an object. • **review** how light passes through other objects (transparent, translucent, opaque). • **review** how light reflects, bends, and absorbs.	**SC.4.P.10.1**	**electrical** **energy** **heat** **light** **mechanical motion** **pitch** **pluck** **sound** **vibrate**
	Investigate and explain that sound is produced by vibrating objects and that pitch depends on how fast or slow the object vibrates. ***Students will:*** • **describe** the requirements/components necessary for sound to be produced. • **Investigate** the production of sound (e.g., tuning forks, hollow tubes, vocal cords, or water bottles filled with different amounts of water). • **explain** that sound is produced by vibrating objects. • **investigate** variations in pitch (e.g., water bottle liquids, rulers, straws, stretched rubber bands). • **explain** that pitch depends on the speed (fast and slow) an object vibrates and the measurements (size and length) of the object.	**SC.4.P.10.3** Embedded Nature of Science SC.4.N.1.1 SC.4.N.1.3 SC.4.N.1.4 SC.4.N.1.6 SC.4.N.1.7	

Heat	*Identify common materials that conduct heat well or poorly.* ***Students will:*** • **review** how things that give off light often give off heat. • **review** how heat is produced when two objects rub against each other. • **investigate** heat energy by measuring temperature changes in a liquid. • **compare** observations with classmates explaining any differences that occur. • **collect and record** temperature readings during investigations in charts, tables, and graphs. • **investigate** which materials are the best conductors of heat (e.g., clay, metal, and glass). • **investigate** which materials are non-conductors/insulators of heat (e.g., plastic, wood, Styrofoam). • **make inferences** about observations made during conductivity investigations. • **form** conclusions about which materials conduct heat well or poorly based on investigations. *Recognize that heat flows from a hot object to a cold object and that heat flow may cause materials to change temperature.* ***Students will:*** • **investigate and diagram** the direction of heat flow (hot → cold). • **record observations** of heat transfer (in the form of temperature changes) within tables, charts, and graphs. • **analyze and form conclusions** based on their recorded observations and data.	**SC.4.P.11.2** Embedded Nature of Science SC.4.N.1.1 SC.4.N.1.2 SC.4.N.1.4 SC.4.N.1.5 SC.4.N.1.6 SC.4.N.1.7 SC.4.N.1.8 **SC.4.P.11.1** Embedded Nature of Science SC.4.N.1.1 SC.4.N.1.4 SC.4.N.1.6 SC.4.N.1.7	**conductor** **heat** **heat flow/transfer** **insulator** **temperature**
Motion of Objects	*Recognize that an object in motion always changes its position and may change its direction.* ***Students will:*** • **describe** an object's position and motion in space. • **explain** that motion is a change of an object's position. • **demonstrate** that moving objects <u>always</u> change position. • **demonstrate** that moving objects <u>may</u> change direction. *Investigate and describe that the speed of an object is determined by the distance it travels in a unit of time and that objects can move at different speeds.* ***Students will:*** • **explain** that the speed of an object is determined by the distance it travels within a unit of time. • **investigate and compare** the speeds of different objects	**SC.4.P.12.1** Embedded Nature of Science SC.4.N.1.1 **SC.4.P.12.2** Embedded Nature of Science SC.4.N.1.1 SC.4.N.1.2 SC.4.N.1.4 SC.4.N.1.6 SC.4.N.1.7	**direction** **distance** **motion** **position** **speed** **time**

	by measuring the distance each object travels during a set amount of time using tools and technology. • **investigate and compare** the speeds of different objects by measuring the amount of time it takes each object to travel a set amount of distance using tools and technology. • **display** obtained speeds in chart, table and graph format.	SC.4.N.1.8	

Resource Alignment	Forms of Energy	Heat	Motion of Objects
Pearson Teacher's Edition	p. 176, 180-182, 209, 212-214 p. 161, 165-167, 172, 196-197	p. 176-183	p. 164 p. 164-165, 185, 196-197
Pearson Student's Edition	Topic 4 Lesson 1 and 3	Topic 4, Lesson 3	Topic 4 Lesson 1 and 2
Content Limits for Standards	Items assessing basic forms of energy are limited to light, heat (thermal), sound, electrical, chemical, and mechanical energy. Items will not assess the transformation of energy from one form to another. Items assessing light reflection, refraction, or absorption should use the term *reflect*, *bend*, or *absorb* to describe light's behavior.	Items will not assess parallel and series circuits. Items assessing electricity will not refer to electrons or the movement of electrons in producing electrical charge. Items that refer to positive and negative charges in attraction and repulsion properties must be in the context of static electricity. Items will not use more than two energy conversions.	Items assessing relationship between mass, force, and motion are limited to a conceptual understanding. Items will not involve mathematical calculations or formulas. Items will address a conceptual understanding of speed and not require mathematical computations. Items may require the identification of the direction of motion but not the magnitude of motion. Items may refer to balanced forces and/or unbalanced forces but not net force. Items assessing forces applied to objects of different masses are limited to pushes, pulls, and friction.
Teacher Hints	• In 3rd grade, students are expected to *identify* basic forms of energy. In 4th grade, students are expected to be able to ***observe and describe*** basic forms of energy. • Students will no longer need to know potential and kinetic energy. • The study of sound energy is new to 4th grade. • Sound activities should focus on vibration and pitch. Students can make their own musical instruments.	• Temperature is a measure of heat energy. Ice water has heat energy. Try the following investigation: Take the temperature of ice water. Add more ice. Take the temperature again. Discuss the findings. • The NGSSS do not contain insulators/insulation in the	• A change of position is called motion. • A change in motion means starting or stopping, speeding up or slowing down, or moving in a different direction. • Speed is a change in position over a period.

		wording of the benchmark language. However, it does show up in the SSA Item Writer glossary making it fair game vocabulary. During heat conduction investigations, refer to objects as good or poor conductors of heat energy as well as conductors and insulators. • The following is a simple conduction experiment: Place a plastic, metal, and wooden spoon in hot water. Record observations.	
Formative Assessment Probes (Page Keeley)	**Volume 1 – 2nd Ed.** #1, *Can It Reflect Light?,* p. 17 #2, *Apple in the Dark,* p. 25 #3, *Birthday Candles,* p. 31	**Volume 1- 2nd Ed.** #9, *Is It Melting,* p. 73 **Volume 2** #5, *Turning the Dial,* p. 47 #6, *Boiling Time and Temperature,* p. 53 #10, *Ice Cold Lemonade,* p. 77 #11, *Mixing Water,* p. 83	
Writing Connection	**Journal Entry:** Explain the different forms of energy you use from the time you wake up until the time you go to bed.	**Narrative:** When an object is heated the heat flows towards objects that have a cooler temperature. Pretend you are a water molecule that has been heated. Write a story in which you describe your journey.	**Expository (journal entry):** Everyone has participated in a "race" of some sort. Think about a time when you have participated in a race. Explain to your reader how you could increase your speed.
Daily and Key Questions	**What is energy?** energy is the ability to do work; work is done when a force moves an object; energy causes motion and can also cause changes in matter **What is light?** light is a form of energy that travels in waves and can move through empty space where there is no air **What is heat?** heat is a form of energy caused by the moving particles in a substance **What is sound?** sound is a form of energy produced by vibrating matter	**What is heat?** heat is the movement of thermal energy between different matter that is at different temperatures **How does thermal energy naturally transfer?** heat always moves from hot matter to cold matter **What is conduction?** conduction is the movement of heat from hotter matter to colder matter it is touching; this transfer of thermal energy is caused when particles in the hotter matter bump into and speed up the particles in the colder matter and	**What is motion?** motion is a change in position **What causes motion?** motion is caused when unbalanced forces are applied to an object Forces act in pairs opposite in direction to each other. If the pair of forces are balanced (equal in strength), the object is 'at rest' (not moving). However, when one force becomes stronger than the other (unbalancing the pair of forces), the object begins to move in the direction the stronger force is applied. The more force applied, the faster the object will move. **How can motion be measured?** motion can be measured by dividing the distance an object

	What is electricity? a form of energy that is produced when electrons move from one place to another **What type of energy do moving objects have?** a moving object has kinetic energy; the faster an object moves the greater its mass and the more kinetic energy it has **What causes sound?** sound is a form of energy produced by vibrating objects **How is a loud sound different from a soft sound?** louder sounds are created by larger vibrations.; larger vibrations make stronger movements in the air molecules as the sound travels; smaller vibrations cause softer (quieter) sounds **What is pitch?** the pitch of a sound is how high or low it sounds; in high sounds compressions happen more often and lower sounds, compressions happen less often	continues until both pieces of matter are the same temperature **What is convection?** convection is the movement of heat energy in a fluid (liquid or gas) in which warmer fluids 'rise' and cooler fluids 'sink' creating a current (flow) from hot to cold **What is radiation?** radiation is the movement of tiny 'bundles of light' energy (called photons) that include both light and heat in waves from the Sun to the Earth through empty space **What is conduction?** conduction is when heat moves from a warmer material to a colder material it is touching **What is the difference between a conductor and an insulator?** a conductor is a material that heat can easily move through; an insulator is a material that heat can't easily move through **How does conduction move heat from one object to another?** when two substances come into contact, their particles touch and the energy of the faster moving particles is transferred to the slower moving particles until the particles in both substances are moving at the same speed (their temperature is equalized)	moves by the time it takes to move (speed = distance/time); this calculation is called the object's speed and describes the rate at which the object is moving
Thinking Maps® & Foldables	Tree map (forms of energy) Five-tab Book foldable (forms of energy)	Pocket Book Foldable (materials that transfer energy)	

