SUPPORT GUIDE 3.0
FOR THIRD GRADE

SOUTH CAROLINA ACADEMIC STANDARDS
AND PERFORMANCE INDICATORS FOR SCIENCE

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INTRODUCTION TO GRADE THREE STANDARDS

Science is a way of understanding the physical universe using observation and experimentation to explain natural phenomena. Science also refers to an organized body of knowledge that includes core ideas to the disciplines and common themes that bridge the disciplines. This document, *South Carolina Academic Standards and Performance Indicators for Science*, contains the academic standards in science for the state's students in kindergarten through grade twelve.

As science educators we must take a 3 dimensional approach in facilitating student learning. By addressing content standards, science and engineering practices and crosscutting concepts, students are able to have relevant and evidence based instruction that can help solve current and future problems. For more information please see: https://www.nap.edu/catalog/13165/a-framework-for-k-12-science-education-practices-crosscutting-concepts.

ACADEMIC STANDARDS

In accordance with the South Carolina Education Accountability Act of 1998 (S.C. Code Ann. § 59-18-110), the purpose of academic standards is to provide the basis for the development of local curricula and statewide assessment. Consensually developed academic standards describe for each grade and high school core area the specific areas of student learning that are considered the most important for proficiency in the discipline at the particular level.

Operating procedures for the review and revision of all South Carolina academic standards were jointly developed by staff at the State Department of Education (SCDE) and the Education Oversight Committee (EOC). According to these procedures, a field review of the first draft of the revised South Carolina science standards was conducted from March through May 2013. Feedback from that review and input from the SCDE and EOC review panels was considered and used to develop these standards.

The academic standards in this document are not sequenced for instruction and do not prescribe classroom activities; materials; or instructional strategies, approaches, or practices. The *South Carolina Academic Standards and Performance Indicators for Science* is not a curriculum.

THE PROFILE OF THE SOUTH CAROLINA GRADUATE

The *2014 South Carolina Academic Standards and Performance Indicators for Science* support the *Profile of the South Carolina Graduate. The Profile of the South Carolina Graduate* has been adopted and approved by the South Carolina Association of School Administrators (SCASA), the South Carolina Chamber of Commerce, the South Carolina Council on Competitiveness, the Education Oversight Committee (EOC), the State Board of Education (SBE), and the South Carolina Department of Education (SCDE) in an effort to identify the knowledge, skills, and characteristics a high school graduate should possess in order to be prepared for success as they enter college or pursue a career. The profile is intended to guide all that is done in support of college- and career-readiness.

Profile of the South Carolina Graduate

World Class Knowledge

- Rigorous standards in language arts and math for career and college readiness
- Multiple languages, science, technology, engineering, mathematics (STEM), arts and social sciences

World Class Skills

- Creativity and innovation
- Critical thinking and problem solving
- Collaboration and teamwork
- Communication, information, media and technology
- Knowing how to learn

Life and Career Characteristics

- Integrity
- Self-direction
- Global perspective
- Perseverance
- Work ethic
- Interpersonal skills

Approved by SCASA Superintendents Roundtable and SC Chamber of Commerce SC Education Oversight Committee, SC State Board of Education, SC Department of Education, SC General Assembly, SC Council on Competitiveness, TransformSC, & SC Arts in Basic Curriculum Steering Committee

SCIENCE AND ENGINEERING PRACTICES

In addition to the academic standards, each grade level or high school course explicitly identifies *Science and Engineering Practice* standards, with indicators that are differentiated across grade levels and core areas. The term "practice" is used instead of the term "skill," to emphasize that scientists and engineers use skill and knowledge simultaneously, not in isolation. These eight science and engineering practices are:

1. Ask questions and define problems
2. Develop and use models
3. Plan and conduct investigations
4. Analyze and interpret data
5. Use mathematical and computational thinking
6. Construct explanations and design solutions
7. Engage in scientific argument from evidence
8. Obtain, evaluate, and communicate information

Students should engage in scientific and engineering practices as a means to learn about the specific topics identified for their grade levels and courses. It is critical that educators understand that the Science and Engineering Practices are ***not*** to be taught in isolation. There should ***not*** be a distinct "Inquiry" unit at the beginning of each school year. Rather, the practices need to be employed ***within the content*** for each grade level or course.

Additionally, an important component of all scientists and engineers' work is communicating their results both by informal and formal speaking and listening, and formal reading and writing. Speaking, listening, reading and writing is important not only for the purpose of sharing results, but because during the processes of reading, speaking, listening and writing, scientists and engineers continue to construct their own knowledge and understanding of meaning and implications of their research. Knowing how one's results connect to previous results and what those connections reveal about the underlying principles is an important part of the scientific discovery process. Therefore, students should similarly be reading, writing, speaking and listening throughout the scientific processes in which they engage.

For additional information regarding the development, use and assessment of the *2014 Academic Standards and Performance Indicators for Science* please see the official document that is posted on the SCDE science web page https://ed.sc.gov/scdoe/assets/file/agency/ccr/Standards-Learning/documents/South_Carolina_Academic_Standards_and_Performance_Indicators_for_Science_2014.pdf.

Support for the guidance, overviews of learning progressions, and explicit details of each SEP can be found in the Science and Engineering Support Document https://ed.sc.gov/scdoe/assets/File/instruction/standards/Science/Support%20Documents/Complete_2014SEPsGuide_SupportDoc2_0.pdf.

CROSSCUTTING CONCEPTS

Seven common threads or themes are presented in *A Framework for K-12 Science Education* (2012). These concepts connect knowledge across the science disciplines (biology, chemistry, physics, earth and space science) and have value to both scientists and engineers because they identify universal properties and processes found in all disciplines. These crosscutting concepts are:

1. Patterns
2. Cause and Effect: Mechanism and Explanation
3. Scale, Proportion, and Quantity
4. Systems and System Models
5. Energy and Matter: Flows, Cycles, and Conservation
6. Structure and Function
7. Stability and Change

These concepts should not to be taught in isolation but reinforced in the context of instruction within the core science content for each grade level or course.

The link http://www.nap.edu/read/13165/chapter/8 provides support from the framework for K-12 Science Education: Practices, Crosscutting Concepts, and Core Ideas (2012) that gives further guidance on each crosscutting concept.

1. **Patterns:** The National Research Council (2012) states that "observed patterns of forms and events guide organization and classification, and they prompt questions about relationships and the factors that influence them" (p. 84).
2. **Cause and Effect: Mechanism and Explanation:** The National Research Council (2012) states that "events have causes, sometimes simple, sometimes multifaceted. A major activity of science is investigating and explaining causal relationships and the mechanisms by which they are mediated. Such mechanisms can then be tested across given contexts and used to predict and explain events in new contexts" (p. 84).
3. **Scale, Proportion, and Quantity:** The National Research Council (2012) states that "in considering phenomena, it is critical to recognize what is relevant at different measures of size, time, and energy and to recognize how changes in scale, proportion, or quantity affect a system's structure or performance" (p. 84).
4. **Systems and Systems Models:** The National Research Council (2012) states that "Defining the system under study—specifying its boundaries and making explicit a model of that system—provides tools for understanding and testing ideas that are applicable throughout science and engineering" (p. 84).
5. **Energy and Matter:** Flows, cycles, and conservation. Tracking fluxes of energy and matter into, out of, and within systems helps one understand the systems' possibilities and limitations.
6. **Structure and Function:** The National Research Council (2012) states that "the way in which an object or living thing is shaped and its substructure determine many of its properties and functions" (p. 84).
7. **Stability and Change:** The National Research Council (2012) states that "For natural and built systems alike, conditions of stability and determinants of rates of change or evolution of a system are critical elements of study" (p. 84).

DECIPHERING THE STANDARDS

Kindergarten
Life Science: Exploring Organisms and the Environment

Standard K.L.2: The student will demonstrate an understanding of the effects of forces on the motion and stability of an object.

K.L.2A. Conceptual Understanding: The environment consists of many types of organisms including plants, animals, and fungi. Organisms depend on the land, water, and air to live and grow. Plants need water and light to make their own food. Fungi and animals cannot make their own food and get energy from other sources. Animals (including humans) use different body parts to obtain food and other resources needed to grow and survive. Organisms live in areas where their needs for air, water, nutrients, and shelter are met.

Performance Indicators: Students who demonstrate this understanding can:

K.L.2A.1 Obtain information to answer questions about different organisms found in the environment (such as plants, animals, or fungi).

Figure 1: Example from the Kindergarten Standards

The code assigned to each performance indicator within the standards is designed to provide information about the content of the indicator. For example, the **K.L.2A.1** indicator decodes as the following:

K: The first part of each indicator denotes the grade or subject. The example indicator is from Kindergarten. The key for grade levels are as follows:

K: Kindergarten
1: First Grade
2: Second Grade
3: Third Grade
4: Fourth Grade
5: Fifth Grade
6: Sixth Grade
7: Seventh Grade
8: Eighth Grade
H.B: High school Biology I
H.B: High School Chemistry I
H.P: High school Physics I
H.E: High School Earth Science

L: After the grade or subject, the content area is denoted by an uppercase letter. The L in the example indicator means that the content covers Life Science. The key for content areas are as follows:
E: Earth Science
EC: Ecology
L: Life Science
P: Physical Science
S: Science and Engineering Practices

2: The number following the content area denotes the specific academic standard. In the example, the 2 in the indicator means that it is within the second academic standard with the Kindergarten science content.

A: After the specific content standard, the conceptual understanding is denoted by an uppercase letter. The conceptual understanding is a statement of the core idea for which students should demonstrate understanding. There may be more than one conceptual understanding per academic standard. The A in the example means that this is the first conceptual understanding for the standard. Additionally, the conceptual understandings are novel to the *2014 South Carolina Academic Standards and Performance Indicators for Science*.

1: The last part of the code denotes the number of the specific performance indicator. Performance indicators are statements of what students can do to demonstrate knowledge of the conceptual understanding. The example discussed is the first performance indicator within the conceptual understanding.

CORE AREAS OF GRADE THREE

- Physical Science: Properties and Changes in Matter
- Physical Science: Energy Transfer – Electricity and Magnetism
- Earth Science: Earth's Materials and Resources
- Life Science: Environments and Habitats

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CONTENT SUPPORT GUIDE
FOR GRADE THREE
SOUTH CAROLINA ACADEMIC STANDARDS AND PERFORMANCE INDICATORS

INTRODUCTION

Local districts, schools and teachers may use this document to construct standards-based science curriculum, allowing them to add or expand topics they feel are important and to organize content to fit their students' needs and match available instructional materials. The support document includes standard, conceptual understanding, performance indicator, science and engineering practices, crosscutting concepts, essential learning experiences, extended learning experiences, assessment guidelines, learning connections, and in some cases note to teacher.

FORMAT OF THE CONTENT SUPPORT GUIDE

The format of this document is designed to be structurally uniformed for each of the academic standards and performance indicators. For each, you will find the following sections--

Standard
- This section provides the standard being explicated.

Conceptual Understanding
- This section provides the overall understanding that the student should possess as related to the standard. Additionally, the conceptual understandings are novel to the *2014 South Carolina Academic Standards and Performance Indicators for Science*.

Performance Indicator
- This section provides a specific set of content with an associated science and engineering practice for which the student must demonstrate mastery.

Science and Engineering Practices (SEPs)
- This section lists the specific science and engineering practice that are paired with the content in the performance indicator. Educators should reference the chapter on this specific science and engineering practice in the *Science and Engineering Practices Support Guide.*
- Educators have the freedom to enhance SEPs addressed during instruction.
- SEPs Support Guide https://ed.sc.gov/scdoe/assets/File/instruction/standards/Science/Support%20Documents/Complete_2014SEPsGuide_SupportDoc2_0.pdf

Crosscutting Concepts (CCCs)
- Cross Cutting Concepts (http://www.nap.edu/read/13165/chapter/8) This link provides support from the Framework for K-12 Science Education: Practices, Crosscutting Concepts, and Core Ideas (2012).
- Educators have the freedom to enhance CCCs addressed during instruction.

Essential Learning Experiences

- This section illustrates the knowledge of the content contained in the performance indicator for which it is fundamental for students to demonstrate mastery.

Note to Teacher

- If necessary or appropriate, this section provides additional instructional guidance.

Extended Learning Experiences

- This section provides educators with topics that will enrich students' knowledge related to topics learned with the explicated performance indicator.

Assessment Guidelines

- This section provides guidelines for educators and assessors to check for student mastery of content utilizing interrelated science and engineering practices.

Learning Connections

- This section provides a list of academic content along with the associated academic standard that students will have received in prior or will experience in future grade levels.