CPALMS	*Energy Kids* *http://www.cpalms.org/Public/PreviewResourceExternal/Preview/30237* *Light and Shadows* *http://www.cpalms.org/Public/PreviewResourceUrl/Preview/35650* *Sound* *http://www.cpalms.org/Public/PreviewResourceUrl/Preview/13638* *Sound - Why can we hear it?* *http://www.cpalms.org/Public/PreviewResourceLesson/Preview/41571*	*Turn Up the Heat!* *http://www.cpalms.org/Public/PreviewResourceLesson/Preview/49810* *Cube Cooler – An Engineering Design Challenge* *http://www.cpalms.org/Public/PreviewResourceLesson/Preview/30809* *Stop Heat from Escaping Keep it Cool – An Engineering Design Challenge* *http://www.cpalms.org/Public/PreviewResourceUrl/Preview/27618*	*Sunshine Power Company – MEA* *http://www.cpalms.org/Public/PreviewResourceLesson/Preview/32274* *Rollercoaster Investigations* *http://www.cpalms.org/Public/PreviewResourceLesson/Preview/34879*
Web Resources	Scholastic Study Jams: *Energy & Matter* Brain Pop: *Energy* Brain Pop – Energy Sources Brain Pop – Forms of Energy Phet - Sound	Brain Pop: *Energy* *Heat Transfer-Hot 2 Cold*	*Scholastic Study Jams: Force & Motion*
Books	*Investigating Heat* Lerner Publishing Group *Finding Out About Geothermal Energy* Lerner Publishing Group *Science Lab: The Transfer of Energy* Cherry Lake		

Fourth Grade Suggested Scope and Sequence

NGSS Body of Knowledge: Physical Science

Continued from last section

Unit of Study: Human Uses of Energy

Prerequisite Learning: **Kindergarten – SC.K.P.10.1**
First Grade – none
Second Grade – SC.2.P.10.1
Third Grade – SC.3.P.10.1, SC.3.P.10.2

Topics	Learning Targets/Skills	Standard(s)	Vocabulary
Energy in Motion	*Investigate and describe that energy has the ability to cause motion or create change. Describe how moving water and air are sources of energy and can be used to move things.* ***Students will:*** • **investigate and describe** how energy can cause motion (e.g., moving water can turn a water wheel to make hydropower, wind can move sand across the beach or sail a model boat, solar energy can power a model car). • **investigate and describe** how energy can create change in matter (e.g., heat energy can melt ice, moving water can make rocks smooth, light can keep food warm). • **explain** the relationship between energy and motion.	**SC.4.P.10.2** **SC.4.P.10.4** Embedded Nature of Science SC.4.N.1.1 SC.4.N.1.4 SC.4.N.1.6 SC.4.N.1.7 SC.4.N.1.8	**change** **energy** **hydropower** **motion** **solar** **water** **wind**

Resource Alignment	**Human Uses of Energy**
Pearson Teacher's Edition	p. 227-231
Pearson Student's Edition	Topic 5, Lesson 3 *****FLUFF ALERT!!!** **The rest of Topic 5 is all review!! Please use only if needed!!**
Content Limits for Standards	Items will not assess sound and chemical energy. I terms assessing relationship between mass, force, and motion are limited to a conceptual understanding. Items will not involve mathematical calculations or formulas. Items will address a conceptual understanding of speed and not require mathematical computations. Items may require the identification of the direction of motion but not the magnitude of motion. Items may refer to balanced forces and/or unbalanced forces but not net force. Items assessing forces applied to objects of different masses are limited to pushes, pulls, and friction.
Teacher Hints	• A change of position is called motion. • A change in motion means starting or stopping, speeding up or slowing down, or moving in a different direction. • Speed is a change in position over a period.
Writing Connection	**Expository (journal entry):** Everyone has participated in a "race" of some sort. Think about a time when you have participated in a race. Explain to your reader how you could increase your speed.
Daily and Key Questions	**What is motion?** motion is a change in position **What causes motion?** motion is caused when unbalanced forces are applied to an object Forces act in pairs opposite in direction to each other. If the pair of forces are balanced (equal in strength), the object is 'at rest' (not moving). However, when one force becomes stronger than the other (unbalancing the pair of forces), the object begins to move in the direction the stronger force is applied. The more force applied, the faster the object will move.

	How can motion be measured? motion can be measured by dividing the distance an object moves by the time it takes to move (speed = distance/time); this calculation is called the object's speed and describes the rate at which the object is moving
CPALMS	*Designing Windmills* *http://www.cpalms.org/Public/PreviewResourceUpload/Preview/13489* *Wind Sculptures – An Engineering Design Challenge* *http://www.cpalms.org/Public/PreviewResourceLesson/Preview/30814*
Web Resources	Scholastic Study Jams: *Sound* Brain Pop: *Energy* Brain Pop – Natural Resources Pearson Virtual Lab – Pearson Interactivity Flocabulary – Natural Resources Kahoot – Earth Science: Natural Resources Legendsoflearning.com - Story of Natural Resources Brain Pop – sortify – natural resources
Books	*Forces: Science All Around Me* by Karen Bryant- Mole (Heinemann, 2002) *Forces and Motion: From Push to Shove* by Christopher Cooper (Heinemann, 2003) *Force and Motion: Laws of Movement* by Don Nardo (Compass Point, 2008)

Fourth Grade Suggested Scope and Sequence

NGSS Body of Knowledge: Life Science
Unit of Study: Plants & Animals (4 weeks)

Prerequisite Learning: **Kindergarten – SC.K.L.14.3**
First Grade – SC.1.L.14.1, SC.1.L.14.2, SC.1.L.14.3, SC.1.L.16.1
Second Grade – SC.2.L.17.1, SC.2.L.17.2
Third Grade – SC.3.L.14.1, SC.3.L.14.2, SC.3.L.17.1

Topics	Learning Targets/Skills	Standard(s)	Vocabulary
Plant Life Cycles	*Compare and contrast the major stages in the life cycles of Florida plants and animals, such as those that undergo incomplete metamorphosis, and flowering and nonflowering seed-bearing plants.* ***Students will:*** • **review** that all living things have a life cycle. • **explore** life cycles of various plants found in Florida (e.g., orange tree, pine tree, hibiscus). • **diagram** the major stages in the life cycles of plants. (seed → seedling → mature plant → flower or cone). • **compare** the major stages in the life cycles of Florida plants, both flowering and nonflowering • seed-bearing plants (e.g., daisies and pine trees).	**SC.4.L.16.4** Embedded Nature of Science SC.4.N.1.1 SC.4.N.1.5	**flowering** **life cycle** **living** **non-flowering** **seed-bearing**
Plant Reproduction	*Identify processes of sexual reproduction in flowering plants, including pollination, fertilization (seed production), seed dispersal, and germination.* ***Students will:*** • **identify** the reproductive structures of a flower and their functions. o stamen/anther (male parts) – makes pollen o pistil/carpel (female parts) – produces ovules o ovule – becomes a seed o ovary – becomes a fruit • **identify and describe** processes of reproduction (sexual) in flowering plants. o pollination – the transfer of pollen from the male parts (stamens) to the female parts (pistils) of a flower o fertilization (seed production) – the joining of an egg cell and a sperm cell o seed dispersal – the transport of seed from one location to another o germination – the sprouting of a plant from a seed	**SC.4.L.16.1** Embedded Nature of Science SC.4.N.1.1	**another** **carpel** **fertilization** **function** **germination** **ovary** **ovule** **pistil** **plant responses** **pollination** **reproduction** **seed dispersal** **stamen** **structure**

Animal Life Cycles	*Compare and contrast the major stages in the life cycles of Florida plants and animals, such as those that undergo incomplete metamorphosis, and flowering and nonflowering seed-bearing plants.* ***Students will:*** • **explore** life cycles of various animals living in Florida. • **describe** complete metamorphosis (4 stages) using animals that undergo this change (e.g., butterflies, frogs, flies, ants). • **describe** incomplete metamorphosis (3 stages) using animals that undergo this change (e.g., grasshoppers, cockroaches, dragonflies). • **compare and contrast** differences in body structures of the different stages (egg, larva, pupa, adult, nymph). • **differentiate** between the major stages in life cycles of Florida animals including, but not limited to, those that undergo incomplete and complete metamorphosis	**SC.4.L.16.4** Embedded Nature of Science SC.4.N.1.1 SC.4.N.1.2 SC.4.N.1.3	**adult** **egg** **larva** **metamorphosis** - complete - incomplete **nymph** **pupa**
Heredity	*Explain that although characteristics of plants and animals are inherited, some characteristics can be affected by the environment.* ***Students will:*** • **explain** that some characteristics (traits) of plants are inherited by offspring from parents (e.g., type of plant, color of flower, leaf shape, size). • **explain** that some characteristics (traits) of plants are affected by the environment in both positive and negative ways (e.g., fires, humans, pollution). • **explain** that some characteristics (traits) of animals are inherited by offspring from parents (e.g., freckles, height, dimples, eye color). • **explain** that some characteristics (traits) of animals are learned/acquired by the environment (e.g., hair color and length, playing an instrument, reading). • **explain** that environmental factors such as climate, disease, light, temperature, predator-prey relationships, and food supply, can affect some characteristics of organisms. *Recognize that animal behaviors may be shaped by heredity and learning.* ***Students will:*** • **give examples** of how animal behaviors may be shaped by heredity or learning. o instinctive/inherited behaviors: hibernation, migration, hunting, protecting young, courtship, grooming, verbal communication, fighting, etc. o learned behaviors: using tools, language, hunting, playing sports, writing, etc. • **form** conclusions that many animal behaviors are a combination of both heredity and learning. • **differentiate** between learned/acquired behaviors and	**SC.4.L.16.2** Embedded Nature of Science SC.4.N.1.1 **SC.4.L.16.3** Embedded Nature of Science SC.4.N.1.1 SC.4.N.1.4 SC.4.N.1.7	**acquired traits** **animal behaviors** **characteristics** **courtship** **grooming** **heredity** **inherited traits** **instincts** **learned behavior**

	inherited/innate behaviors.		

Resource Alignment	Plant Life Cycles Plant Reproduction	Animal Life Cycles	Heredity
Pearson Teacher's Edition	TE 258-265	TE 268-275	TE 276-283 TE 286-291
Pearson Student's Edition	Topic 6 Lesson 1	Topic 6 Lesson 2	Topic 6, Lesson 3 and 4
Daily and Key Questions	**What is a young plant called?** A young plant is called a seedling. **How do cones of the slash pine compare to the flowers of the orange tree?** Cones of the slash pine produce seeds and flowers of the orange tree produce seeds. The cones and flowers are both producers of seeds . **An apple tree is a flowering plant. Describe the pollination of an apple tree.** As the apple tree grows, flowers are pollinated when their pollen is transferred from one plant to another. Pollinated flowers produce seeds. **What are seeds?** seeds are the tiny parts of flowering plants that contain a tiny new plant and a source of stored food **What are flowers?** flowers are the reproductive structures of plants; flowering plants reproduce sexually; the stamens, or male reproductive parts, produce pollen; the pistil, or female reproductive part, produces the eggs **What is pollination?** pollination is the transfer of pollen from a male part of a plant (stamen) to the female part (pistil); some plants pollinate themselves, fertilizing their eggs with wind-blown pollen; other plants get assistance from insects, birds, or bats called pollinators, which help cross-pollinate one plant to another	**What happens to insects as they grow?** Insects go through a metamorphosis, which is a change in form, as they grow. **What happens in complete metamorphosis?** in complete metamorphosis the body or an organism completely changes in shape and appearance at each stage of its life cycle: egg, larva, pupa and adult **How are incomplete and complete metamorphosis different? s**ome organisms produce young that look like tiny versions of the adult; the young grow and develop until they become adult-size, but their body appearance does not change as much as in complete metamorphosis	**What are some characteristics of humans that help us survive in varying climates?** We have hair on our bodies to keep us warm if the weather becomes cold. **How can heredity be positive and negative for an animal?** Inheriting certain traits can be beneficial for a plant of animal's survival in its environment, whereas other inherited traits could make it more difficult for a plant or animal to survive in its environment. **What are learned behaviors?** animals also learn behaviors from their parents; birds are born with the physical structures needed to fly, but learn the skill of flying from a parent; carnivores instinctively kill and eat other animals, but need to learn hunting skills from a parent in order to survive; the difference between an instinct and a learned behavior is that instincts are inherited inborn and a learned behavior is not; learning behaviors that refine instincts help ensure survival **What are instincts?** instincts are innate behaviors that organisms inherit or are born with. Instincts are not unique to an individual, but instead are shared by an entire population. Behaviors like building a shelter or nest, finding a mate, killing prey, the ability to swim or fly, migrate, or hibernate are all examples of instinctive behaviors

	What is fertilization? the union of pollen (male part) and eggs (female part) **What is germination?** the process in which a fertilized seed begins to sprout and grow		
Content Limits for Standards	• Students will identify and/or describe the parts of plants and/or the part's role. • Students will describe how plants respond to stimuli. • Students will describe processes of sexual reproduction in flowering plants. • Items assessing the structures and functions of major parts of plants are limited to stem, leaf/needle, root, flower, seed, and fruit. • Items assessing sexual reproduction in flowering plants are limited to stamen, pistil, ovary, petal, sperm, and egg. • Items will not assess cellular processes. • Items referring to a plant's response to stimuli are limited to a conceptual understanding of a plant's response to heat, light, or gravity. • Items will not use the term *phototropism*, *geotropism*, *hydrotropism*, or. • Items will only assess the life cycles of plants and animals commonly found in Florida. • Items assessing the life cycles of flowering and nonflowering plants are limited to seed, seedling, and other stages of plant development.	• Items will only assess the life cycles of plants and animals commonly found in Florida. • Items assessing the life cycles of insects are limited to egg, larva, pupa, and adult (complete metamorphosis) or egg, nymph, and adult (incomplete metamorphosis). • Items assessing the life cycles of animals are limited to egg, embryo, infant, adolescent, and adult stages. • Items will not assess the major stages of the human life cycle.	• Items referring to the adaptation of organisms to different environments may address but will not assess the different stages of the organism's life cycle. • Items may require knowledge of how animals living in a particular environment are adapted to survive the seasonal changes in that environment.
Teacher Hints	**Teacher Hints for "Plant Life Cycles":** • All living things have a life cycle (plants and animals). • Items assessing the structures and functions of major parts of plants should be limited to the stem (nutrient transport and support), leaf/needle (food production), root (water and nutrient	• Students are to be comfortable with classifying animals into major groups according to physical characteristics and behaviors (e.g., mammals, birds, reptiles, amphibians, fish, or arthropods (insects, spiders, lobsters, shrimp, crab, crayfish); vertebrate or	• The term *characteristics* should be used in conjunction with the term *traits*. For assessment purposes, the term *characteristics* will be used instead of the term *traits*.

	transport), flower (reproduction), seed (reproduction), and fruit (reproduction). • Students need to understand and be exposed to the life cycles of <u>various</u> plant organisms (i.e., radishes, oak tree. grass). • Many students confuse *dead* and *nonliving*. Something that is dead (a leaf that has fallen off of a tree) is considered living because it was <u>once living</u>. Something that is nonliving (metal and plastic) was <u>never living</u>. **Teacher Hints for "Plant Reproduction":** • Germination and pollination are introduced in 3rd grade. Fertilization and seed dispersal are introduced in 4th grade. • Use a hand lens to observe pistils and stamens. Make inferences about which flowers have been pollinated. • Dissect fruits, such as apples and oranges, to find evidence of fertilization. • Take a Sock Walk. Wear a sock on the outside of your shoe. Walk around the school yard to gather seeds for observation in the classroom. Have discussions about seed dispersal. Germinate the seeds collected by planting the socks in potting soil. Watch them grow! • Additional information about the biology of plants can be found at http://www.mbgnet.net/bioplants/main.html. • Caution: Germinating seeds in a window creates the misconception that seeds require light to grow.	invertebrate; live birth or egg laying; scales, feathers, or fur). • Students need to understand and be exposed to the life cycles of <u>various</u> animals (e.g., human, chicken, butterfly, frog). • Students need to understand the difference between complete metamorphosis (development through four stages: egg, larva, pupa, adult) and incomplete metamorphosis (development through three stages: egg, nymph, adult). • Some animals that go through complete metamorphosis are butterflies, bees, flies, and beetles. Some animals that go through incomplete metamorphosis are dragonflies, cockroaches, and grasshoppers. • Additional incomplete/complete metamorphosis examples can be found at http://www.mrsscienceteacher.com/Metamorphosis/Metamorphosis.html. • Stress with students that both humans and invertebrates are animals.	
Formative Assessment Probes (Page Keeley)	**<u>Volume 2</u>** #12, *Is it a Plant?,* p. 93 #13, *Needs of Seeds,* p. 101 #15, *Is it Food for Plants?,* p. 113 #16, *Giant Sequoia Tree,* p. 121		**<u>Volume 2</u>** #17, *Baby Mice,* p. 129 #19, *Habitat Change,* p. 143

Writing Connection	**Research/Expository:** Students individually or in teams can research the life cycles of plants that reside in the state of Florida and present their findings to their classmates.	**Narrative:** All living things have a life cycle. Pick a living thing that has a life cycle and write a story that describes the life cycle of your living thing. **Research/Expository:** Students individually or in teams can research the life cycles of plants and animals that reside in the state of Florida and present their findings to their classmates.	**Narrative:** Pretend you are an animal. Write a story detailing an instinctive behavior you exhibit (hibernation, migration, hunting, protecting young). **Expository:** Everyone has certain traits/characteristics that they have learned or acquired. Think about the traits/characteristics you have learned or acquired. Write an essay explaining your best learned or acquired traits/characteristics.
Thinking Maps® & Foldables	Brace map (life cycle stages) Double Bubble map (life cycle stages) Circle map (processes of reproduction) Top-tab book foldable (processes of reproduction)	Four-door foldable (complete metamorphosis) Pyramid foldable (incomplete metamorphosis)	Bridge map (inherited/acquired/learned) Two-door foldable (inherited/acquired/learned)
CPALMS	*Forest Trees of Florida* *http://www.cpalms.org/Public/PreviewResourceUrl/Preview/511* *Seed Dispersal* *http://www.cpalms.org/Public/PreviewResourceUrl/Preview/1741* *The Secret Lives of Flowers* *http://www.cpalms.org/Public/PreviewResourceUrl/Preview/2856*	*Have I Morphed Yet?* *http://www.cpalms.org/Public/PreviewResourceLesson/Preview/11522*	*Who's to Blame? Me or My Parents?* http://www.cpalms.org/Public/PreviewResourceLesson/Preview/46711
Web Resources	Scholastic Study Jams: *Plants with Seeds* Brain Pop: *Seed Plants* Brain Pop: *Seedless Plants* *The Life Cycle of Plants* *Life Cycle of a Plant* The Great Plant Escape	*Scholastic Study Jams: Animal Life Cycles* Brain Pop: *Metamorphosis* Brain Pop: *Amphibians* *Cycles of Life* *Metamorphosis*	Scholastic Study Jams: *Animal Adaptations* Scholastic Study Jams: *Plant Adaptations* Brain Pop: *Heredity* *Introduction to Heredity* *Genetics* *Teaching Genetics* http://sciencenetlinks.com/lessons/pets-oh-behave/
Books	World Book Online- Plant Life Cycles by Joseph Midthun and Samuel Hiti The Tiny Seed by Eric Carle	World Book Online- Animal Life Cycles by Joseph Midthun and Samuel Hiti	World Book Online- Animal Behavior by Joseph Midthun and Samuel Hiti Animals Hibernating by Pamela Hickman