Physical Science: Properties and Changes in Matter

Standard 3.P.2: The student will demonstrate an understanding of the properties used to classify matter and how heat energy can change matter from one state to another.	
3.P.2A. Conceptual Understanding: Matter exists in several different states and is classified based on observable and measurable properties. Matter can be changed from one state to another when heat (thermal energy) is added or removed.	
Performance Indicator	**3.P.2A.1:** Analyze and interpret data from observations and measurements to describe and compare the physical properties of matter (including length, mass, temperature, and volume of liquids).
Science and Engineering Practice	**3.S.1A.4:** Analyze and interpret data from observations, measurements, or investigations to understand patterns and meanings.
Crosscutting Concepts	The following Crosscutting Concepts may be applied to the content of this indicator. For more information see page 6. Patterns Scale, Proportion, and Quantity

Essential Learning Experiences:
It is essential that students collect data through measurements and observations of the following observable and measureable physical properties of matter:

Observable Properties (using senses)	Measurable Properties (using tools)

• Color, size, shape, shininess or luster
  ○ Using sense of sight
• Texture or relative temperature how (hot or cold something feels)
  ○ Using sense of touch
• Odor present or not
  ○ Using sense of smell
	• Mass
	  ○ Using a balance
	• Volume
	  ○ Using a graduated cylinder, syringe, or beaker
	• Temperature
	  ○ Using a thermometer
	• Length
	  ○ Using a ruler, tape measure, meter stick

- Length
  - Length is the measurement of something from end to end.
  - Length can be measured using a ruler, tape measure, or meter stick.
  - An object with a greater length will extend past an object with a lesser length.

- Mass
    - Mass is how much matter is in an object.
    - Mass can be measured using a balance with known masses compared to the unknown mass being measured.
    - An object with a large mass feels heavier than an object with a smaller mass.
- Temperature
    - Temperature is a measure of heat in an object,
    - Temperature can be measured using a thermometer.
    - An object with a greater temperature feels hotter to the touch than an object with a lower temperature.
- Volume
    - Volume is the amount of space an object takes up.
    - Volume of a liquid can be measured with a beaker, graduated cylinder or graduated syringe.
    - An object that takes up more space has a greater volume than an object that takes up less space.

It is essential that students organize, analyze, and interpret their data to describe and compare different forms of matter based on these physical properties, including the understanding that matter (regardless of state) is anything that has mass and takes up space.

NOTE TO TEACHER: Students should use the following scientific tools to make their measurements and observations: magnifier, metric ruler, tape measure, meter stick, beaker, graduated cylinder, graduated syringe, balance, mass-weights, thermometer

NOTE TO TEACHER: The data collected, analyzed, and interpreted for this performance indicator can be the data used to construct explanations for how matter is classified as a solid, liquid or gas (**3.P.2A.2**).

Extended Learning Experiences:
The following knowledge and learning experiences are not essential to the success of this learning goal but can be used by teachers to extend the depth and rigor of student engagements.

- Students may obtain information about the composition of different states of matter, including that matter is made of atoms and molecules.
- Students may obtain information about the difference between mass and weight.
- Students may collect data related to the chemical characteristics of matter.

Assessment Guidelines:
Students should engage in multiple science and engineering practices when interacting with the content outlined in this performance indicator. For further information please see SEP Support Guide at:
https://ed.sc.gov/scdoe/assets/File/instruction/standards/Science/Support%20Documents/Complete_2014SEPsGuide_SupportDoc2_0.pdf

Learning Connections	**Previous Learning Connections (K-2):** **K.P.4A.1:** Analyze and interpret data to compare the qualitative properties of objects (such as size, shape, color, texture, weight, flexibility, attraction to magnets, or ability to sink or float) and classify objects based on similar properties. **K.P.4A.2:** Develop and use models to describe and compare the properties of different materials (including wood, plastic, metal, cloth, and paper) and classify materials by their observable properties, by their uses, and by whether they are natural or human-made. **2.P.3A.1:** Analyze and interpret data from observations and measurements to describe the properties used to classify matter as a solid or a liquid. **Future Learning Connections (4-8):** **5.P.2A.1:** Analyze and interpret data from observations and measurements of the physical properties of matter (including volume, shape, movement, and spacing of particles) to explain why matter can be classified as a solid, liquid or gas. **7.P.2B.1:** Analyze and interpret data to describe substances using physical properties (including state, boiling/melting point, density, conductivity, color, hardness, and magnetic properties) and chemical properties (the ability to burn or rust). **7.P.2B.3:** Analyze and interpret data to compare the physical properties, chemical properties (neutralization to form a salt, reaction with metals), and pH of various solutions and classify solutions as acids or bases.

Physical Science: Properties and Changes in Matter

Standard 3.P.2: The student will demonstrate an understanding of the properties used to classify matter and how heat energy can change matter from one state to another.	
3.P.2A. Conceptual Understanding: Matter exists in several different states and is classified based on observable and measurable properties. Matter can be changed from one state to another when heat (thermal energy) is added or removed.	
Performance Indicator	**3.P.2A.2:** Construct explanations using observations and measurements to describe how matter can be classified as a solid, liquid or gas.
Science and Engineering Practice	**3.S.1A.6:** Construct explanations of phenomena using (1) scientific evidence and models, (2) conclusions from scientific investigations, (3) predictions based on observations and measurements, or (4) data communicated in graphs, tables, or diagrams.
Crosscutting Concepts	The following Crosscutting Concepts may be applied to the content of this indicator. For more information see page 6. Patterns Cause and Effect: Mechanisms and Explanations Energy and Matter: Flows, Cycles, and Conservation

Essential Learning Experiences:
It is essential that students use the data from their observations and measurements (**3.P.2A.1**) of the physical properties of matter to construct explanations for how matter is classified as solid, liquid, or gas in the following ways:

- Solids have a definite size and shape, meaning the size and shape do not change. Measurable properties of solids could include length, temperature, mass and volume.
- Liquids have a definite volume, but they take the shape of their containers. Measurable properties of liquids could include temperature, mass and volume.
- Gases do not have a definite shape, or volume. Gases take the shape and size of their container. Measurable properties of gases include temperature and mass.

NOTE TO TEACHER: The observations and measurements used to construct explanations for how matter is classified as a solid, liquid or gas can come from the data the students collected as part of performance indicator **3.P.2A.1**.

Extended Learning Experiences:
The following knowledge and learning experiences are not essential to the success of this learning goal but can be used by teachers to extend the depth and rigor of student engagements.

- Students may construct explanations for how plasma is classified as a different state of matter.

Assessment Guidelines:
Students should engage in multiple science and engineering practices when interacting with the content outlined in this performance indicator. For further information please see SEP Support Guide at:
https://ed.sc.gov/scdoe/assets/File/instruction/standards/Science/Support%20Documents/Complete_2014SEPsGuide_SupportDoc2_0.pdf

Learning Connections	**Previous Learning Connections (K-2):** **2.P.3A.1:** Analyze and interpret data from observations and measurements to describe the properties used to classify matter as a solid or a liquid. **Future Learning Connections (4-8):** **5.P.2A.1:** Analyze and interpret data from observations and measurements of the physical properties of matter (including volume, shape, movement, and spacing of particles) to explain why matter can be classified as a solid, liquid or gas.

Physical Science: Properties and Changes in Matter

Standard 3.P.2: The student will demonstrate an understanding of the properties used to classify matter and how heat energy can change matter from one state to another.	
3.P.2A. Conceptual Understanding: Matter exists in several different states and is classified based on observable and measurable properties. Matter can be changed from one state to another when heat (thermal energy) is added or removed.	
Performance Indicator	**3.P.2A.3:** Plan and conduct scientific investigations to determine how changes in heat (increase or decrease) change matter from one state to another (including melting, freezing, condensing, boiling, and evaporating).
Science and Engineering Practice	**3.S.1A.3:** Plan and conduct scientific investigations to answer questions, test predictions and develop explanations: (1) formulate scientific questions and predict possible outcomes, (2) identify materials, procedures, and variables, (3) select and use appropriate tools or instruments to collect qualitative and quantitative data, and (4) record and represent data in an appropriate form. Use appropriate safety procedures.
Crosscutting Concepts	The following Crosscutting Concepts may be applied to the content of this indicator. For more information see page 6. Cause and Effect: Mechanism and Explanation Energy and Matter: Flows, Cycles, and Conservation Stability and Change

Essential Learning Experiences:
It is essential that students plan and carry out investigations to collect data for how adding or removing heat energy changes matter from one state to another, including the following steps:

- Generate scientifically testable questions about how adding or removing heat might affect different states of matter, specifically:
  - Changing a solid to a liquid by added heat energy
  - Changing a liquid to a gas by added heat energy
  - Changing a gas to a liquid by removing heat energy
  - Changing a liquid to a solid by removing heat energy
- Plan the steps of an investigation to manipulate different variables, including adding or removing heat energy, to see how these change the state of matter.
- Collect and organize data to describe what happens to matter when heat energy is either added or removed, including the following explanations:
  - Melting
    - Melting occurs when sufficient heat energy is added to change the solid to a liquid.
    - Ice starts to melt at 0°C or 32°F

        - Examples of solids that can be easily melted include ice, chocolate, and wax.
- Freezing
    - Freezing occurs when sufficient heat energy is removed to change the liquid to a solid.
    - Water starts to freeze at 0°C or 32°F
    - Water will expand when it freezes; most other substances contract.
- Condensing
    - Condensing is a change in state from a gas to a liquid.
    - Condensing occurs when sufficient heat energy is removed to change a gas to a liquid.
    - Examples of condensing include the formation of water droplets on the outside of a glass of cold liquid, or the formation of water droplets on the cool surface of a mirror during a warm shower. The water droplets that form during condensing are called condensation.
- Boiling
    - Boiling is a change in state from a liquid to a gas.
    - Boiling occurs when sufficient heat is added to a liquid causing bubble of gas to form within the liquid and rise to the surface.
    - Boiling causes liquids to change to a gas more quickly than evaporation.
    - Water starts to boil at 100°C or 212°F. When most substances are heated, they will expand and take up more space.
- Evaporation
    - Evaporation is a change in state from a liquid to a gas.
    - Evaporation occurs at the surface of the liquid as heat is added from the surroundings
    - Evaporation causes liquids to change to a gas more slowly than boiling.

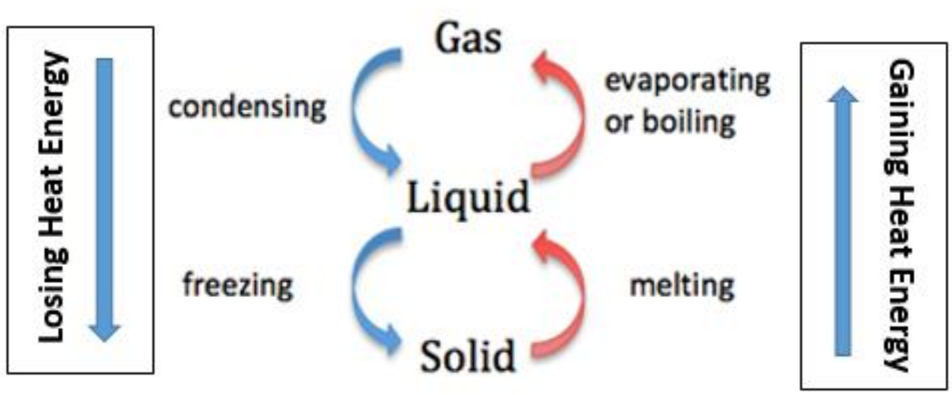


Image Source: Adapted from SC Science Academic Standards Support Document 2005

NOTE TO TEACHER: Students should use the following tools during their investigations into states of matter: thermometers, beakers, stopwatch, and heat lamp.

NOTE TO TEACHER: Teachers need to take into account the potential hazard of students getting burned as a result of investigations into adding heat energy to change states of matter, especially when investigating boiling.

Extended Learning Experiences:
The following knowledge and learning experiences are not essential to the success of this learning goal but can be used by teachers to extend the depth and rigor of student engagements.

- Students may investigate other ways that matter changes states, including deposition (gas to solid) or sublimation (solid to gas).
- Students may investigate how when matter changes states the total mass is still conserved.
- Students may investigate how even though changing the state of matter is a physical change, the chemical identity of the matter remains the same.

Assessment Guidelines:
Students should engage in multiple science and engineering practices when interacting with the content outlined in this performance indicator. For further information please see SEP Support Guide at:
https://ed.sc.gov/scdoe/assets/File/instruction/standards/Science/Support%20Documents/Complete_2014SEPsGuide_SupportDoc2_0.pdf

Learning Connections	**Previous Learning Connections (K-2):** **2.P.3A.3:** Conduct structured investigations to test how adding or removing heat can cause changes in solids and liquids. **2.P.3A.4:** Construct scientific arguments using evidence from investigations to support claims that some changes in solids or liquids are reversible and some are not when heat is added or removed. **Future Learning Connections (4-8):** **7.P.2B.1:** Analyze and interpret data to describe substances using physical properties (including state, boiling/melting point, density, conductivity, color, hardness, and magnetic properties) and chemical properties (the ability to burn or rust). **7.P.2B.4:** Plan and conduct controlled scientific investigations to answer questions about how physical and chemical changes affect the properties of different substances.