Fourth Grade Suggested Scope and Sequence

NGSS Body of Knowledge: Life Science
Unit of Study: Living Things & Their Environment (4 weeks)

Prerequisite Learning: **Kindergarten – none**
First Grade – SC.1.L.16.1, SC.1.L.17.1
Second Grade – SC.2.L.17.1, SC.2.L.17.2
Third Grade – SC.3.L.17.1, SC.3.L.17.2

Topics	Learning Targets/Skills	Standard(s)	Vocabulary
Seasonal Changes	*Compare the seasonal changes in Florida plants and animals to those in other regions of the country.* ***Students will:*** • **review** how plants respond to different stimuli (heat, light, and gravity). • **compare** ecosystems in Florida to ones found in other regions of the country (e.g., deciduous forest, ocean, grassland, wetland). • **discuss** environmental and biological triggers that initiate an organism's response to seasonal change both in Florida and in different regions of the country (e.g., temperature, precipitation, dormancy, molting, breeding, camouflaging). • **differentiate** the seasonal changes of Florida plants to those in other regions of the country (e.g., dormancy, leaves changing color and falling off, flowering season). • **differentiate** the seasonal changes of Florida animals to those in other regions of the country • (e.g., color change, body covering change, hibernation, migration, camouflage).	**SC.4.L.17.1** Embedded Nature of Science SC.4.N.1.1 SC.4.N.1.4 SC.4.N.1.7	**dormancy** **hibernation** **migration** **seasonal changes**
Food Chains	*Explain that animals, including humans, cannot make their own food and that when animals eat plants or other animals, the energy stored in the food source is passed to them.* ***Students will:*** ○ **review** that all living things need energy to survive. ○ **explain** that plants make their own food (photosynthesis) and are called producers. ○ **explain** that animals, including humans, cannot make their own food and are called consumers. ○ **explain** that when animals eat plants or other animals, the energy stored in the food source is passed to them. *Trace the flow of energy from the Sun as it is transferred along the food chain through the producers to the consumers.* ***Students will:***	**SC.4.L.17.2** Embedded Nature of Science SC.4.N.1.1 **SC.4.L.17.3** Embedded Nature of Science	**carnivore** **consumers** **flow of energy** **food chain** **herbivore** **omnivore** **producers**

	• **describe** that all life on Earth is dependent upon the sun. • **trace** the flow of energyfrom the sun as it is transferred along the food chain through the producers to the consumers (e.g., sun → grass → rabbit → fox). • **explain** that some energy is lost from one organism to the next in the form of heat. • **classify** consumers as herbivores, carnivores, or omnivores. • **describe** the relationship between plants as producers and animals as consumers.	SC.4.N.1.1 SC.4.N.3.1	

Environment	*Recognize ways plants and animals, including humans, can impact the environment.*
	Students will:
	• **describe** the positive (helpful) and negative (harmful) impact plants may have onthe environment.
	  • positive – decor, medicine, oxygen, erosion control, food source
	  • negative – invasive species, poisonous plants, reduction in diversity
	• **describe** the positive (helpful) and negative (harmful) impact animals may have onthe environment.
	  • positive – migration, predator-prey, pets, food source
	  • negative – overpopulation, poisonous/dangerous animals, destruction)
	• **describe** ways that humans help and harm the environment.
		SC.4.L.17.4
		Embedded Nature of Science SC.4.N.1.1
			environment
			invasive species
			negative/harmful
			overpopulation
			positive/helpful
			predator
			prey

Resource Alignment	Seasonal Changes	Food Chains	Environment
Pearson Teacher's Edition	p. 311-315	p. 319-331	p.337-340
Pearson Student's Edition	Topic 7, Lesson 1	Topic 7, Lessons 2 and 3	Topic 7, Lesson 4

Content Limits for Standards	Items referring to the adaptation of organisms to different environments may	Items assessing the flow of energy from the Sun through a food chain are limited to the	Items referring to the adaptation of organisms to different environments may

	address but will not assess the different stages of the organism's life cycle. Items may require knowledge of how animals living in a particular environment are adapted to survive the seasonal changes in that environment. Items will not assess renewable or nonrenewable resources.	direction of energy flow. Items will not address or assess the amounts of energy flowing through the food chain or the efficiency of the energy transfers. Items will not address or assess cellular respiration or any other cellular process. Items will not address or assess decomposers. Items will not address or assess food webs, trophic levels, or energy pyramids. Items will not assess more than five components (links) in a food chain.	address but will not assess the different stages of the organism's life cycle. Items may require knowledge of how animals living in a particular environment are adapted to survive the seasonal changes in that environment. Items will not assess renewable or nonrenewable resources.
Daily and Key Questions	**What are the seasons?** a season is a time of year - each season has a weather pattern. There are four seasons: winter, spring, summer and fall **What is the climate?** climate is the general weather of an area over a long period of time, and includes the seasonal changes in weather **What are South Florida's seasons?** South Florida's subtropical climate promotes two seasons, summers that are hot and wet and winters that are cool and dry	**What is a producer and how do they get the energy they need to survive?** most producers make their own food using the energy of sunlight (photosynthesis) and raw materials from the environment; plants, algae and bacteria that make their own food are producers **What is a consumer and how do they get the food energy they need to survive?** consumers are any organisms that get their food by eating other organisms; consumers are classified based on the way they eat **What is a food chain?** a food chain is a diagram that traces the transfer of food energy from one consumer to the next (like links in a chain) by what they eat and by what eats them **What is a food web?** a food web is an arrangement of several overlapping food chains in an ecosystem **How is a food chain different from a food web?** a food chain only shows one energy path, but most organisms are part of more than one food chain; a food web is a system of overlapping food chains; a food web diagrams the interdependence one organism has on many other organisms for survival	**What harms ecosystems the most?** people, human populations, affect the Earth's ecosystems more than any other factor, living or nonliving; other animal populations are kept in balance by the limiting factors of each ecosystem; people, however, can upset the natural balance or, if they choose, can help keep it **How do plants and animals affect each other in an ecosystem?** plants and animals affect each other when they compete for the same limited resources: food, water, shelter, and living space; competition occurs whenever more than one individual or population (group of the same organism) tries to make use of the same limited resource; if a population grows too large, it will consume more resources; only those organisms able to get the resources they need will survive; predator-prey relationships help keep an ecosystem in balance by preventing any one population from getting too large

Teacher Hints	• Compare seasonal changes of plants and animals in Florida with the seasonal changes in plants and animals from various regions of the United States. • Living organisms have regular patterns and routines that involve obtaining food and carrying out life history stages such as breeding, migrating, molting, and hibernating. • The acquisition, utilization, and storage of energy reserves (and other resources) are critical to lifetime reproductive success. • Plants and animals are adapted to survive and reproduce within the ever-changing environments.	• Although photosynthesis is taught in 3rd grade, a review of this concept is recommended. • Students should understand that the arrows in a food chain diagram represent the direction in which energy is transferred (e.g., the sun's energy is used by grass for photosynthesis. This energy is transferred to the rabbit when it eats the grass. The energy then transfers to the fox when it eats the rabbit.). • Decomposers are no longer part of the science curriculum in the elementary grades. • Food webs and food pyramids are no longer part of the science curriculum in the elementary grades.	• It is recommended that human and animal discussions on the helpful and harmful impacts that each of on the environment be conducted separately.
Formative Assessment Probes	**Volume 2** #19, *Habitat Change,* p. 143		**Volume 1- 2nd Ed.** #20, *Functions of Living Things,* p. 157
Writing Connection	**Narrative:** Some bears hibernate during the winter months. Imagine that you are a bear preparing for winter. Write a story about how you would prepare to hibernate in your environment (i.e. bears in Florida versus bears in Maine).	**Narrative:** Draw a food chain. Now imagine that you are one item on the food chain (you can't be the sun) and write a story about what happened to you based on your food chain. **Research:** Have students research and study how different animals get their energy and pass energy on to other animals.	**Expository:** A building company wants to tear down a forest in your city to build a parking lot. Explain how tearing down the forest will impact the living organisms in that environment.
Thinking Maps® & Foldables	Double Bubble map (seasonal changes) Pop-up book foldable (seasonal changes)	Flow map (food chains) Four-door diorama (food chains)	Circle map (environmental impact) Accordion book foldable (environmental impact)
CPALMS		*Dramatic Food Chains* *http://www.cpalms.org/Public/PreviewResourceLesson/Preview/46523*	Aquifer in a Cup http://www.cpalms.org/Public/PreviewResourceUrl/Preview/2139 Environmental Effects: EMBARK Port Canaveral http://www.cpalms.org/Public/PreviewResourceUrl/Preview/15613 How Important is the Amazon Rainforest? http://www.cpalms.org/Public/PreviewResourceLesson/Preview/74312

Web Resources	Brain Pop: *Migration* Brain Pop: *Hibernation* Scholastic: *A Time to Sleep Article & Activities* *USGS: Florida Ecosystems*	*Build a Food Chain* Scholastic Study Jams: *Food Chains* Brain Pop: *Food Chains* *Food Chains & Food Webs* *The Food Chain*	Brain Pop: *Humans* & Their Environment Brain Pop: *Ecosystems*

Fourth Grade Suggested Scope and Sequence

NGSS Body of Knowledge: Nature of Science
Unit of Study: Enrichment (6 weeks)

Prerequisite Learning: **Kindergarten – SC.K.N.1.1, SC.K.N.1.2, SC.K.N.1.3, SC.K.N.1.4, SC.K.N.1.5**
First Grade – SC.1.N.1.1, SC.1.N.1.2, SC.1.N.1.3, SC.1.N.1.4, SC.1.E.5.3
Second Grade – SC.2.N.1.1, SC.2.N.1.2, SC.2.N.1.3, SC.2.N.1.4, SC.2.N.1.5, SC.2.N.1.6
Third Grade – SC.3.N.1.1, SC.3.N.1.2, SC.3.N.1.3, SC.3.N.1.4, SC.3.N.1.5, SC.3.N.1.6, SC.3.N.1.7