Physical Science: Properties and Changes in Matter

Standard 3.P.2: The student will demonstrate an understanding of the properties used to classify matter and how heat energy can change matter from one state to another.	
3.P.2A. Conceptual Understanding: Matter exists in several different states and is classified based on observable and measurable properties. Matter can be changed from one state to another when heat (thermal energy) is added or removed.	
Performance Indicator	**3.P.2A.4:** Obtain and communicate information to compare how different processes (including burning, friction, and electricity) serve as sources of heat energy.
Science and Engineering Practice	**3.S.1A.8:** Obtain and evaluate informational texts, observations, data collected, or discussions to (1) generate and answer questions, (2) understand phenomena, (3) develop models, or (4) support explanations, claims, or designs. Communicate observations and explanations using the conventions and expectations of oral and written language.
Crosscutting Concepts	The following Crosscutting Concepts may be applied to the content of this indicator. For more information see page 6. Energy and Matter: Flows, Cycles, and Conservation Structure and Function

Essential Learning Experiences:
It is essential that students obtain information from a variety of sources, including informational texts, observations, investigations, videos, pictures, expert speakers, etc. about different sources of heat energy.

It is essential that students use their information to compare how different processes serve as sources of heat energy, including the following:

- Explaining that sources of heat produce heat energy and make things warmer.
    - For example, fires, stoves, toasters, ovens, the Sun, light bulbs, engines, animals, and other common objects in their environment produce heat.
- Students should know that the processes of burning, friction and electricity produce heat energy. Students should compare how different processes serve as sources of heat energy.
    - Burning
        - When materials are burned, heat can be produced. For example, when wood or candles are burned, they produce heat
    - Friction
        - Friction is the rubbing of two objects together.
        - When objects are rubbed together, heat is produced. For example, when hands are rubbed together, they get warmer

- Electricity
  - When electricity is used, heat can be produced.
  - For example, when electricity is used in light bulbs, heaters, stoves, toasters, and ovens, they produce heat and the surfaces become warm

Extended Learning Experiences:
The following knowledge and learning experiences are not essential to the success of this learning goal but can be used by teachers to extend the depth and rigor of student engagements.
- Students may obtain information about other sources of heat energy beyond burning, friction, and electricity.
- Students may investigate how particle movement is related to heat energy.
- Students may investigate how friction is also related to motion.

Assessment Guidelines:
Students should engage in multiple science and engineering practices when interacting with the content outlined in this performance indicator. For further information please see SEP Support Guide at:
https://ed.sc.gov/scdoe/assets/File/instruction/standards/Science/Support%20Documents/Complete_2014SEPsGuide_SupportDoc2_0.pdf

Learning Connections	**Previous Learning Connections (K-2):** **1.E.3A.4:** Conduct structured investigations to answer questions about the effect of sunlight on Earth's surface. **1.E.3A.5:** Define problems related to the warming effect of sunlight and design possible solutions to reduce its impact on a particular area. **2.P.4A.4:** Conduct structured investigations to answer questions about the relationship between friction and the motion of objects. **Future Learning Connections (4-8):** **5.P.5A.4:** Analyze and interpret data to describe how a change of force, a change in mass, or friction affects the motion of an object. **6.P.3A.1:** Analyze and interpret data to describe the properties and compare sources of different forms of energy (including mechanical, electrical, chemical, radiant, and thermal).

Physical Science: Properties and Changes in Matter

Standard 3.P.2: The student will demonstrate an understanding of the properties used to classify matter and how heat energy can change matter from one state to another.	
3.P.2A. Conceptual Understanding: Matter exists in several different states and is classified based on observable and measurable properties. Matter can be changed from one state to another when heat (thermal energy) is added or removed.	
Performance Indicator	**3.P.2A.5:** Define problems related to heat transfer and design devices or solutions that facilitate (conductor) or inhibit (insulator) the transfer of heat.
Science and Engineering Practice	**3.S.1B.1:** Construct devices or design solutions to solve specific problems or needs: (1) ask questions to identify problems or needs, (2) ask questions about the criteria and constraints of the devices or solutions, (3) generate and communicate ideas for possible devices or solutions, (4) build and test devices or solutions, (5) determine if the devices or solutions solved the problem and refine the design if needed, and (6) communicate the results.
Crosscutting Concepts	The following Crosscutting Concepts may be applied to the content of this indicator. For more information see page 6. Energy and Matter; Flow, Cycles, and Conservation Structure and Function

Essential Learning Experiences:
It is essential that students obtain information from different sources, including observations, informational texts, videos, etc. to identify and describe problems related to the transfer of heat energy, both in terms of facilitating/helping heat transfer and/or inhibiting/blocking heat transfer. For example:

- A student's hot cocoa gets cold quickly when served in a paper cup.
- Students are burned while sliding down the metal slide at recess.
- Classroom laptops are overheating and turning off during use by students.

It is essential that students engage in the design process to design and test different solutions to solving the problem of heat transfer through insulating or conducting the transfer of thermal energy, including the following steps:

- Asking questions about the nature of the problems related to using insulators to inhibit heat transfer or using conductors to facilitate heat transfer.
- Designing devices or devising solutions to these problems based on applying an understanding of heat transfer, insulators, and conductors, including the following:

- Conductors of Heat Transfer
    - Conductors facilitate, or conduct, the transfer of heat energy.
    - Materials that allow heat to move easily through them, and from one object to another through direct contact are called conductors.
    - Metal objects are good conductors of heat because heat can transfer easily through the metal. For example, the handle of a metal spoon will become warm when the spoon is placed in hot water.
- Insulators of Heat Transfer
    - Insulators inhibit, or insulate, the transfer of heat energy.
    - Materials that do not allow heat to move easily through them or from one object to another through direct contact are called insulators.
    - Wooden and plastic objects are good insulators of heat because heat does not transfer easily through wood or plastic. For example, the handle of a wooden or plastic spoon does not become warm when the spoon is placed in hot water.

- Testing their devices or solutions in order to collect data related to the how effective their solutions are at insulating or conducting heat transfer.
- Analyzing and interpreting their data to determine if their solutions are successful how well their solutions facilitate or inhibit heat transfer.
- Using their data to refine and retest their designs (if necessary).
- Communicating their solutions.

NOTE TO TEACHER: Students will use thermometers as part of their tests involving insulators and conductors.

Extended Learning Experiences:
The following knowledge and learning experiences are not essential to the success of this learning goal but can be used by teachers to extend the depth and rigor of student engagements.

- Students may investigate the variations in the efficiency of different thermal insulators or conductors.
- Students may investigate the different forms of heat transfer through conduction, convection, and radiation.

Assessment Guidelines:
Students should engage in multiple science and engineering practices when interacting with the content outlined in this performance indicator. For further information please see SEP Support Guide at:
https://ed.sc.gov/scdoe/assets/File/instruction/standards/Science/Support%20Documents/Complete_2014SEPsGuide_SupportDoc2_0.pdf

Learning Connections	**Previous Learning Connections (K-2):** **K.P.4A.2:** Develop and use models to describe and compare the properties of different materials (including wood, plastic, metal, cloth, and paper) and classify materials by their observable properties, by their uses, and by whether they are natural or human-made.

	K.P.4A.3: Conduct structured investigations to answer questions about which materials have the properties that are best suited to solve a problem or need. **Future Learning Connections (4-8):** **6.P.3A.5:** Develop and use models to describe and compare the directional transfer of heat through convection, radiation, and conduction. **6.P.3A.6:** Design and test devices that minimize or maximize heat transfer by conduction, convection, or radiation.

Physical Science: Energy Transfer- Electricity and Magnetism

Standard 3.P.3: The student will demonstrate an understanding of how electricity transfers energy and how magnetism can result from electricity.	
3.P.3A. Conceptual Understanding: Energy can be transferred from place to place by electric currents. Electric currents flowing through a simple circuit can be used to produce motion, sound, heat, or light. Some materials allow electricity to flow through a circuit and some do not.	
Performance Indicator	**3.P.3A.1:** <u>Obtain and communicate information</u> to develop models showing how electrical energy can be transformed into other forms of energy (including motion, sound, heat, or light).
Science and Engineering Practice	**3.S.1A.8:** <u>Obtain and evaluate</u> informational texts, observations, data collected, or discussions to (1) generate and answer questions, (2) understand phenomena, (3) develop models, or (4) support explanations, claims, or designs. <u>Communicate</u> observations and explanations using the conventions and expectations of oral and written language.
Crosscutting Concepts	The following Crosscutting Concepts may be applied to the content of this indicator. For more information see page 6. Systems and System Models Energy and Matter

Essential Learning Experiences:
<u>It is essential</u> that students obtain information from different sources, including investigations, observations, and tests of real circuits, informational texts, videos, expert speakers, and pictures concerning electrical energy being transformed into other forms of energy (motion, sound, heat, and light).

<u>It is essential</u> that students use this information to develop models that illustrate different ways that electrical energy into other forms of energy, including the following:

- Motion
    - Electrical energy can be changed to energy of motion with an electric motor, such as an electric fan or hair dryer.
- Sound
    - Electrical energy can be changed to sound energy with radios and televisions.
- Heat
    - Electrical energy can be changed to heat energy in stoves, toasters, and ovens.
- Light
    - Electrical energy can be changed to light energy with light bulbs in lamps, televisions, and computer monitors.

Extended Learning Experiences:
The following knowledge and learning experiences are not essential to the success of this learning goal but can be used by teachers to extend the depth and rigor of student engagements.

- Students may obtain additional information about why specific energy transformations occur.
- Students may obtain additional information about how energy is neither created nor destroyed but can only be transformed.
- Students may obtain additional information about other examples of energy transformation, such as chemical energy, potential and kinetic energy transformations, etc.
- Students may obtain additional information about how energy of motion can be transformed into electrical energy.

Assessment Guidelines:
Students should engage in multiple science and engineering practices when interacting with the content outlined in this performance indicator. For further information please see SEP Support Guide at:
https://ed.sc.gov/scdoe/assets/File/instruction/standards/Science/Support%20Documents/Complete_2014SEPsGuide_SupportDoc2_0.pdf

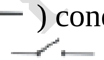
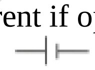
Learning Connections	**Future Learning Connections (4-8):** **6.P.3A.1:** Analyze and interpret data to describe the properties and compare sources of different forms of energy (including mechanical, electrical, chemical, radiant, and thermal). **6.P.3A.3:** Construct explanations for how energy is conserved as it is transferred and transformed in electrical circuits.

Physical Science: Energy Transfer- Electricity and Magnetism

Standard 3.P.3: The student will demonstrate an understanding of how electricity transfers energy and how magnetism can result from electricity.	
3.P.3A. Conceptual Understanding: Energy can be transferred from place to place by electric currents. Electric currents flowing through a simple circuit can be used to produce motion, sound, heat, or light. Some materials allow electricity to flow through a circuit and some do not.	
Performance Indicator	**3.P.3A.2:** <u>Develop and use models</u> to describe the path of an electric current in a complete simple circuit as it accomplishes a task (such as lighting a bulb or making a sound).
Science and Engineering Practice	**3.S.1A.2:** <u>Develop, use, and refine models</u> to (1) understand or represent phenomena, processes, and relationships, (2) test devices or solutions, or (3) communicate ideas to others.
Crosscutting Concepts	The following Crosscutting Concepts may be applied to the content of this indicator. For more information see page 6. Systems and System Models Energy and Matter

Essential Learning Experiences:
<u>It is essential</u> that students obtain information primarily through investigations testing and using circuits as well as other sources, including informational texts, videos, interactive models, videos, expert speakers, pictures, etc. about the parts of a circuit and how to construct a simple, series circuit through which electrical energy travels as it is transformed into different forms of energy.

<u>It is essential</u> that students use information from their investigations and tests using circuits (as well as other sources) to develop models that illustrate the components of a simple, series circuit and the path of electricity through a complete simple circuit, including the following elements:

- The wire ( ) conducts the electric current (the flow of electricity)
- The switch () completes the circuit and allows current to flow if closed and stops the current if open
- The battery () pushes the electric current around the circuit
- The light bulb () is the object in the circuit that changes electrical energy to light energy

<u>It is essential</u> that students use their models to communicate the following information about circuits:

- In a simple, series circuit, the electric current goes through each component in the circuit in one complete sequential path from the source of the current.

- A diagram of a simple circuit has one path for the electric current to flow through and has symbols for a battery, a wire, a switch, and a device that changes electrical energy to another form of energy.
- If there is a break in the circuit (an open switch, a break in the wire, a broken element light, motor, etc.), the electrical energy will no longer complete its path through the circuit.
    - For example, if a light bulb in a series goes out, all the other light bulbs in the circuit go out too because the circuit is no longer complete.
- If a circuit is not complete, the electrical energy will not be able to transform into some other form of energy (for example: the lightbulb will not light, the motor will not work, the element will not produce heat).

Extended Learning Experiences:
The following knowledge and learning experiences are not essential to the success of this learning goal but can be used by teachers to extend the depth and rigor of student engagements.

- Students may investigate parallel circuits and model how parallel circuits differ from series circuits.
- Students may investigate how adding additional elements to a circuit affects the flow of electricity and how well each element performs.

Assessment Guidelines:
Students should engage in multiple science and engineering practices when interacting with the content outlined in this performance indicator. For further information please see SEP Support Guide at:
https://ed.sc.gov/scdoe/assets/File/instruction/standards/Science/Support%20Documents/Complete_2014SEPsGuide_SupportDoc2_0.pdf

Learning Connections	**Future Learning Connections (4-8):** **6.P.3A.1:** Analyze and interpret data to describe the properties and compare sources of different forms of energy (including mechanical, electrical, chemical, radiant, and thermal). **6.P.3A.3:** Construct explanations for how energy is conserved as it is transferred and transformed in electrical circuits.