Topics	Learning Targets/Skills	Standard(s)	Vocabulary
Science Process	*Explain that science does not always follow a rigidly defined method ("the scientific method") but that science does involve the use of observations and empirical evidence.* *Explain that science focuses solely on the natural world.* ***Students will:*** • *explain the role of a scientist (ask questions and find answers).* • *explain that scientific investigations do not always follow a rigidly defined method (e.g., scientific method, observation, investigation, research).* • *explain that science does involve the use of observations and evidence.* *Keep records that describe observations made, carefully distinguishing actual observations from ideas and inferences about the observations.* ***Students will:*** • **record** observations of an object and/or an event in a science notebook using a varietyof data collection tools (e.g., diagrams, charts, graphs). • **make inferences** based on observations. • **distinguish** observations from inferences. *Compare the observations made by different groups using multiple tools and seek reasons to explain the differences across groups.* *Compare the methods and results of investigations done by other classmates.* ***Students will:*** • **demonstrate** proper use of scientific tools to ensure accuracy of measurements. • **engage** in a common team investigation using metric measurement tools (e.g., beakers, graduated cylinders, ruler, meter stick, tape measure, thermometer, scale, gram weights). • **compare** the methods and results of other team investigations**.** • **formulate** opinions, new ideas, and conclusions based on team comparisons. • **seek** reasons to explain any differences that may have occurred. • **critique** others' work in a written manner to make recommendations of how to improve future investigations.	**SC.4.N.1.3** **SC.4.N.2.1** **SC.4.N.1.6** **SC.4.N.1.2** **SC.4.N.1.5**	**evidence** **experiment investigation** **observation science scientific method** **chart/data** **table** **diagrams** **findings** **graph** **inference** **observation** **records** **investigation** **metric** **scientific tools** ○ **beaker** ○ **graduated cylinder** ○ **hand lens** ○ **meter stick** ○ **ruler** ○ **scale** ○ **stopwatch** ○ **tape measure** ○ **thermometer** **weights**

Science Process	*Raise questions about the natural world, use appropriate reference materials that support understanding to obtain information (identifying the source), conduct both individual and team investigations through free exploration and systematic investigations and generate appropriate explanations based on those explorations.* *Recognize that science involves creativity in designing experiments.* ***Students will:*** • **generate** testable questions about the world that can be answered through observation and investigation. • **research** topics related to the questions they generate (e.g., internet, leveled-readers, non- fiction resources, newspaper). • **form** a hypothesis based on research. • **investigate** student-generated questions, individually and in teams, through free exploration, experimentation (scientific method), or other types of investigations using appropriate science tools (metric measurement). • **form** conclusions based on data obtained during investigations. • **identify** any flaw(s) in the experimental design that may have affected the outcome. *Recognize and explain that scientists base their explanations on evidence.* *Attempt reasonable answers to scientific questions and cite evidence in support.* ***Students will:*** • **define** data and evidence (a collection of observable and measurable information gathered during an investigation). • **discuss** previously acquired data/evidence to form a conclusion (a statement that explains whether the data does or does not support the hypothesis including an explanation of why). • **compare** conclusions. • **recognize** that sharing ideas and conclusions is a source of new information and knowledge for a scientist. • **explain** that scientists base their explanations on data and evidence.	**SC.4.N.1.1** **SC.4.N.1.8** **SC.4.N.1.7** **SC.4.N.1.4**	**communication** **evidence flaw interpretation** **prediction** **scientific method** ○ **question** ○ **research** ○ **hypothesis** ○ **experiment** ▪ **materials** ▪ **procedure** ○ **data** ○ **results** ○ **conclusion** **variable**


Resources:
Just for YOU!

Science Process Skills: Basic and Integrated

Observing: using your senses to gather information about an object or event; a description of what is actually perceived; information that is considered to be qualitative data

Measuring: using standard measures or estimations to describe specific dimensions of an object or event; information considered to be quantitative data

Inferring: formulating assumptions or possible explanations based upon observations

Classifying: grouping or ordering objects or events into categories based upon characteristics or defined criteria

Predicting: guessing the most likely outcome of a future event based upon a pattern of evidence

Communicating: using words, symbols, or graphics to describe an object, action, or event

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Formulating Hypotheses: stating the proposed solutions or expected outcomes for experiments; proposed solutions to a problem must be testable

Identifying Variables: stating the changeable factors that can affect an experiment; important to change only the variable being tested and keep the rest constant

Defining Variables: explaining how to measure a variable in an experiment

Designing Investigations: designing an experiment by identifying materials and describing appropriate steps in a procedure to test a hypothesis

Experimenting: carrying out an experiment by carefully following directions of the procedure so the results can be verified by repeating the procedure several times

Acquiring Data: collecting qualitative and quantitative data as observations and measurements

Organizing Data: making data tables and graphs for data collected

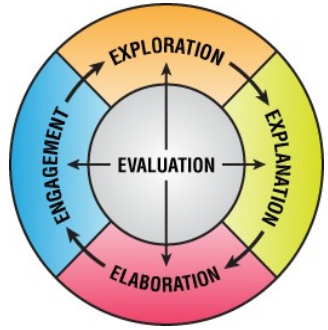
Analyzing Investigations: interpreting data, identifying errors, evaluating the hypothesis, formulating conclusions, and recommending further testing when necessary

5E Learning Cycle: An Instructional Model

ENGAGEMENT	EXPLORATION	EXPLANATION	ELABORATION	EVALUATION
The engagement phase of the model is intended to capture students' interest and focus their thinking on the concept, process, or skill that is to be learned. During this engagement phase, the teacher is on center stage.	The exploration phase of the model is intended to provide students with a common set of experiences from which to make sense of the concept, process or skill that is to be learned. During the exploration phase, the students come to center stage.	The explanation phase of the model is intended to grow students' understanding of the concept, process, or skill and its associated academic language. During the explanation phase, the teacher and students share center stage.	The elaboration phase of the model is intended to construct a deeper understanding of the concept, process, or skill through the exploration of related ideas. During the elaboration phase, the teacher and students share center stage.	The evaluation phase of the model is intended to be used during all phases of the learning cycle driving the decision-making process and informing next steps. During the evaluation phase, the teacher and students share center stage.

What does the teacher do?
• **create** interest/curiosity
• **raise** questions
• **elicit** responses that uncover student thinking/prior knowledge (preview/process)
• **remind** students of previously taught concepts that will play a role in new learning
• **familiarize** students with the unit
	What does the teacher do?
	• **provide** necessary materials/tools
	• **pose** a hands-on/minds-on problem for students to explore
	• **provide** time for students to "puzzle" through the problem
	• **encourage** students to work together
	• **observe** students while working
	• **ask** probing questions to redirect student thinking as needed
		What does the teacher do?
		• **ask** for justification/clarification of newly acquired understanding
		• **use** a variety of instructional strategies
		• **use** common student experiences to:
		  ○ develop academic language
		  ○ explain the concept
		• **use** a variety of instructional strategies to grow understanding
		• **use** a variety of assessment strategies to gauge understanding
			What does the teacher do?
			• **provide** new information that extends what has been learned
			• **provide** related ideas to explore
			• **pose** opportunities (examples and non-examples) to apply the concept in unique situations
			• **remind** students of alternate ways to solve problems
			• **encourage** students to persevere in solving problems
				What does the teacher do?
				• **observe** students during all phases of the learning cycle
				• **assess** students' knowledge and skills
				• **look** for evidence that students are challenging their own thinking
				• **present** opportunities for students to assess their learning
				• **ask** open-ended questions:
				  ○ What do you think?
				  ○ What evidence do you have?
				  ○ How would you explain it?

What does the student do?
• **show** interest in the topic
• **reflect and respond** to questions
• **ask** self-reflection questions:
  ○ What do I already know?
  ○ What do I want to know?
  ○ How will I know I have learned the concept, process, or skill?
• **make** connections to past learning experiences
	What does the student do?
	• **manipulate** materials/tools to explore a problem
	• **work** with peers to make sense of the problem
	• **articulate** understanding of the problem to peers
	• **discuss** procedures for finding a solution to the problem
	• **listen** to the viewpoint of others
		What does the student do?
		• **record** procedures taken towards the solution to the problem
		• **explain** the solution to a problem
		• **communicate** understanding of a concept orally and in writing
		• **critique** the solution of others
		• **comprehend** academic language and explanations of the concept provided by the teacher
		• **assess** own understanding through the practice of self-reflection
			What does the student do?
			• **generate** interest in new learning
			• **explore** related concepts
			• **apply** thinking from previous learning and experiences
			• **interact** with peers to broaden one's thinking
			• **explain** using information and experiences accumulated so far
				What does the student do?
				• **participate** actively in all phases of the learning cycle
				• **demonstrate** an understanding of the concept
				• **solve** problems
				• **evaluate** own progress
				• **answer** open-ended questions with precision
				• **ask** questions

<u>Evaluation of Engagement</u> The role of evaluation during the engagement phase is to gain access to students' thinking during the pre-assessment event/activity. Conceptions and misconceptions currently held by students are uncovered during this phase. These outcomes determine the concept, process, or skill to be explored in the next phase of the learning cycle.	**<u>Evaluation of Exploration</u>** The role of evaluation during the exploration phase is to gather an understanding of how students are progressing towards making sense of a problem and finding a solution. Strategies and procedures used by students during this phase are highlighted during explicit instruction in the next phase. The concept, process, or skill is formally explained in the next phase of the learning cycle.	**<u>Evaluation of Explanation</u>** The role of evaluation during the explanation phase is to determine the students' degree of fluency (accuracy and efficiency) when solving problems. Conceptual understanding, skill refinement, and vocabulary acquisition during this phase are enhanced through new explorations. The concept, process, or skill is elaborated in the next phase of the learning cycle.	**<u>Evaluation of Elaboration</u>** The role of evaluation during the elaboration phase is to determine the degree of learning that occurs following a differentiated approach to meeting the needs of all learners. Application of new knowledge in unique problem-solving situations during this phase constructs a deeper and broader understanding. The concept, process, or skill has been and will be evaluated as part of all phases of the learning cycle.	

Webb's Depth of Knowledge (DOK) Model of Cognitive Complexity

LOW COMPLEXITY Level 1 (Recall)	MODERATE COMPLEXITY Level 2 (Basic Application of Concepts and Skills)	HIGH COMPLEXITY Level 3 (Strategic Thinking & Complex Reasoning)	HIGH COMPLEXITY Level 4 (Extended Thinking & Complex Reasoning)
This level is the recall of information such as a fact, definition, or term, as well as performing a simple science process or procedure. Level 1 only requires students to demonstrate a rote response; use a well-known formula; follow a set, well-defined procedure (like a recipe); or perform a clearly defined series of steps. **Some examples are:** • Recall or recognize a fact, term, or property. • Represent in words or diagrams a scientific concept or relationship. • Provide or recognize a standard scientific representation for simple phenomena. • Perform a routine procedure, such as measuring length. • Identify familiar forces (e.g., pushes, pulls, gravitation, friction, etc.). • Identify objects and materials as solids, liquids, and gases.	This level includes the engagement of some mental processing beyond recalling or reproducing a response. The content knowledge or process involved is more complex than in Level 1. Level 2 requires that students make some decisions as to how to approach the question or problem. Level 2 activities include making observations, and collecting data; classifying, organizing, and comparing data; and representing and displaying data in tables, graphs, and charts. **Some examples are:** • Specify and explain the relationships among facts, terms, properties, and variables. • Identify variables, including controls, in simple experiments. • Distinguish between experiments and systematic observations. • Describe and explain examples and non-examples of science concepts. • Select a procedure according to specified criteria and perform it. • Formulate a routine problem given data and conditions. • Organize and represent data.	This level requires reasoning, planning, using evidence, and a higher level of thinking than the previous two levels. The cognitive demands at Level 3 are complex and abstract because the multi-step task requires more demanding reasoning than Level 2. Level 3 activities include drawing conclusions from observations; citing evidence and developing a logical argument for concepts; explaining phenomena in terms of concepts; and using concepts to solve non-routine problems. **Some examples are:** • Identify research questions and design investigations for a scientific problem. • Design and execute an experiment or systematic observation to test a hypothesis or research question. • Develop a scientific model for a complex situation. • Form conclusions from experimental data. • Cite evidence that living systems follow the laws of conservation of mass and energy. • Explain the physical properties of the sun and its dynamic nature and connect them to conditions and events on Earth.	This level has the same high cognitive demands as Level 3 with the additional requirement that students work over an extended period or with extended effort. Students are required to make several connections—relating ideas within the content area or among content areas—and must select or devise one approach among many alternatives for how the situation or problem can be solved. It is important to note that the extended time is not a distinguishing factor if the required work is only repetitive and does not require the application of significant conceptual understanding and higher-order thinking. **Some examples are:** • Based on provided data from a complex experiment that is novel to the student, deduce the fundamental relationship among several variables. • Investigate, from specifying a problem to designing and carrying out an experiment and analyzing data and forming conclusions. • Produce a detailed report of a scientific experiment or systematic observation, and infer conclusions based upon evidence obtained.

More detailed information about Florida's DOK levels is available online at http://www.cpalms.org/cpalms/dok.aspx.

Levels of Depth of Knowledge for Science
Adapted from the Florida Interim Assessment Item Bank and Test Platform

Level 1
Recall or Reproduction…

is the recall of information such as a fact, definition, or term as well as performing a simple science process or procedure. Level 1 only requires students to demonstrate a rote response, restate information in their own words, and/or follow or perform a well-defined procedure.

Some Examples of Level 1 Performance

- Recall or recognize a fact, term, or property (e.g., how speed is determined).
- Represent a scientific concept or relationship in words or diagrams.
- Retrieve information from a chart, table, diagram, or graph.
- Recognize a standard scientific representation of a simple phenomenon (e.g., water cycle model).
- Identify common examples of topics, objects, and materials (e.g., familiar forces and invertebrates).
- Perform a routine procedure such as measuring length.

Question Stems

What is (was) _____?
What_____did you use?
What are some examples of_____?
How many _____?
Identify the _____?
Make a listing of_____?
Why did you choose_____?
How would you describe_____?
How can you recognize_____?
When did_____happen?
Recall what happened.
What happened when _____?
Retell.
Draw.
Select or retrieve _____?
What data represents _____?
Which_____has the most? Least?
Read your data table, chart, or graph.
Is_____ on the graph?
What pattern is seen when_____?

Levels of Depth of Knowledge for Science
Adapted from the Florida Interim Assessment Item Bank and Test Platform

Level 2
Basic Application…

is engaging in a mental process that goes beyond basic recall or reproduction, requiring two or more steps before giving a response. Students are asked to apply their knowledge of content on a simple level. Level 2 requires student to make some decisions as to how to approach a question or problem such as to classify, organize, and compare data.

Some Examples of Level 2 Performance

- Read and interpret information from a simple graph.
- Designate and explain the relationships among facts, terms, properties, and variables (e.g., compare physical properties of solids, liquids, and gases).
- Identify variable and controls in simple experiments.
- Distinguish between experiments and systematic observations.
- Describe and explain examples and non-examples of science concepts (e.g., flowering and non-flowering plants).
- Select a procedure according to specified criteria, and perform it.
- Formulate a routine problem given data and conditions.

Question Stems

Explain how_____affected_____.
Apply what you have learned to_____.
Compare/contrast.
How would you classify_____?
What could you use to classify?
How are_____alike? Different?
Summarize.
What do you notice about _____?
What do you observe? Infer?
What are some examples of_____?
What are some non-examples of_____?
Given the data, what was the testable question?
What variable is being tested?
What is the control group?
What procedure would you use?

Levels of Depth of Knowledge for Science
Adapted from the Florida Interim Assessment Item Bank and Test Platform

Level 3
Strategic Thinking…

requires reasoning, planning, using evidence, and complex and abstract thinking. The complexity results from there being multiple correct responses in which student justification is necessary and thorough. Level 3 asks students to cite evidence when developing a logical argument and to explain scientific phenomena in terms of concepts.

Some Examples of Level 3 Performance

- Design and execute an experiment or systematic observation to test a hypothesis or research question.
- Design and develop a scientific model to explain a scientific concept or theory.
- Form conclusions from experimental data.
- Cite evidence for scientific theory (e.g., energy is neither lost nor created within food chains and electrical circuits).
- Compare information within or across data sets (several monthly temperature graphs of the same city).
- Explain how political, social, and economic concerns can affect science, and vice versa.
- Explain the properties of the sun and its position within the solar system and then connect this knowledge to the condition and events occurring on Earth.

Question Stems

What conclusions can you draw?
How would you test_____?
What would the outcome be if_____?
What features of the graph should be considered when_____?
What question could we ask now?
What evidence should be considered?
Explain your thinking when there is more than one answer. Elaborate.
Formulate a reason as to why_____?
Which facts support _____?
What is the best answer? Why?
How would you adapt _____ to create a different _____?
How is_____related to_____?

Levels of Depth of Knowledge for Science
Adapted from the Florida Interim Assessment Item Bank and Test Platform

Level 4
Extended Thinking…

requires the same high cognitive demands as Level 3 with the additional requirement that students work over an extended period of time and/or with extended effort. Level 4 assessment items require significant thought.

Some Examples of Level 4 Performance

- Relate scientific concepts to other content areas (e.g., impact of environment changes).
- Develop generalizations of the results obtained and apply them to new situations (e.g., predict the weather in a particular place and time).
- Select or devise an approach among many alternatives for how a situation or problem is to be solved.
- Analyze multiple sources of evidence.
- Apply understanding in a new way, provide argument or justification for the application (e.g., using inertia).
- Conduct an investigation, from specifying a problem to designing and carrying out an experiment and analyzing data and forming conclusions.

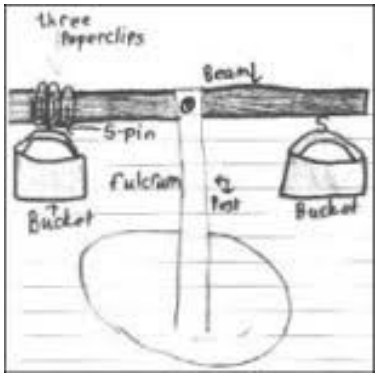
Question Stems/Tasks

What information can you gather to support your idea about_____?
Apply information from one text to another text to develop a persuasive argument.
Write a research paper/thesis on a topic from multiple sources.
Judge the value of material for a given purpose.
Consider multiple lines of inquiry to explain a particular scientific theory (e.g., conservation of mass and inertia).
Produce a detailed report of a scientific experiment or systematic observation, and infer conclusions based upon evidence obtained.
Provide time for extended thinking.
Assess through performance and open-ended activities.