Physical Science: Energy Transfer- Electricity and Magnetism

Standard 3.P.3: The student will demonstrate an understanding of how electricity transfers energy and how magnetism can result from electricity.	
3.P.3A. Conceptual Understanding: Energy can be transferred from place to place by electric currents. Electric currents flowing through a simple circuit can be used to produce motion, sound, heat, or light. Some materials allow electricity to flow through a circuit and some do not.	
Performance Indicator	**3.P.3A.3:** Analyze and interpret data from observations and investigations to classify different materials as either an insulator or conductor of electricity.
Science and Engineering Practice	**3.S.1A.4:** Analyze and interpret data from observations, measurements, or investigations to understand patterns and meanings.
Crosscutting Concepts	The following Crosscutting Concepts may be applied to the content of this indicator. For more information see page 6. Patterns Energy and Matter Structure and Function

Essential Learning Experiences:
It is essential that students obtain data from investigations using circuits to test the properties of different materials as either conductors or insulators of electrical energy.

It is essential that students organize, analyze, and interpret data from their investigations to classify different materials as either conductors or insulators of electrical energy based on the following characteristics:

- Conductors of Electricity
    - Conductors of electricity facilitate, or conduct, the transfer of electric energy.
    - Conductors of electricity are made of materials in which the electrons can move freely and allow the flow of electricity.
    - Materials that allow electricity to move easily through them and from one object to another through direct contact are called conductors.
    - Metal objects are good conductors of electricity because electricity can transfer easily through the metal. For example, a metal wire will allow electricity to move easily through a circuit.
- Insulators of Electricity
    - Insulators of electricity inhibit, or insulate, the transfer of electric energy.
    - Insulators of electricity are made of materials in which electrons are not free to move and thus impede the flow of electricity.
    - Materials that do not allow electricity to move easily through them or from one object to another through direct contact are called insulators.

  - Wooden and plastic objects are good insulators of electric energy because electricity does not move easily through wood or plastic. For example, a wooden craft stick or plastic spoon does not allow electricity to move through a circuit.

Extended Learning Experiences:
The following knowledge and learning experiences are not essential to the success of this learning goal but can be used by teachers to extend the depth and rigor of student engagements.

- Students may investigate the conductivity of different types of metals.
- Students may investigate conductivity of different materials by collecting data on electrical resistance.

Assessment Guidelines:
Students should engage in multiple science and engineering practices when interacting with the content outlined in this performance indicator. For further information please see SEP Support Guide at:
https://ed.sc.gov/scdoe/assets/File/instruction/standards/Science/Support%20Documents/Complete_2014SEPsGuide_SupportDoc2_0.pdf

Learning Connections	**Previous Learning Connections (K-2):** **K.P.4A.2:** Develop and use models to describe and compare the properties of different materials (including wood, plastic, metal, cloth, and paper) and classify materials by their observable properties, by their uses, and by whether they are natural or human-made. **K.P.4A.3:** Conduct structured investigations to answer questions about which materials have the properties that are best suited to solve a problem or need. **Future Learning Connections (4-8):** **6.P.3A.3:** Construct explanations for how energy is conserved as it is transferred and transformed in electrical circuits.

Physical Science: Energy Transfer- Electricity and Magnetism

Standard 3.P.3: The student will demonstrate an understanding of how electricity transfers energy and how magnetism can result from electricity.	
3.P.3B. Conceptual Understanding: Magnets can exert forces on other magnets or magnetizable materials causing energy transfer between them, even when the objects are not touching. An electromagnet is produced when an electric current passes through a coil of wire wrapped around an iron core. Magnets and electromagnets have unique properties.	
Performance Indicator	**3.P.3B.1:** Develop and use models to describe and compare the properties of magnets and electromagnets (including polarity, attraction, repulsion, and strength).
Science and Engineering Practice	**3.S.1A.2:** Develop, use, and refine models to (1) understand or represent phenomena, processes, and relationships, (2) test devices or solutions, or (3) communicate ideas to others.
Crosscutting Concepts	The following Crosscutting Concepts may be applied to the content of this indicator. For more information see page 6. Systems and System Models Energy and Matter

Essential Learning Experiences:
It is essential that students obtain information primarily from investigations as well as from various sources, including observations, informational texts, videos, expert speakers, pictures, etc. about the following characteristics of magnets and electromagnets:

- A magnet is an object that produces a magnetic field. This magnetic field is an invisible force commonly experienced as attraction and repulsion.
    - Magnets can exert forces on other magnets or materials which can be magnetized. This causes an energy transfer between the objects, even when they are not touching.
- An electromagnet is produced when an electrical current passes through a coil of wire wrapped around any core that can be magnetized.
    - An electromagnet is a magnet created by wrapping a conductive wire around a magnetic core. When an electrical current is running through the wire, the magnetic core produces a magnetic field, but that magnetic field goes away when the electrical current is cut off.
        - For example, a copper wire wrapped around an iron nail and attached to a battery is an electromagnet.
- Magnets and electromagnets have the following unique properties:
    - Polarity

        - Magnets and electromagnets have areas on their ends (if bar or horseshoe magnets) or on their tops and bottoms (if ceramic, plastic, or "donut" magnets) that are called poles.
        - The magnetic pull or attraction is strongest at these poles. Every magnet has a North Pole and a South Pole.
        - Like poles repel each other.
            - If the North Pole of one magnet and the North Pole of another magnet are brought close to each other, they will move away from each other; they will repel.
            - The same thing happens if the South Pole of one magnet and the South Pole of another magnet are brought close to each other.
        - Unlike poles attract each other.
            - If the North Pole of one magnet and the South Pole of another magnet are brought close to each other, they will move toward each other; they will attract.
    - Attraction
        - Magnets and electromagnets attract each other when unlike poles are near each other.
        - Magnets attract certain types of metals, such as iron, nickel and steel.
        - When iron nails or steel paper clips are held near a magnet, they will move toward, or be attracted to, the magnet.
    - Repulsion
        - Magnets and electromagnets can push each other apart if their like poles (North-North or South-South) are brought near each other.
    - Strength
        - The strength of a magnet or electromagnet is how strong of an attracting repelling force the magnet exerts on objects around it.
        - The attractive strength of a magnet or electromagnet is greatest at its poles.
        - Some magnets have a greater strength than other magnets.
        - The strength of a magnet or electromagnet can be measured and compared by counting the number of objects, for example paper clips the magnet can pick up.

<u>It is essential</u> that students use their models to communicate these characteristics and to compare the characteristics of magnets and electromagnets.

Extended Learning Experiences:
The following knowledge and learning experiences are not essential to the success of this learning goal but can be used by teachers to extend the depth and rigor of student engagements.

- Students may investigate the details of the shape and appearance of magnetic fields, such as how the magnetic field is made of lines of force.
- Students may investigate the direction of the flow of the magnetic field from the north magnetic pole to the south magnetic pole
- Students may use different types of materials to see the flow of the magnetic field, such as iron filings.

- Students may obtain information about how the interaction of the Earth's inner and outer cores result in the Earth functioning as a giant magnet.
- Students may investigate the effects of magnetic fields on compass needles.

Assessment Guidelines:
Students should engage in multiple science and engineering practices when interacting with the content outlined in this performance indicator. For further information please see SEP Support Guide at:
https://ed.sc.gov/scdoe/assets/File/instruction/standards/Science/Support%20Documents/Complete_2014SEPsGuide_SupportDoc2_0.pdf

Learning Connections	**Previous Learning Connections (K-2):** **K.P.4A.1:** Analyze and interpret data to compare the qualitative properties of objects (such as size, shape, color, texture, weight, flexibility, attraction to magnets, or ability to sink or float) and classify objects based on similar properties. **2.P.3B.1:** Conduct structured investigations to answer questions about how the poles of magnets attract and repel each other. **2.P.3B.2:** Analyze and interpret data from observations to compare the effects of magnets on various materials. **Future Learning Connections (4-8):** **6.P.3A.4:** Develop and use models to exemplify how magnetic fields produced by electrical energy flow in a circuit is interrelated in electromagnets, generators, and simple electrical motors.

Physical Science: Energy Transfer- Electricity and Magnetism

Standard 3.P.3: The student will demonstrate an understanding of how electricity transfers energy and how magnetism can result from electricity.	
3.P.3B. Conceptual Understanding: Magnets can exert forces on other magnets or magnetizable materials causing energy transfer between them, even when the objects are not touching. An electromagnet is produced when an electric current passes through a coil of wire wrapped around an iron core. Magnets and electromagnets have unique properties.	
Performance Indicator	**3.P.3B.2:** Plan and conduct scientific investigations to determine the factors that affect the strength of an electromagnet.
Science and Engineering Practice	**3.S.1A.3:** Plan and conduct scientific investigations to answer questions, test predictions and develop explanations: (1) formulate scientific questions and predict possible outcomes, (2) identify materials, procedures, and variables, (3) select and use appropriate tools or instruments to collect qualitative and quantitative data, and (4) record and represent data in an appropriate form. Use appropriate safety procedures.
Crosscutting Concepts	The following Crosscutting Concepts may be applied to the content of this indicator. For more information see page 6. Energy and Matter Structure and Function

Essential Learning Experiences:
It is essential that students plan and carry out investigations to collect data for how different factors affect the strength of an electromagnet, including the following steps:

- Generate scientifically testable questions about how changing different factors related to an electromagnet can impact the strength of an electromagnet.
    - An electromagnet is produced when an electrical current passes through a coil of insulated wire wrapped around any core that can be magnetized.
    - The primary elements of an electromagnet are an electrical current, a coiled wire, and a core that can be magnetized.
- Plan the steps of an investigation to manipulate different variables related to the elements of an electromagnet to see how these changes affect the strength of an electromagnet, including the following:
    - Properties of the wire:
        - By increasing the number of coils of insulated conductive wire around a magnetic core (such as an iron nail), the strength of the electromagnet can be increased.
        - By increasing the (or thickness) of the conductive wire used, the strength of the electromagnet can be increased.

- Strength of the electrical current:
  - By using a battery with a greater voltage, the strength of the electromagnet can be increased.
  - By adding more batteries (in series) to the electrical circuit, the strength of the electromagnet can be increased.
- Properties of the core:
  - Changing the composition of the core will alter the strength of the electromagnet. For example, an electromagnet with an iron core will have a greater magnetic strength than an electromagnet with a nickel core of the same size.
  - By increasing the diameter of the core, the strength of the electromagnet can be increased.
- Collect and organize data to describe what happens to the strength of an electromagnet when these elements are manipulated.

Extended Learning Experiences:
The following knowledge and learning experiences are not essential to the success of this learning goal but can be used by teachers to extend the depth and rigor of student engagements.

- Students may investigate how the strongest electromagnets use charged gases as a core.
- Students may investigate other sources of electrical energy, such as generators, for an electromagnet.
- Students may investigate the nature of the magnetic field generated by an electromagnet.

Assessment Guidelines:
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https://ed.sc.gov/scdoe/assets/File/instruction/standards/Science/Support%20Documents/Complete_2014SEPsGuide_SupportDoc2_0.pdf

Learning Connections	**Future Learning Connections (4-8):** **6.P.3A.4:** Develop and use models to exemplify how magnetic fields produced by electrical energy flow in a circuit is interrelated in electromagnets, generators, and simple electrical motors.

Earth Science: Earth's Materials and Processes

Standard 3.E.4: The student will demonstrate an understanding of the composition of Earth and the processes that shape features of Earth's surface.	
3.E.4A. Conceptual Understanding: Earth is made of materials (including rocks, minerals, soil, and water) that have distinct properties. These materials provide resources for human activities.	
Performance Indicator	**3.E.4A.1:** Analyze and interpret data from observations and measurements to describe and compare different Earth materials (including rocks, minerals, and soil) and classify each type of material based on its distinct physical properties.
Science and Engineering Practice	**3.S.1A.4:** Analyze and interpret data from observations, measurements, or investigations to understand patterns and meanings.
Crosscutting Concepts	The following Crosscutting Concepts may be applied to the content of this indicator. For more information see page 6. Patterns

Essential Learning Experiences:
It is essential that students collect data from observations and measurements of the physical properties of rocks.

It is essential that students organize, analyze, and interpret their data in order to describe and classify rocks based on the following characteristics:

- Rocks can be classified by properties, such as how they are formed, color, visible crystals or minerals, grain pieces, patterns in the rock such as layers or stripes.
- Igneous Rocks
    - Igneous rock was once melted, but it has cooled and hardened.
    - The melted material is called magma or lava.
    - Some igneous rocks may be glassy or grainy with crystals of different types of minerals in them, such as granite.
    - Some igneous rocks may be a uniform color with few visible crystal grains, such as basalt.
    - Some igneous rocks have holes in them from gas bubbles that were trapped when lava cooled, such as scoria or pumice.
    - Igneous rocks typically do not have layers.
- Sedimentary Rocks
    - Sedimentary rocks are usually made up of pieces of rock that have been pressed and cemented together.
    - Sediments are pieces of older rocks that have been broken down by the process of weathering.

  - Sedimentary rocks can be recognized by being made of sediments of various sizes, including pebbles, sand grains, silt, and clay/mud.
  - Sandstone and limestone are examples of sedimentary rocks.
  - With few very rare exceptions, sedimentary rocks are the only rocks that may contain fossils.
    - Fossils may be shells, bones, or other remains of plants or animals.
- Metamorphic Rocks
  - Metamorphic rock was once another type of rock deep inside Earth, but heat and pressure caused the minerals to change and form a new type of rock.
  - Sedimentary rocks, igneous rocks, and even other metamorphic rocks can be changed into metamorphic rocks.
  - Marble and slate are examples of metamorphic rocks.
  - Metamorphic rocks that were created by pressure will have minerals line up in layers. Some have bands or stripes of alternating light and dark minerals colors.
  - Sometimes the heat just changes the size of the mineral crystals.
  - Metamorphic rocks that form mainly from heat do not always have layers or bands.

<u>It is essential</u> that students collect data from observations and measurements of the physical properties of soils.

<u>It is essential</u> that students organize, analyze, and interpret their data in order to describe and classify soils based on the following characteristics:

- Humus
  - Humus is soil that is made up of decayed parts of once-living organisms.
  - It is dark, soft, and very crumbly.
- Sand
  - Sand has large grains with large spaces between the grains.
  - This lets water leave it quickly.
  - Sand feels gritty.
- Silt
  - Silt has pieces that are smaller than sand. It feels like powder.
- Clay
  - Clay has very small grains, much smaller than sand or silt, and holds water easily.
  - This makes clay sticky when wet, but when it dries, it forms hard clumps.
- Some soils are combinations of these soil types. For example, “loam” soil has large and small grains with lots of humus. This makes it dark and rich soil for plants. Another example, “potting soil” or “topsoil”; also has a lot of humus. Once some sand has been added to it, it is also good for growing plants.

<u>It is essential</u> that students collect data from observations and measurements of the physical properties of minerals, including the following:

- Minerals are solid, formed in nature, have never been alive, and have properties by which they can be identified.
- Hardness

    - Hardness refers to whether the mineral can be scratched or can scratch something else.
    - The harder a mineral, the fewer things can scratch it.
    - The hardness is measured 1-10 with 1 being the softest and 10 being the hardest.
    - Diamond is the hardest mineral.
    - A person's fingernail has a hardness of 2.5 and will scratch very soft minerals
    - A piece of glass will have a hardness of 5.5 and can be used to distinguish between soft minerals (5 or less) and hard minerals (6 to 10).
- Color
    - Color can be used along with other properties to help identify a mineral.
    - Since many minerals have the same color and many minerals can be found in more than one color, color along cannot be used as the only property for identification.
- Luster
    - Luster describes how a mineral reflects light shined on it.
    - Geologists describe luster in the following ways:
        - Glassy (shiny like glass)
        - Pearly (silky like a pearl)
        - Metallic (shiny like metal)
        - Dull (not shiny at all)
- Special Properties
    - Some minerals will react when weak acid (vinegar) is placed on them, by bubbling or fizzing.
    - Some minerals split into thin sheets.
    - Some minerals have magnetic properties.

<u>It is essential</u> that students organize, analyze, and interpret their data in order to describe and classify minerals based on the observable characteristics in the following manner:

- A mineral identification key is a chart that will give information about the properties of the minerals listed on the key. Properties of a given mineral are compared to those listed on the key and the mineral can be identified. Some common minerals with very observable properties might include calcite, feldspar, mica, talc, gypsum, quartz, and fluorite. A sample mineral identification key is provided.

Properties

Mineral	Hardness (scratch test)	Color	Luster	Special Properties
Calcite	3 Cannot scratch glass	White	Dull/Glassy	Bubbles with acid/vinegar
Feldspar	6 Scratches glass	Pink or white	Dull/Pearly	--
Mica	2 Scratched by fingernail	Black or Gray	Glassy	Splits into thin sheets Black variety is Biotite Gray variety is Muscovite
Talc	1 Easily scratched by fingernail	White	Dull	--
Gypsum	2 Scratched by fingernail	White/Gray	Dull	--
Quartz	7 Scratches glass	Various colors	Glassy	--
Fluorite	4 Cannot scratch glass	Various Colors	Glassy	--
Magnetite	6 Scratches glass	Black	Metallic	Magnetic
Pyrite	6 Scratches glass	Gold	Metallic	Also called “Fool’s Gold”

Extended Learning Experiences:
The following knowledge and learning experiences are not essential to the success of this learning goal but can be used by teachers to extend the depth and rigor of student engagements.

- Students may analyze and interpret data to classify rocks within each different rock type.
- Students may obtain information about how rocks form to develop a rock cycle model.
- Students may use data to compare and contrast soil types based on grain size.
- Students may obtain information to describe the characteristics of soil layers.
- Students may use data to describe the crystal shapes of different minerals.

- Students may use data to classify minerals based on how they break and exhibit cleavage or fracture.
- Students may use the Mohs Scale of Mineral Hardness
- Students may use data from the color of the powdered mineral streak to classify minerals.

Assessment Guidelines:
Students should engage in multiple science and engineering practices when interacting with the content outlined in this performance indicator. For further information please see SEP Support Guide at:
https://ed.sc.gov/scdoe/assets/File/instruction/standards/Science/Support%20Documents/Complete_2014SEPsGuide_SupportDoc2_0.pdf

Learning Connections	**Previous Learning Connections (K-2):** **K.P.4A.1:** Analyze and interpret data to compare the qualitative properties of objects (such as size, shape, color, texture, weight, flexibility, attraction to magnets, or ability to sink or float) and classify objects based on similar properties. **K.P.4A.2:** Develop and use models to describe and compare the properties of different materials (including wood, plastic, metal, cloth, and paper) and classify materials by their observable properties, by their uses, and by whether they are natural or human-made. **1.E.4A.1:** Analyze and interpret data from observations and measurements to compare the properties of Earth materials (including rocks, soils, sand, and water). **Future Learning Connections (4-8):** **7.EC.5A.2:** Construct explanations of how soil quality (including composition, texture, particle size, permeability, and pH) affects the characteristics of an ecosystem using evidence from soil profiles. **8.E.5A.2:** Use the rock cycle model to describe the relationship between the processes and forces that create igneous, sedimentary, and metamorphic rocks. **8.E.5C.1:** Obtain and communicate information regarding the physical and chemical properties of minerals, ores, and fossil fuels to describe their importance as Earth resources.

Earth Science: Earth's Materials and Processes

Standard 3.E.4: The student will demonstrate an understanding of the composition of Earth and the processes that shape features of Earth's surface.	
3.E.4A. Conceptual Understanding: Earth is made of materials (including rocks, minerals, soil, and water) that have distinct properties. These materials provide resources for human activities.	
Performance Indicator	**3.E.4A.2:** Develop and use models to describe and classify the pattern distribution of land and water features on Earth.
Science and Engineering Practice	**3.S.1A.2:** Develop, use, and refine models to (1) understand or represent phenomena, processes, and relationships, (2) test devices or solutions, or (3) communicate ideas to others.
Crosscutting Concepts	The following Crosscutting Concepts may be applied to the content of this indicator. For more information see page 6. Patterns Scale, Proportion, and Quantity Systems and System Models

Essential Learning Experiences:
It is essential that students obtain information from various sources, including observations, videos, pictures, maps, informational texts, expert guests, etc. about the different characteristics of water features on the Earth's surface.

It is essential that students use this information to develop models that illustrate, describe, and classify the characteristics of water features, including the following:

- There are many places on Earth where water is found. Sometimes the water is saltwater and other times it is fresh water. Most of the water on Earth is saltwater. Water is mostly in liquid form in these features, but sometimes it can be solid (ice). Earth's water features include:
- Oceans
    - Large bodies of salt water that surround a continent.
- Seas
    - Large bodies of saltwater that are often connected to an ocean.
    - May be partly or completely surrounded by land.
- Rivers
    - Large, flowing bodies of fresh water that usually empty into a sea or ocean.
- Streams
    - Small, flowing bodies of fresh water that flow into rivers.

- Lakes and Ponds
    - Usually fresh water bodies.
    - Surrounded by land.
    - Lakes are generally thought to be larger and deeper than ponds, but by definition there is no difference.
- Glaciers
    - Glaciers are huge sheets of ice that cover land.
    - They are found where temperatures are very cold, for example, high in the mountains or near the poles of Earth.

<u>It is essential</u> that students develop models that visually represent the distribution of land and different water features based on their characteristics and locations on the Earth's surface.

NOTE TO TEACHER: You may want to integrate the models the students develop for the distribution of land and water features with the models they develop to illustrate the characteristics of different landforms (**3.E.4B.1**).

Extended Learning Experiences:
The following knowledge and learning experiences are not essential to the success of this learning goal but can be used by teachers to extend the depth and rigor of student engagements.

- Students may obtain information about specific bodies of water.
- Students may develop models that represent the different environments that include these bodies of water.
- Students may use their models to compare different aquatic ecosystems.

Assessment Guidelines:
Students should engage in multiple science and engineering practices when interacting with the content outlined in this performance indicator. For further information please see SEP Support Guide at:
https://ed.sc.gov/scdoe/assets/File/instruction/standards/Science/Support%20Documents/Complete_2014SEPsGuide_SupportDoc2_0.pdf

Learning Connections	**Previous Learning Connections (K-2):** **1.E.4A.2:** Develop and use models (such as drawings or maps) to describe patterns in the distribution of land and water on Earth and classify bodies of water (including oceans, rivers and streams, lakes, and ponds). **Future Learning Connections (4-8):** **5.E.3A.1:** Construct explanations of how different landforms and surface features result from the location and movement of water on Earth's surface through watersheds (drainage basins) and rivers. **5.E.3A.2:** Develop and use models to describe and compare the characteristics and locations of the landforms on continents with those on the ocean floor (including the continental shelf and slope, the mid-ocean ridge, the rift zone, the trench, and the abyssal plain).

Earth Science: Earth's Materials and Processes

Standard 3.E.4: The student will demonstrate an understanding of the composition of Earth and the processes that shape features of Earth's surface.	
3.E.4A. Conceptual Understanding: Earth is made of materials (including rocks, minerals, soil, and water) that have distinct properties. These materials provide resources for human activities.	
Performance Indicator	**3.E.4A.3** Obtain and communicate information to exemplify how humans obtain, use, and protect renewable and nonrenewable Earth resources.
Science and Engineering Practice	**3.S.1A.8** Obtain and evaluate informational texts, observations, data collected, or discussions to (1) generate and answer questions, (2) understand phenomena, (3) develop models, or (4) support explanations, claims, or designs. Communicate observations and explanations using the conventions and expectations of oral and written language.
Crosscutting Concepts	The following Crosscutting Concepts may be applied to the content of this indicator. For more information see page 6. Structure and Function

Essential Learning Experiences:
It is essential that students obtain information from various sources, including informational texts, videos, pictures, expert guests, field studies, etc. to describe examples for the different ways humans obtain, use, and protect renewable and nonrenewable Earth resources, including the following:

- Fuels
    - Earth materials come from inside Earth and are used as fuels. For example, fuels such as oil and coal can be burned to produce heat or made into gasoline to help run cars and other vehicles.
        - These are classified as nonrenewable resources because the time it takes for these resources to develop naturally means that they cannot be replenished naturally in a time frame (millions of years) that allows for what is obtained and used to be replaced to be used again.
        - Fossil fuels can be conserved by reducing the use of these fuels, by developing more efficient ways of use less, and by switching to non-fossil fuel energy sources.
    - Water that flows downhill as a result of gravity can also be a source of energy as moving water can be used to generate electricity through spinning turbines.
        - Running water that is used to generate electricity can be considered renewable as long as the source of upstream water is restored by precipitation (rain and snow) through the water cycle.
        - Running water can be conserved by taking steps to make sure that the water quality is not harmed when it is used. Steps can also be taken to

minimize the impact of hydroelectric power generation on river habitats and ecosystems.

- Geothermal energy is produced by heat trapped deep underground and can be used to turn water into steam that is pumped through pipes to generate electricity through spinning turbines.
  - Geothermal energy is considered a renewable Earth resource as the heat underground is used to turn water to steam but the source of the heat is never actually obtained and removed.
  - Geothermal energy can be conserved by using efficient insulation that minimizes the amount of heat lost during the process of generating power.
- Energy from the Sun (though not truly considered an Earth resource) is another source of energy as this energy can be collected using solar panels and converted into electrical energy.
  - Energy from the Sun is considered renewable as that energy is constantly shining onto the Earth's surface and will continue for as long as the Sun remains in the sky (approximately another 4.5 billion years).
  - Although there is no need to actively conserve energy from the Sun, solar energy can be used as part of conservation efforts to reduce the use of other, non-renewable energy sources, like fossil fuels.