Formative Assessment Strategies
Science K-5

APPENDIX A

Adapted from Page Keeley's *Science Formative Assessment: 75 Practical Strategies for Linking Assessment, Instruction, and Learning*

Strategy Name	Description	Additional Information
A & D Statements	*A & D Statements* analyze a set of "fact or fiction" statements. First, students may choose to agree or disagree with a statement or identify whether they need more information. Students are asked to describe their thinking about why they agree, disagree, or are unsure. In the second part, students describe what they can do to investigate the statement by testing their ideas, researching what is already known, or using other means of inquiry.	
Agreement Circles	*Agreement Circles* provide a kinesthetic way to activate thinking and engage students in scientific argumentation. Students stand in a circle as the teacher reads a statement. While standing, they face their peers and match themselves up in small groups of opposing beliefs. Students discuss and defend their positions. After some students defend their answers, the teacher can ask if others have been swayed. If so, stand up. If not, what are your thoughts? Why did you disagree? After hearing those who disagree, does anyone who has agreed want to change their minds? This should be used when students have had some exposure to the content.	**Energy** 1. Energy is a material that is stored in an object. 2. When energy changes from one form to another, heat is usually given off. 3. Energy can never be created or destroyed. 4. Something has to move in order to have energy.
Annotated Student Drawings	*Annotated Student Drawings* are student-made, labeled illustrations that visually represent and describe students' thinking about scientific concepts. Younger students may verbally describe and name parts of their drawings while the teacher annotates them.	

Strategy Name	Description	Additional Information
Card Sorts	*Card Sorts* is a sorting activity in which students group a set of cards with pictures or words according to certain characteristics or category. Students sort the cards based on their preexisting ideas about the concepts, objects, or processes on the cards. As students sort the cards, they discuss their reasons for placing each card into a designated group. This activity promotes discussion and active thinking.	
Chain Notes	*Chain Notes* is a strategy that begins with a question printed at the top of a paper. The paper is then circulated from student to student. Each student responds with one to two sentences related to the question and passes it on to the next student. A student can add a new thought or build on a previous statement.	**What is Matter?** Matter is all around us. Matter makes up everything. Matter has volume and takes up space. You can feel and see matter.
Commit and Toss	*Commit and Toss* is a technique used to anonymously and quickly assess student understanding on a topic. Students are given a question. They are asked to answer it and explain their thinking. They write this on a piece of paper. The paper is crumpled into a ball. Once the teacher gives the signal, they toss, pass, or place the ball in a basket. Students take turns reading their "caught" response. Once all ideas have been made public and discussed, engage students in a class discussion to decide which ideas they believe are the most plausible and to provide justification for the thinking.	**Solids and Holes** Lance has a thin, solid piece of material. He places it in water. It floats. He takes the material out and punches holes all the way through it. What do you think Lance will observe when he puts the material with holes back in the water? A. It will sink. B. It will barely float. C. It will float the same as it did before the holes were punched. D. It will neither sink nor float. It will bob up and down in the water. Explain your thinking. Describe the reason for the answer you selected.
Concept Card Mapping	*Concept Card Mapping* is a variation on concept mapping. Students are given cards with the concepts written on them. They move the cards around and arrange them as a connected web of knowledge. This strategy visually displays relationships between concepts.	

<table>
<tr><th>Strategy Name</th><th>Description</th><th>Additional Information</th></tr>
<tr><td>Concept Cartoons</td><td>Concept Cartoons are cartoon drawings that visually depict children or adults sharing their ideas about common everyday science.
Students decide which character in the cartoon they agree with most and why. This formative assessment is designed to engage and motivate students to uncover their own ideas and encourage scientific argumentation.
Concept Cartoons are most often used at the beginning of a new concept or skill. These are designed to probe students' thinking about everyday situations they encounter that involve the use of science.
Not all cartoons have one "right answer." Students should be given ample time for ideas to simmer and stew to increase cognitive engagement.</td><td> 
www.pixton.com</td></tr>
<tr><td>Data Match</td><td>Data Match provides students with a data set from a familiar investigation and several statements about data. Students use evidence from the data to determine which statements are accurate. This strategy provides students with an opportunity to consider what constitutes evidence, practice interpreting data, and consider how confident they are in interpreting results of an inquiry.</td><td><table><tr><th>Where We Put the Ice Cube</th><th>How Many Minutes It Took to Melt</th></tr><tr><td>On the blacktop in the sun</td><td>3</td></tr><tr><td>On the blacktop in the shade</td><td>7</td></tr><tr><td>On the grass</td><td>10</td></tr><tr><td>On the metal side</td><td>2</td></tr><tr><td>On the dirt underneath the slide</td><td>5</td></tr></table>Which of these statements match your results?
The ice cube on the grass took longest to melt.
The metal slide was hotter than the dirt underneath the slide.
The ice cube melted faster on the blacktop in the sun than on the shaded blacktop.
Ice placed on dark things melts faster than ice placed on light things.
Ice melts faster on some surfaces than on others.</td></tr>
<tr><td>Fact First Questioning</td><td>Fact First Questioning is a higher-order questioning technique used to draw out students' knowledge. It takes a factual "what" question and turns it into a deeper "how" or "why" question. Teachers state the fact first and then ask students to elaborate, enabling deeper thinking processes that lead to a more enduring understanding of science concepts.</td><td>Examples of Fact First Questions
Glucose is a form of food for plants.
Why is glucose considered a food for plants?
A cell is called the basic unit of life.
Why is the cell called the basic unit of life?
The patterns of stars in the night sky stay the same.
Why do the patterns of stars in the night sky stay the same?
Sandstone is a sedimentary rock.
Why is sandstone considered a sedimentary rock?</td></tr>
</table>

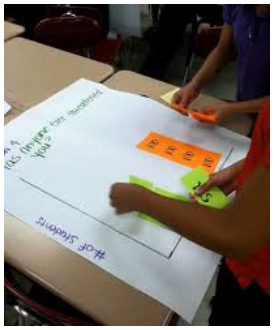
<table>
<tr><th>Strategy Name</th><th>Description</th><th>Additional Information</th></tr>
<tr><td>Familiar Phenomenon Probes</td><td>Familiar Phenomenon Probes is a strategy involving two-tiered questions consisting of a selected response section and a justification for the selected response. They engage students in thinking about scientific ideas related to the phenomenon and committing to a response that matches their thinking. The distracters (wrong choices) include commonly held misconceptions that children have in science.</td><td>What's in the Bubbles?
Hannah is boiling water in a glass tea kettle. She notices large bubbles forming on the bottom of the kettle that rise to the top and wonders what is in the bubbles. She asks her family what they think, and this is what they may say:
Dad: They are bubble of heat.
Calvin: The bubbles are filled with air.
Grandma: The bubbles are an invisible form of water.
Mom: The bubbles are empty. There is nothing inside them.
Lucy: The bubbles contain oxygen and hydrogen that separated from the water.
Which person do you most agree with and why? Explain your thinking.</td></tr>
<tr><td>First Word-Last Word</td><td>First Word-Last Word is a variation of acrostic poetry. Students construct statements about a concept or topic before and after instruction that begins with the designated letter of the alphabet. The acrostic format provides a structure for them to build their idea statements off different letters that make up the topic word.</td><td>
<table>
<tr><th>First Word-Photosynthesis</th><th>Last Word-Photosynthesis</th></tr>
<tr><td><u>P</u>lants make their own food.</td><td>Producers such as plants use energy from the sun to make their food.</td></tr>
<tr><td><u>H</u>appens in cells</td><td>Happens in cells that have structures called chloroplasts</td></tr>
<tr><td><u>O</u>ther animals eat plants.</td><td>Organisms that eat plants are using energy from the plant.</td></tr>
<tr><td><u>T</u>he roots take up food and water.</td><td>The roots take water up to the leaves where it reacts with sunlight and carbon dioxide.</td></tr>
<tr><td><u>O</u>xygen is breathed in through leaves.</td><td>Oxygen is given off during photosynthesis and is used by plants and animals for respiration.</td></tr>
<tr><td><u>S</u>unlight makes food for plants.</td><td>Sunlight provides the energy so plants can make food.</td></tr>
<tr><td><u>Y</u>ou can't make your own food.</td><td>You need to have cells with chloroplast and chlorophyll to make food.</td></tr>
<tr><td><u>N</u>eeds water, sunlight, oxygen, and minerals</td><td>Needs water, carbon dioxide and sunlight to make food</td></tr>
<tr><td><u>T</u>he leaves, roots, and stems are all parts that make food.</td><td>The leaf is the food making part.</td></tr>
<tr><td><u>H</u>ave to have sun and water</td><td>Have to have sunlight, water, and carbon dioxide</td></tr>
<tr><td><u>E</u>nergy comes from the sun.</td><td>Energy comes from sunlight.</td></tr>
<tr><td><u>S</u>unlight turns plants green.</td><td>Sunlight is trapped in the chlorophyll.</td></tr>
<tr><td>It happens in all plants.</td><td>It is necessary life process for all plants.</td></tr>
<tr><td><u>S</u>oil is used by plants to make food.</td><td>Soil holds the water for plants and gives some minerals.</td></tr>
</table>
</td></tr>
</table>

Strategy Name	Description	Additional Information
Fist to Five	*Fist to Five* asks students to indicate the extent of their understanding of a scientific concept by holding up a closed fist (no understanding), one finger (very little understanding), and a range up to five fingers (understand completely and can easily explain it to someone else). Fist to Five provides a simple feedback opportunity for all students in a class to indicate when they do not understand a concept or skill and need additional support for their learning.	 I do not understand it. I understand some of it. I understand most of it. I understand it completely. I understand it and can explain it.
Four Corners	*Four Corners* is a kinesthetic strategy. The four corners of the classroom are labeled: Strongly Agree, Agree, Disagree and Strongly Disagree. Initially, the teacher presents a science statement to students and asks them to go to the corner that best aligns with their thinking. Students then pair up to defend their thinking with evidence. The teacher circulates and records student comments. Next, the teacher facilitates a whole group discussion. Students defend their thinking and listen to others' thinking before returning to their desks to record their new understanding.	Agree Strongly Agree Strongly Disagree Disagree
Frayer Model	*Frayer Model* is a strategy that graphically organizes prior knowledge about a concept into an operational definition, characteristics, examples, and non-examples. It provides students with the opportunity to clarify what they are thinking about the concept and to communicate their understanding.	Definition Characteristics **Living Things** Examples Non-examples
Friendly Talk Probes	*Friendly Talk Probes* is a strategy that involves a selected response section followed by justification. The probe is set in a real-life scenario in which friends talk about a science-related concept or phenomenon. Students are asked to pick the person they most agree with and explain why. This can be used to engage students at any point during a unit. It can be used to access prior knowledge before the unit begins, or assess learning throughout and at the close of a unit.	**Talking about Gravity** Two friends are talking about gravity. Ben says, "Gravity needs atmosphere or air. If there is no air or atmosphere, there will be no gravity." Kelly says, "Gravity doesn't need an atmosphere or air. If there is no air or atmosphere, there will still be gravity." Which friend do you agree with?_____ Describe your thinking. Explain why you agree with one friend and disagree with the other.