- Building structures
  - Earth materials can be obtained from Earth through mining and quarries and used to make building blocks or other building materials. For example, granite, marble, and sandstone have been used to make blocks for homes and office buildings.
    - These are classified as nonrenewable resources because the time it takes for these resources to develop naturally means that they cannot be replenished naturally in a time frame (millions of years) that allows for what is obtained and used to be replaced to be used again.
    - Earth materials used in buildings can be conserved by reusing and recycling them in order to reduce the need to acquire more Earth materials.
- Growing plants
  - Earth materials are used for growing plants. For example, soil is made up of weathered pieces of rocks, minerals, and humus, which supply water, nutrients and support for growing plants. Different types of soil are needed depending upon the type of plants that need to grow in the soil. Climate can also affect type and growth of plants.
    - Soils for growing plants can be considered renewable resources as long as efforts are made to allow the nutrients in the soil to be replenished through natural processes such as weathering, erosion, and deposition as well as the decomposition of organic materials.
    - Soil can be conserved by taking steps to replenish nutrients taken by growing plants as well as using ground cover to minimize weathering and erosion of topsoil.
  - Water is used for growing plants. For example, water can be pumped from underground sources (aquifers), collected from rivers, streams, lakes, and ponds,

and collected from rain and snow. When the water source is not near the agricultural site, it can be pumped in through irrigation.

  - Water from rain and surface water features can be considered a renewable resource as long as efforts are made to conserve water and not overuse it. Water from underground sources is considered a nonrenewable resource because of the long time it takes for underground water sources to recharge.
  - Water for growing plants can be conserved by using it more efficiently, reducing water loss from runoff and evaporation, and by planting crops that are appropriate for the environment (for example, farms in dry, arid regions should grow plants that are able to thrive with little water).
- Renewable resources are those than be replenished. Some examples include: sun, wind, replanting trees, etc. Nonrenewable resources are those that cannot be replenished and will eventually disappear. Some examples include: fossil fuels such as coal, oil, and natural gas.

Extended Learning Experiences:
The following knowledge and learning experiences are not essential to the success of this learning goal but can be used by teachers to extend the depth and rigor of student engagements.

- Students may obtain information related to other Earth materials and how humans obtain, use, and protect them.
- Students may investigate how water moving across the Earth's surface is part of the water cycle.
- Students may investigate the role fossil fuels have played in the development of the modern civilization.
- Students may investigate the impact of the overuse of fossil fuels.

Assessment Guidelines:
Students should engage in multiple science and engineering practices when interacting with the content outlined in this performance indicator. For further information please see SEP Support Guide at:
https://ed.sc.gov/scdoe/assets/File/instruction/standards/Science/Support%20Documents/Complete_2014SEPsGuide_SupportDoc2_0.pdf

Learning Connections	**Previous Learning Connections (K-2):** **1.E.4B.1:** Obtain and communicate information to summarize how natural resources are used in different ways (such as soil and water to grow plants; rocks to make roads, walls, or buildings; or sand to make glass). **1.E.4B.2:** Obtain and communicate information to explain ways natural resources can be conserved (such as reducing trash through reuse, recycling, or replanting trees). **Future Learning Connections (4-8):** **5.E.3B.3:** Construct scientific arguments to support claims that human activities (such as conservation efforts or pollution) affect the land and oceans

	of Earth. **5.E.3B.4:** Define problems caused by natural processes or human activities and test possible solutions to reduce the impact on landforms and the ocean shore zone. **8.E.5C.1:** Obtain and communicate information regarding the physical and chemical properties of minerals, ores, and fossil fuels to describe their importance as Earth resources.

Earth Science: Earth's Materials and Processes

Standard 3.E.4: The student will demonstrate an understanding of the composition of Earth and the processes that shape features of Earth's surface.	
3.E.4B. Conceptual Understanding: Earth's surface has changed over time by natural processes and by human activities. Humans can take steps to reduce the impact of these changes.	
Performance Indicator	**3.E.4B.1:** Develop and use models to describe the characteristics of Earth's continental landforms and classify landforms as volcanoes, mountains, valleys, canyons, plains, and islands.
Science and Engineering Practice	**3.S.1A.2** Develop, use, and refine models to (1) understand or represent phenomena, processes, and relationships, (2) test devices or solutions, or (3) communicate ideas to others.
Crosscutting Concepts	The following Crosscutting Concepts may be applied to the content of this indicator. For more information see page 6. Patterns Scale, Proportion, and Quantity Systems and System Models

Essential Learning Experiences:
It is essential that students obtain information from various sources, including observations, videos, pictures, maps, informational texts, expert guests, field studies, etc. about the characteristics and descriptions of different continental landforms.

It is essential that students use this information to develop models that visibly illustrate different landforms and can be used to describe and classify these landforms based on their characteristics, including the following:

- Volcanoes
    - An opening in Earth's surface from which lava flows.
    - As the lava hardens and builds up, a volcanic mountain forms.
- Mountains
    - A place on Earth's surface where the land is much higher than the land that surrounds it.
    - Some mountains are tall and rocky and others are rounded and covered with trees.
    - A mountain area that has a flat top is called a plateau.
- Valleys
    - A lowland area between higher areas such as mountains.
    - Sometimes rivers can wear away land to form valleys.
- Canyons
    - A deep valley with very steep sides.
    - They are often carved from the Earth by a river.

- Plains
    - A flat region of lowlands. Occurs at the bottoms of valleys.
- Islands
    - An area of land that is entirely surrounded by water.
    - Sometimes islands are located in lakes, or they may be out from the seashore as barrier islands.

NOTE TO TEACHER: You may want to integrate the models the students develop for landforms with the models they develop for the distribution of land and water features (**3.E.4A.2**).

Extended Learning Experiences:
The following knowledge and learning experiences are not essential to the success of this learning goal but can be used by teachers to extend the depth and rigor of student engagements.
- Students may obtain information to identify and model specific, unique landforms.
- Students may use their models to compare landforms with ocean floor features.
- Students may use their models to demonstrate how specific landforms develop through volcanic activity, mountain building process, and plate tectonics.

Assessment Guidelines:
Students should engage in multiple science and engineering practices when interacting with the content outlined in this performance indicator. For further information please see SEP Support Guide at:
https://ed.sc.gov/scdoe/assets/File/instruction/standards/Science/Support%20Documents/Complete_2014SEPsGuide_SupportDoc2_0.pdf

Learning Connections	**Previous Learning Connections (K-2):** **1.E.4A.2:** Develop and use models (such as drawings or maps) to describe patterns in the distribution of land and water on Earth and classify bodies of water (including oceans, rivers and streams, lakes, and ponds). **Future Learning Connections (4-8):** **5.E.3A.2:** Develop and use models to describe and compare the characteristics and locations of the landforms on continents with those on the ocean floor (including the continental shelf and slope, the mid-ocean ridge, the rift zone, the trench, and the abyssal plain). **8.E.5A.4:** Construct explanations for how the theory of plate tectonics accounts for (1) the motion of lithospheric plates, (2) the geologic activities at plate boundaries, and (3) the changes in landform areas over geologic time. **8.E.5A.5:** Construct and analyze scientific arguments to support claims that plate tectonics accounts for (1) the distribution of fossils on different continents, (2) the occurrence of earthquakes, and (3) continental and ocean floor features (including mountains, volcanoes, faults and trenches).

Earth Science: Earth's Materials and Processes

Standard 3.E.4: The student will demonstrate an understanding of the composition of Earth and the processes that shape features of Earth's surface.	
3.E.4B. Conceptual Understanding: Earth's surface has changed over time by natural processes and by human activities. Humans can take steps to reduce the impact of these changes.	
Performance Indicator	**3.E.4B.2:** Plan and conduct scientific investigations to determine how natural processes (including weathering, erosion, and gravity) shape Earth's surface.
Science and Engineering Practice	**3.S.1A.3:** Plan and conduct scientific investigations to answer questions, test predictions and develop explanations: (1) formulate scientific questions and predict possible outcomes, (2) identify materials, procedures, and variables, (3) select and use appropriate tools or instruments to collect qualitative and quantitative data, and (4) record and represent data in an appropriate form. Use appropriate safety procedures.
Crosscutting Concepts	The following Crosscutting Concepts may be applied to the content of this indicator. For more information see page 6. Patterns Cause and Effect Stability and Change

Essential Learning Experiences:
It is essential that students plan and carry out investigations to collect data for how the processes of weathering, erosion, deposition, and gravity shape the Earth's surface, including the following steps:

- Generate scientifically testable questions about how moving water, wind, and gravity can change the shape of landforms on the Earth's surface.
- Plan the steps of an investigation to collect data from observations and measurements for how moving water, wind, and gravity change the shape of landforms, including the following:
  - Weathering
    - When weathering is occurring, Earth materials, like rocks, are being broken apart. Little or big cracks in the rock are evidence that weathering is taking place. Rocks and landforms that have been worn smooth are also evidence that weathering has taken place.
    - Weathering can change the shape of the Earth's surface by breaking down the rocks and soils that make up landforms.
    - Moving water can cause weathering. As water flows over the surface of the Earth (from rivers, streams, waves, runoff, etc…), the force of the water and the sediments it is carrying can break down the rocks and soils its flows over and change the shape of the Earth's surface.

        - Wind can cause weather. As wind blows, the force of the sediments it carries can break down rocks and soils, changing the shape of the Earth's surface.
        - Glaciers can cause weathering as the slow moving ice travels across the Earth's surface, it crushes any rocks in its patch, breaking them into smaller pieces and grinding them into fine powder (silt).
    - Erosion
        - When erosion is occurring, Earth materials, like rock, sand, and soil, are being carried away from their original location. Water and wind are often the causes for erosion.
        - Moving water (rivers, streams, runoff, waves, etc…) can cause erosion as the pieces of rock and soil (broken down by weathering) are carried away by the moving water.
        - Wind can cause erosion as moving air carries away the weathered pieces of rock and soil.
        - Glaciers can cause erosion as the moving ice pushes rocks that have been crushed by the ice to the side or out ahead of the front of the glacier.
        - Gravity can cause erosion through the process of mass movement. Mass movement is when rocks and soils on a slope are no longer able to stay in place and begin to move down the hill or mountain side as a result of gravity. Sometimes this happens slowly and sometimes it can happen very fast, such as with landslides or mudslides.
    - Deposition
        - When deposition is occurring, Earth materials that have been eroded are put in a new location.
        - When the wind stops blowing, sand and soil may be put down in piles as large as dunes.
        - Water may deposit its material at the end of a river and form a delta.
        - Glaciers deposit their eroded materials either along the sides or at the very front once they begin retreating (melting).
        - Gravity deposits material when the eroded debris reaches the bottom of the slope.
- Collect and organize data to describe how moving water, wind, and gravity acts through the processes of weather, erosion, and deposition.

NOTE TO TEACHER: Students may use stream tables as part of their investigations into how moving water, wind, and gravity cause weathering, erosion, and deposition.

NOTE TO TEACHER: In addition to using tools such as stream tables, it would be appropriate for students to collect data for different processes of weathering, erosion, and deposition through videos and pictures that show the occurrence of these processes in real life.

Extended Learning Experiences:
The following knowledge and learning experiences are not essential to the success of this learning goal but can be used by teachers to extend the depth and rigor of student engagements.

- Students may investigate other forms of weathering, including chemical and biological weathering agents.
- Students may investigate weathering, erosion, and deposition in the context of different natural events, such as earthquakes and storms.
- Students may describe the ways that weathering, erosion, and deposition act as destructive and constructive processes in the ways they affect the Earth's surface.

Assessment Guidelines:
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https://ed.sc.gov/scdoe/assets/File/instruction/standards/Science/Support%20Documents/Complete_2014SEPsGuide_SupportDoc2_0.pdf

Learning Connections	**Previous Learning Connections (K-2):** **1.E.4A.3:** Conduct structured investigations to answer questions about how the movement of water can change the shape of the land. **Future Learning Connections (4-8):** **5.E.3A.1:** Construct explanations of how different landforms and surface features result from the location and movement of water on Earth's surface through watersheds (drainage basins) and rivers. **5.E.3B.1:** Analyze and interpret data to describe and predict how natural processes (such as weathering, erosion, deposition, earthquakes, tsunamis, hurricanes, or storms) affect Earth's surface. **5.E.3B.2:** Develop and use models to explain the effect of the movement of ocean water (including waves, currents, and tides) on the ocean shore zone (including beaches, barrier islands, estuaries, and inlets). **8.E.5A.1:** Develop and use models to explain how the processes of weathering, erosion, and deposition change surface features in the environment.

Earth Science: Earth's Materials and Processes

Standard 3.E.4: The student will demonstrate an understanding of the composition of Earth and the processes that shape features of Earth's surface.	
3.E.4B. Conceptual Understanding: Earth's surface has changed over time by natural processes and by human activities. Humans can take steps to reduce the impact of these changes.	
Performance Indicator	**3.E.4B.3**: Obtain and communicate information to explain how natural events (such as fires, landslides, earthquakes, volcanic eruptions, or floods) and human activities (such as farming, mining, or building) impact the environment.
Science and Engineering Practice	**3.S.1A.8**: Obtain and evaluate informational texts, observations, data collected, or discussions to (1) generate and answer questions, (2) understand phenomena, (3) develop models, or (4) support explanations, claims, or designs. Communicate observations and explanations using the conventions and expectations of oral and written language.
Crosscutting Concepts	The following Crosscutting Concepts may be applied to the content of this indicator. For more information see page 6. Cause and Effect Stability and Change

Essential Learning Experiences:
It is essential that students obtain information from various sources, including observations, pictures, videos, informational texts, expert guests, field studies, etc. about how different natural events and human activities impact the environment and the Earth's surface.

It is essential that students use this information to communicate the cause and effect relationships between the different natural events and human activities and the impact they have on the Earth's surface and environment, including the following:

- Natural events that impact the Earth's surface and environment are phenomena that are caused by natural processes. Human activities that impact the Earth's surface and environment are the result of human actions.
- The following are different natural events caused by natural processes.
  - Landslides
    - When a landslide is occurring, Earth materials, like rock, sand, and soil, on the side of a slope or cliff drop down to a lower location. Water soaking into the ground often makes this happen.

- Volcanic Eruptions
  - When a volcanic eruption is occurring, Earth material called lava comes out of the volcano, and flows down the side of the volcanic mountain (or is sent up into the air and lands nearby) where it hardens. The hardened volcanic rock forms new Earth material and often makes the volcanic mountain larger.
- Floods
  - When a flood is occurring, a lot of water causes rivers and streams to overflow their banks over the surrounding land around them. Heavy rainfall in the area is usually the cause of a flood.
- Earthquakes
  - When an earthquake is occurring, the surface of the ground shakes and rolls causing damage to the Earth's surface, like cracks and other openings, and damage to roads and buildings.
- Fires
  - When fires occur, they can impact the environment by damaging or destroying natural habitats as well as human communities. Fires also destroy ground cover that can result in increased erosion. When fires destroy habitats, new habitats can develop as a result. Additionally, some plants require the heat from wildfires to spread their seeds.
  - Wildfires often happen in areas where it is very dry or where old, dead plant materials has accumulated over a period of time.
  - Fires can be either natural events caused by lightning strikes during storms or human activities caused by people accidentally or deliberately setting fires that spread out of control.

- The following are different human impacts that are the result of human actions.
  - Farming
    - Farming can impact the Earth's surface in different ways. Farming often requires that land be cleared of existing plants and trees. Removing plants and trees can increase weather and erosion of soils on the farmland. Sometimes, farms use chemical fertilizers that can wash into nearby bodies of water through runoff. Crops can also remove essential nutrients from the soil, making it harder to grow new crops on that land in the future.
  - Building
    - Buildings can impact the Earth's surface in different ways. Land is often cleared and leveled (made flat) before a new building is constructed. This can increase weathering and erosion of soils on the cleared land. Many of the materials used in buildings are Earth materials that must be mined from within the Earth (such as sandstone, granite, marble, etc…)
  - Mining
    - Mining involves removing Earth materials from the surface of the Earth or from beneath the surface of the Earth. Mining can change the shape of the Earth's surface and can create waste materials (left over Earth materials that are not wanted or needed). Earth materials that are mined are non-renewable. Some mining processes use harsh, dangerous chemicals.

Extended Learning Experiences:
The following knowledge and learning experiences are not essential to the success of this learning goal but can be used by teachers to extend the depth and rigor of student engagements.

- Students may obtain information to explain how and why different natural events, such as earthquakes and volcanic eruptions occur.
- Students may obtain information to explain the impacts of different natural events and human activities beyond those listed in the performance indicator.
- Students may obtain information to describe how environments can be restored following these impacts.

Assessment Guidelines:
Students should engage in multiple science and engineering practices when interacting with the content outlined in this performance indicator. For further information please see SEP Support Guide at:
https://ed.sc.gov/scdoe/assets/File/instruction/standards/Science/Support%20Documents/Complete_2014SEPsGuide_SupportDoc2_0.pdf

Learning Connections	**Future Learning Connections (4-8):** **5.E.3B.1:** Analyze and interpret data to describe and predict how natural processes (such as weathering, erosion, deposition, earthquakes, tsunamis, hurricanes, or storms) affect Earth's surface. **5.E.3B.3:** Construct scientific arguments to support claims that human activities (such as conservation efforts or pollution) affect the land and oceans of Earth. **8.E.5B.1:** Analyze and interpret data to describe patterns in the location of volcanoes and earthquakes related to tectonic plate boundaries, interactions, and hot spots. **8.E.5B.2:** Construct explanations of how forces inside Earth result in earthquakes and volcanoes.

Earth Science: Earth's Materials and Processes

Standard 3.E.4: The student will demonstrate an understanding of the composition of Earth and the processes that shape features of Earth's surface.	
3.E.4B. Conceptual Understanding: Earth's surface has changed over time by natural processes and by human activities. Humans can take steps to reduce the impact of these changes.	
Performance Indicator	**3.E.4B.4:** Define problems caused by a natural event or human activity and design devices or solutions to reduce the impact on the environment.
Science and Engineering Practice	**3.S.1B.1:** Construct devices or design solutions to solve specific problems or needs: (1) ask questions to identify problems or needs, (2) ask questions about the criteria and constraints of the devices or solutions, (3) generate and communicate ideas for possible devices or solutions, (4) build and test devices or solutions, (5) determine if the devices or solutions solved the problem and refine the design if needed, and (6) communicate the results.
Crosscutting Concepts	The following Crosscutting Concepts may be applied to the content of this indicator. For more information see page 6. Energy and Matter Structure and Function

Essential Learning Experiences:
It is essential that students obtain information from different sources, including observations, informational texts, videos, etc. to identify and describe problems related the impact of natural events and human activities (this can include the natural events and human activities identified under **3.E.4B.3**).

It is essential that students engage in the design process to design and test different solutions to reduce the negative impact of different natural events and human activities on the environment and Earth's surface, including the following steps:

- Asking questions about the impact of different natural events and human activities on the Earth's surface and the environment, including the following:
    - Fires
    - Landslides
    - Earthquakes
    - Volcanic eruptions
    - Floods
    - Farming
    - Building
    - Mining

- Designing devices or devising solutions to these problems based on applying an understanding the impact of these natural events and human activities on the Earth's surface and environment.
    - Some example of solutions students may devise could include:
        - Fires: Clearing away old, dead plant material that can act as fuel for wildfires. Educating people about the dangers of unattended fires.
        - Landslides: Posting warning signs in areas prone to landslides. Planting ground cover to help reduce erosion.
        - Earthquakes: Educating people about what to do in the event of an earthquake. Building structures that are designed to withstand shaking during an earthquake.
        - Volcanic eruptions: Educating people about what to do in the event of a volcanic eruption. Monitoring volcanoes to have an early warning system.
        - Floods: Educating people about what to do in the event of a flood if they live in a flood-prone area. Leaving undeveloped areas natural so that water soaks in instead of becoming more runoff.
        - Farming: Rotating crops to reduce the impact crops have on soil nutrients. Preventing fields from going barren to reduce the impact of surface erosion.
        - Building: Using reused and recycled materials that reduce the impact on the environment. Building in a way that does not damage the existing environment.
        - Mining: Reducing the use of harsh chemicals during the mining process. Reclaiming and restoring the land after the area is no longer used for mining.
- Testing their devices or solutions in order to collect data related to the how effective their solutions are at reducing the impact of these natural events and human activities.
- Analyzing and interpreting their data to determine if their solutions are successful how well their solutions reduced the impact of these problems.
- Using their data to refine and retest their designs (if necessary).
- Communicating their solutions.

Extended Learning Experiences:
The following knowledge and learning experiences are not essential to the success of this learning goal but can be used by teachers to extend the depth and rigor of student engagements.

- Students may define problems and design solutions related to additional natural events and human activities beyond those listed in the essential learning experiences above.

Assessment Guidelines:
Students should engage in multiple science and engineering practices when interacting with the content outlined in this performance indicator. For further information please see SEP Support Guide at:
https://ed.sc.gov/scdoe/assets/File/instruction/standards/Science/Support%20Documents/Complete_2014SEPsGuide_SupportDoc2_0.pdf

Learning Connections	**Future Learning Connections (4-8):** **5.E.3B.3:** Construct scientific arguments to support claims that human activities (such as conservation efforts or pollution) affect the land and oceans of Earth. **5.E.3B.4:** Define problems caused by natural processes or human activities and test possible solutions to reduce the impact on landforms and the ocean shore zone. **8.E.5B.3:** Define problems that may be caused by a catastrophic event resulting from plate movements and design possible devices or solutions to minimize the effects of that event on Earth's surface and/or human structures.

Life Science: Environments and Habitats

Standard 3.L.5: The student will demonstrate an understanding of how the characteristics and changes in environments and habitats affect the diversity of organisms.	
3.L.5A. Conceptual Understanding: The characteristics of an environment (including physical characteristics, temperature, availability of resources, or the kinds and numbers of organisms present) influence the diversity of organisms that live there. Organisms can survive only in environments where their basic needs are met. All organisms need energy to live and grow. This energy is obtained from food. The role an organism serves in an ecosystem can be described by the way in which it gets its energy.	
Performance Indicator	**3.L.5A.1:** Analyze and interpret data about the characteristics of environments (including salt and fresh water, deserts, grasslands, forests, rain forests, and polar lands) to describe how the environment supports a variety of organisms.
Science and Engineering Practice	**3.S.1A.4:** Analyze and interpret data from observations, measurements, or investigations to understand patterns and meanings.
Crosscutting Concepts	The following Crosscutting Concepts may be applied to the content of this indicator. For more information see page 6. Patterns Cause and Effect

Essential Learning Experiences:
It is essential that students collect, analyze, and interpret data from various sources, including informational texts, online resources, videos, pictures, expert speakers, field studies, etc… to describe the characteristics of different environments and to explain how the environments are able to support the organisms that live there. For example:

- Organisms survive best in certain environments in which their physical factors (light, temperature, water, soil, and space for shelter and reproduction) are present. Each environment has a unique combination of these factors that allows certain organisms to survive there.
- Saltwater:
    - Oceans
        - Oceans are large bodies of salt water divided by continents. Since ocean water is constantly moving, the characteristics of the water are constantly changing. The amount of sunlight varies by depth, hence temperature also varies by depth. The amount of salt, other minerals and additives also varies based on what lives within the water and sometimes what pollution has been placed in the water.

        - Most organisms live in the shallow portion of the ocean because sunlight can penetrate the shallow parts of the ocean are drifters (jellyfish or seaweed), swimmers (fish), crawlers (crabs), and those anchored to the sea floor (corals).
        - Some organisms live in the open ocean, near the surface of the ocean, or in the deep ocean bottom. Plankton float in the upper regions of the water. Some organisms swim to the surface for food or air (whales, turtles, dolphins) while other organisms stay closer to the bottom of the ocean (octopus).
    - Estuaries:
        - Estuaries are found where freshwater rivers and salt water meets.
        - Estuaries are saltier than a river but not as salty as the ocean. The amount of salt (salinity) changes with the tides.
        - Estuaries contain salt marshes with grasses and marsh plants adapted to this changing water. Examples of animals that live in the estuaries/salt marshes include crabs, shrimp, birds (i.e. blue heron and egrets), and muskrats
- Fresh Water:
    - Lakes and Ponds
        - Lakes and ponds are bodies of freshwater that are surrounded by land.
        - Ponds are usually shallower than lakes and the temperature of the water usually stays the same from top to bottom.
        - Plants and algae usually grow along the edges where the water is shallow.
        - Examples of animals that live in freshwater include fish, amphibians, ducks, turtles, or beavers.
    - Rivers and Streams
        - Rivers and streams are moving bodies of water that can be found in warm or cold areas.
        - The water in rivers and streams can be fast or slow moving.
        - The speed of the water flow determines the types of plants and animals that live in or use the rivers and streams.
        - There are many plants (bushes and trees) along the banks as well as plants growing in the water.
        - Many animals (i.e. fish, crayfish, snakes, worms, and insects) use these plants for food or shelter.
    - Swamps
        - Swamps are located in areas with warm temperatures.
        - Since swamps have thick plant growth such as ferns and reeds, small bushes and small trees do not thrive due to lack of sunlight.
        - The surviving trees are very tall, reaching for sunlight. Standing water causes the trunks of the trees to spread out to provide support.
            - For example the cypress, a tree found in the swamp, has “knees” or roots that come to the surface.
        - The animals that live in the swamp are very adapted to a water environment (i.e. alligators, turtles, ducks, and egrets).

- Terrestrial:
  - Deserts
    - Are dry with extreme temperature ranges.
    - Some deserts are covered with sand.
    - In some deserts during the day, it is very hot, whereas the nights are very cold.
    - Most of the plants (i.e. cacti) and animals (i.e. lizards, scorpions, and rabbits) have ways to conserve moisture; are able to go long periods without water; or can withstand the extreme temperature changes.
    - Most of the animals are active during the night when temperatures are cooler.
  - Grasslands
    - Have fertile soil and are covered with tall grasses.
    - They usually get a moderate amount of rain, but less than forests.
    - Temperatures may also vary depending on where the grassland is located.
    - Some examples of animals that live in the grasslands are prairie dogs, bison, and grasshoppers.
  - Forests
    - Have many trees (with needles or with leaves), shrubs, grasses and ferns, and a variety of animals.
    - They usually get more rain than grasslands.
    - Temperatures in the forests may vary depending on where the forest is located.
  - Rainforests
    - Are very humid and warm and have an abundance of rain that leads to lush plant growth (for example, tall trees, vines, ferns, orchids, and other colorful flowering plants).
    - Animals that live in the rainforest are often very colorful, to match the varieties of plants (for camouflage)
    - Many animals are also tree dwellers (i.e. birds and lizards), moving across the canopy rather than traveling on the ground.
  - Polar Lands
    - Are usually very cold and the amount of daylight varies throughout the year.
    - Winters are mostly dark with only moonlight and starlight, whereas in the summers, there is up to 24 hours of daylight. There is little variety of plant life (mosses, for example).
    - Animals that live in the polar region (for example, reindeer, seals, polar bears, arctic foxes, and penguins) are adapted to these conditions by having extra fat or thick fur for insulation.