Strategy Name	Description	Additional Information
Give Me Five	*Give Me Five* is a simple, quick technique for inviting and valuing public reflection and welcoming feedback from the students. Students should be given time to quietly reflect, perhaps through a quick write. Teacher selects five "volunteers" to share their reflection. NOTE: Deliberately select students for the purpose of reinforcing correct understanding and addressing misconceptions.	1. What was the most significant learning you had during today's lesson? 2. How "in the zone" do you feel right now as far as understanding the concept? 3. How did today's lesson help you better understand the concept? 4. What was the high point of this week's activities on the concept? 5. How well do you think today's science discussion worked in improving your understanding of the concept?
Human Scatterplot	*Human Scatterplot* is a quick, visual way for teacher and students to get an immediate classroom snapshot of students' thinking and the level of confidence students have in their ideas. Teachers develop a selective response question with up to four answer choices. Label one side of the room with the answer choices. Label the adjacent wall with a range of low confidence to high confidence. Students read the question and position themselves in the room according to their answer choice and degree of confidence in their answer.	
I Used to Think… But Now I Know…	*I Used to Think…But Now I Know* is a self-assessment and reflection exercise that helps students recognize if and how their thinking has changed at the end of a sequence of instruction. An additional column can be added to include…*And This Is How I Learned It* to help students reflect on what part of their learning experiences helped them change or further develop their ideas.	
Justified List	*Justified List* begins with a statement about an object, process, concept or skill. Examples that fit or do not fit the statement are listed. Students check off the items on the list that fit the statement and provide a justification explaining their rule or reasons for their selections. This can be done individually or in small group. Small groups can share their lists with the whole class for discussion and feedback. Pictures or manipulatives can be used for English-language learners.	**Making Sound** All of the objects listed below make sounds. Put an X next to the objects you think involve vibration in producing sound. ____guitar strings ____drum ____piano ____dripping faucet_____flute ____wind ____hammer ____crumpled paper ____thunderstorm ____barking dog ____screeching brakes Explain your thinking. What "rule" or reasoning did you use to decide which objects involve vibration?

Strategy Name	Description	Additional Information
K-W-L Variations	*K-W-L* is a general technique in which students describe what they **K**now about a topic, what they **W**ant to know about a topic, and what they have **L**earned about the topic. It provides an opportunity for students to become engaged with a topic, particularly when asked what they want to know. *K-W-L* provides a self-assessment and reflection at the end, when students are asked to think about what they have learned. The three phrases of *K-W-L* help students see the connections between what they already know, what they would like to find out, and what they learned as a result.	
Learning Goals Inventory (LGI)	*Learning Goals Inventory (LGI)* is a set of questions that relate to an identified learning goal in a unit of instruction. Students are asked to "inventory" the learning goal by accessing prior knowledge. This requires them to think about what they already know in relation to the learning goal statement as well as when and how they may have learned about it. The *LGI* can be given back to students at the end of the instructional unit as a self-assessment and reflection of their learning.	
Look Back	*Look Back* is a recount of what students learned over a given instructional period of time. It provides students with an opportunity to look back and summarize their learning. Asking the students "how they learned it" helps them think about their own learning. The information can be used to differentiate instruction for individual learners, based on their descriptions of what helped them learn.	
Muddiest Point	*Muddiest Point* is a quick-monitoring technique in which students are asked to take a few minutes to jot down what the most difficult or confusing part of a lesson was for them. The information gathered is then to be used for instructional feedback to address student difficulties.	**Scenario:** Students have been using a hand lens to make observations of the details on a penny. *Teacher states, "I want you to think about the muddiest point for you so far when it comes to using a hand lens. Jot it down. I will use the information you give me to think about ways to help you better use the hand lens in tomorrow's lesson."*

Strategy Name	Description	Additional Information
Odd One Out	*Odd One Out* combines similar items/terminology and challenges students to choose which item/term in the group does not belong. Students are asked to justify their reasoning for selecting the item that does not fit with the others. Odd One Out provides an opportunity for students to access scientific knowledge while analyzing relationships between items in a group.	Properties of Matter: In each set, circle the ***Odd One Out*** and describe why it does not fit with the others.
Paint the Picture	*Paint the Picture* visually depicts students' thinking about an idea in science without using any annotations. This involves giving the students a question and asking them to design a visual representation that reveals their thinking and answers the question. *Paint the Picture* provides an opportunity for students to organize their thinking and represent their thinking in a creative, unique visual format.	What role do minerals play in the formation of a rock? minerals rock
Partner Speaks	*Partner Speaks* provides students with an opportunity to talk through an idea or question with another student before sharing with a larger group. When ideas are shared with the larger group, pairs speak from the perspective of their partner's ideas. This encourages careful listening and consideration of another's ideas.	**Today we are going to investigate how objects float and sink in water.** - *What do you think affects whether an object floats or sinks in water?* - *What can you do to change how an object floats or sinks?* **Turn to your partner and take turns discussing ideas.**
Pass the Question	*Pass the Question* provides an opportunity for students to collaborate in activating their own ideas and examining other students' thinking. Students begin by working together in pairs to respond to a question. Time is allotted for partial completion of their responses. When the time is up, they exchange their partially completed response with another pair. Students are provided time to finish, modify, add to, or change it as they deem necessary. Pairs then group to give feedback to each other on the modifications.	What are the phases of the moon? Can sound travel through a solid? What is the difference between temperature and humidity? Are science tools helpful? How can you measure matter?
A Picture Tells a Thousand Words	*A Picture Tells a Thousand Words* is a technique where students are digitally photographed during an inquiry-based activity or investigation. They are given the photograph and asked to describe and annotate what they were doing and learning in the photo. Images can be used to spark student discussions, explore new directions in inquiry, and probe their thinking as it relates to the moment the photograph was taken.	

Strategy Name	Description	Additional Information
Question Generating	*Question Generating* is a technique that switches roles from the teacher as the question generator to the student as the question generator. The ability to formulate good questions about a topic can indicate the extent to which a student understands ideas that underlie the topic. This technique can be used any time during instruction. Students can exchange or answer their own questions, revealing further information about the students' ideas related to the topic.	**Question Generating Stems:** • Why does_ _? • How does_ _? • What if___? • What could be the reason for___? • What would happen if _? • How does _compare to _? • How could we find out if___?
Sticky Bars	*Sticky Bars* is a technique that helps students recognize the range of ideas that students have about a topic. Students are presented with a short answer or multiple-choice question. The answer is anonymously recorded on a Post-it note and given to the teacher. The notes are arranged on the wall or whiteboard as a bar graph representing the different student responses. Students then discuss the data and what they think the class needs to do in order to come to a common understanding.	
Thinking Logs	*Thinking Logs* is a strategy that informs the teacher of the learning successes and challenges of individual students. Students choose the thinking stem that would best describe their thinking at that moment. Provide a few minutes for students to write down their thoughts using the stem. The information can be used to provide interventions for individuals or groups of students as well as match students with peers who may be able to provide learning support.	• I was successful in… • I got stuck… • I figured out… • I got confused when…so I… • I think I need to redo… • I need to rethink… • I first thought…but now I realize… • I will understand this better if I… • The hardest part of this was… • I figured it out because… • I really feel good about the way…
Think-Pair-Share	*Think-Pair-Share* is a technique that combines thinking with communication. The teacher poses a question and gives individual students time to think about the question. Students then pair up with a partner to discuss their ideas. After pairs discuss, students share their ideas in a small-group or whole-class discussion. (Kagan) NOTE: Varying student pairs ensures diverse peer interactions.	

Strategy Name	Description	Additional Information
Traffic Light Cups	*Traffic Light Cups* is a monitoring strategy that can be used at any time during instruction to help teachers gauge student understanding. The colors indicate whether students have full, partial, or minimal understanding. Students are given three different-colored cups, asked to self-assess their understanding about the concept or skill they are learning, and display the cup that best matches their understanding.	
Two-Minute Paper	*Two-Minute Paper* is a quick way to collect feedback from students about their learning at the end of an activity, field trip, lecture, video, or other type of learning experience. Teacher writes two questions on the board or on a chart to which students respond in two minutes. Responses are analyzed and results are shared with students the following day.	• What was the most important thing you learned today? • What did you learn today that you didn't know before? • What important question remains unanswered for you? • What would help you learn better tomorrow?
Two Stars and a Wish	*Two Stars and a Wish* is a way to balance positive and corrective feedback. The first sentence describes two positive commendations for the student's work. The second sentence provides one recommendation for revision. This strategy could be used teacher-to-student or student-to-student.	
3-2-1	*3-2-1* is a technique that provides a structured way for students to reflect upon their learning. Students respond in writing to three reflective prompts. This technique allows students to identify and share their successes, challenges, and questions for future learning. Teachers have the flexibility to select reflective prompts that will provide them with the most relevant information for data-driven decision making.	**Sample 1** • **3 – Three** key ideas I will remember • **2 – Two** things I am still struggling with • **1 – One** thing that will help me tomorrow **Sample 2**