Summary of Characteristics of Distinct Environments

	Temperature	**Water**	**Light**	**Plant Life (examples)**	**Animal Life (examples)**
Oceans	cold to warm (depending on location)	extremely salty	lots of light near the surface, less light at depth	plankton	whales, turtles, sharks, jellyfish, crabs
Estuaries/ Salt Marsh	cold to warm (depending on location)	brackish (partially salty)	abundant light on land surfaces; light is filtered through water	cordgrass, trees, shrubs	crabs, shrimp, water birds, deer, snails
Lakes and Ponds	cold to warm (depending on the location)	freshwater	lots of light near the surface, less light at depth	algae, shallow water grasses	fish, amphibians, ducks, turtles, beavers
Rivers and Streams	cold to warm (depending on location)	freshwater	abundant light on land surfaces; light is filtered through water	bushes, trees on banks, water plants	fish, crayfish, snakes, insects
Swamps	warm-hot	freshwater	light is filtered through trees to the swamp floor	cypress trees, ferns, water lilies	alligators, water birds, turtles
Deserts	hot and dry during the day, cold at night	dry, limited rainfall	abundant light	cactus	lizards, scorpions, rabbits
Grasslands	cool to warm (depending on location)	medium amount of rain	abundant light	grasses	prairie dogs, bison, grasshoppers
Forest	cold to warm (depending on location)	medium amount of rain	abundant light on tree canopy; less light is filtered to the forest floor through the trees	trees with leaves or needles, shrubs, grasses, ferns	birds, foxes, rabbits, bears, snakes, deer
Tropical Rainforest	hot and humid	frequent rain; large amounts	abundant light on tree canopy; less light is filtered to the forest floor through the trees	abundant trees, vines, lush growth	birds, frogs, monkeys, snakes

Polar Lands	cold	dry/frozen	amount of daylight varies throughout the year	lichens, mosses	seals, polar bears (Arctic), penguins (Antarctic)

Extended Learning Experiences:
The following knowledge and learning experiences are not essential to the success of this learning goal but can be used by teachers to extend the depth and rigor of student engagements.

- Students may collect data from additional habitats in addition to those listed above.
- Students may collect data to distinguish between variations of specific environments, such as different types of forests, different zones within the ocean, etc.

Assessment Guidelines:
Students should engage in multiple science and engineering practices when interacting with the content outlined in this performance indicator. For further information please see SEP Support Guide at:
https://ed.sc.gov/scdoe/assets/File/instruction/standards/Science/Support%20Documents/Complete_2014SEPsGuide_SupportDoc2_0.pdf

Learning Connections	**Previous Learning Connections (K-2):** **K.L.2A.2:** Conduct structured investigations to determine what plants need to live and grow (including water and light). **K.L.2A.5:** Construct explanations from observations of what animals need to survive and grow (including air, water, nutrients, and shelter). **K.L.2A.6:** Obtain and communicate information about the needs of organisms to explain why they live in particular areas. **1.L.5B.1:** Conduct structured investigations to answer questions about what plants need to live and grow (including air, water, sunlight, minerals, and space). **1.L.5B.2:** Develop and use models to compare how the different characteristics of plants help them survive in distinct environments (including deserts, forests, and grasslands). **2.L.5B.1:** Obtain and communicate information to describe and compare how animals interact with other animals and plants in the environment. **2.L.5B.2:** Develop and use models to exemplify characteristics of animals that help them survive in distinct environments (such as salt and freshwater, deserts, forests, wetlands, or polar lands). **Future Learning Connections (4-8):** **5.L.4A.1:** Analyze and interpret data to summarize the abiotic factors (including quantity of light and water, range of temperature, salinity, and soil composition) of different terrestrial ecosystems and aquatic ecosystems. **5.L.4A.2:** Obtain and communicate information to describe and compare the biotic factors (including individual organisms, populations, and communities)

	of different terrestrial and aquatic ecosystems. **5.L.4B.3:** Construct explanations for how organisms interact with each other in an ecosystem (including predators and prey, and parasites and hosts). **5.L.4B.4:** Construct scientific arguments to explain how limiting factors (including food, water, space, and shelter) or a newly introduced organism can affect an ecosystem. **7.EC.5A.3:** Analyze and interpret data to predict changes in the number of organisms within a population when certain changes occur to the physical environment (such as changes due to natural hazards or limiting factors). **7.EC.5B.1:** Develop and use models to explain how organisms interact in a competitive or mutually beneficial relationship for food, shelter, or space (including competition, mutualism, commensalism, parasitism, and predator-prey relationships). **7.EC.5B.3:** Analyze and interpret data to predict how changes in the number of organisms of one species affects the balance of an ecosystem. **7.EC.5B.4:** Define problems caused by the introduction of a new species in an environment and design devices or solutions to minimize the impact(s) to the balance of an ecosystem.

Life Science: Environments and Habitats

Standard 3.L.5: The student will demonstrate an understanding of how the characteristics and changes in environments and habitats affect the diversity of organisms.	
3.L.5A. Conceptual Understanding: The characteristics of an environment (including physical characteristics, temperature, availability of resources, or the kinds and numbers of organisms present) influence the diversity of organisms that live there. Organisms can survive only in environments where their basic needs are met. All organisms need energy to live and grow. This energy is obtained from food. The role an organism serves in an ecosystem can be described by the way in which it gets its energy.	
Performance Indicator	**3.L.5A.2:** Develop and use a food chain model to classify organisms as producers, consumers, and decomposers and to describe how organisms obtain energy.
Science and Engineering Practice	**3.S.1A.2:** Develop, use, and refine models to (1) understand or represent phenomena, processes, and relationships, (2) test devices or solutions, or (3) communicate ideas to others.
Crosscutting Concepts	The following Crosscutting Concepts may be applied to the content of this indicator. For more information see page 6. Systems and System Models Energy and Matter

Essential Learning Experiences:
It is essential that students obtain information from different sources, including observations, habitat data, informational texts, videos, pictures, expert speakers, field studies, etc. about how organisms obtain their energy and develop food chain models that can be used to illustrate how different organisms obtain their energy and to classify organisms as producers, consumers, and decomposers. For example:

- All organisms need energy to survive. Energy gives the organism its ability to do the things it needs to do to survive. In most habitats, the sun provides the initial energy for the plants, which is passed from plants (producers) to animals (consumers) when animals eat the plants.
- Food Chains:
  - When scientists describe the way energy is passed from one organism to another they use a model called a food chain.
  - A food chain uses arrows to show the direction of energy flow and usually contains no more than six organisms.
  - Example of a grassland food chain
- Classification of plants and animals in a food chain:
  - Producers: Plants that use energy from the Sun to make their own food are classified as producers.

- Consumers: Animals that get their energy by eating other plants and/or animals are classified as consumers.
- Decomposers: Organisms that get their energy by breaking down dead plants and animals are classified as decomposers. Mushrooms are a type of fungi that are classified as decomposers.
  - Decomposers are not always illustrated on a food chain model because decomposers can get their energy from many different producers and consumers on a particular food chain.

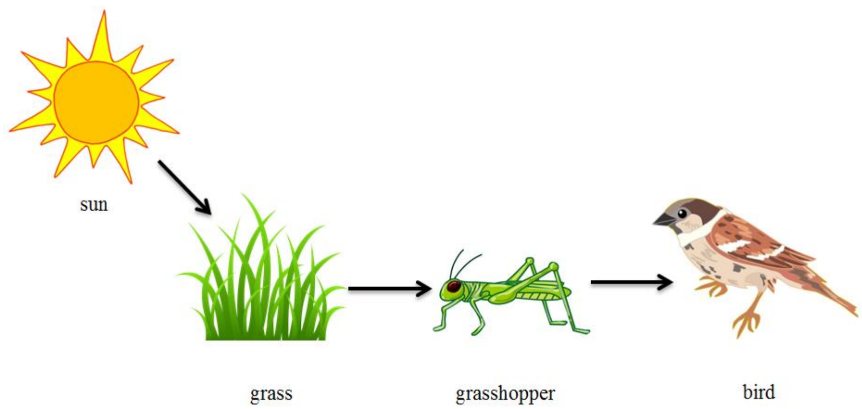

Figure 2. Food chain (SCDE, 2018).

Extended Learning Experiences:
The following knowledge and learning experiences are not essential to the success of this learning goal but can be used by teachers to extend the depth and rigor of student engagements.

- Students may develop multiple food chain models to illustrate how together they form a food web.
- Students may use their models to identify the specific role of consumers based on what they eat (herbivores, carnivores, omnivores).
- Students may use their models to identify consumers are primary, secondary, tertiary consumers.
- Students may use their models to identify specific relationships, such as predator-prey.

Assessment Guidelines:
Students should engage in multiple science and engineering practices when interacting with the content outlined in this performance indicator. (See SEP Support document.)

Learning Connections	**Previous Learning Connections (K-2):** **K.L.2A.2:** Conduct structured investigations to determine what plants need to live and grow (including water and light). **K.L.2A.5:** Construct explanations from observations of what animals need to survive and grow (including air, water, nutrients, and shelter). **1.L.5B.1:** Conduct structured investigations to answer questions about what

	plants need to live and grow (including air, water, sunlight, minerals, and space). **2.L.5B.1:** Obtain and communicate information to describe and compare how animals interact with other animals and plants in the environment. **Future Learning Connections (4-8):** **5.L.4B.1:** Analyze and interpret data to explain how organisms obtain their energy and classify an organisms as producers, consumers (including herbivore, carnivore, and omnivore), or decomposers (such as fungi and bacteria). **5.L.4B.2:** Develop and use models of food chains and food webs to describe the flow of energy in an ecosystem. **5.L.4B.3:** Construct explanations for how organisms interact with each other in an ecosystem (including predators and prey, and parasites and hosts). **7.EC.5B.1:** Develop and use models to explain how organisms interact in a competitive or mutually beneficial relationship for food, shelter, or space (including competition, mutualism, commensalism, parasitism, and predator-prey relationships). **7.EC.5B.2:** Develop and use models (food webs and energy pyramids) to exemplify how the transfer of energy in an ecosystem supports the concept that energy is conserved.

Life Science: Environments and Habitats

Standard 3.L.5: The student will demonstrate an understanding of how the characteristics and changes in environments and habitats affect the diversity of organisms.	
3.L.5B. Conceptual Understanding: When the environment or habitat changes, some plants and animals survive and reproduce, some move to new locations, and some die. Fossils can be used to infer characteristics of environments from long ago.	
Performance Indicator	**3.L.5B.1:** Obtain and communicate information to explain how changes in habitats (such as those that occur naturally or those caused by organisms) can be beneficial or harmful to the organisms that live there.
Science and Engineering Practice	**3.S.1A.8:** Obtain and evaluate informational texts, observations, data collected, or discussions to (1) generate and answer questions, (2) understand phenomena, (3) develop models, or (4) support explanations, claims, or designs. Communicate observations and explanations using the conventions and expectations of oral and written language.
Crosscutting Concepts	The following Crosscutting Concepts may be applied to the content of this indicator. For more information see page 6. Cause and Effect Stability and Change

Essential Learning Experiences:
It is essential that students obtain information from various sources, including observations, informational texts, videos, pictures, expert speakers, field studies, etc… to construct explanations for how some changes in habitats can be beneficial to the organisms that live there and some changes in habitats can be harmful to the organisms that live there. For example:

- Habitats change due to natural causes or actions of organisms and those changes may be helpful or harmful to the organisms that live there. All organisms (including humans) change the environment in helpful or harmful ways (see table below). Natural changes in the environment include floods, fires (due to lightning), droughts, landslides, volcanic eruptions, and earthquakes. Changes to an environment can also be caused by human carelessness, urbanization, pollutants, or the introduction of non-native species.

Actions of Organisms	Harmful Effect	Beneficial Effect
humans pollute the air with emissions from vehicles and factories	organisms breathing unclean air may become sick or die	None
humans cut down trees to build homes	animals struggle to find trees and plants for food and shelter; there are less trees to clean the air	plants and animals that thrive in grassland areas have new areas for shelter and space
humans pollute the water with toxic chemicals and trash	drinking water for humans and animals is poor quality; plants and animals that live in the water are harmed	None
herd animals (cows, etc) may overgraze the land	land with less or no grass can be easily eroded by wind and water; animals may pollute streams or lakes with their droppings	herd animals fertilize the land with their droppings which lead to new plant growth
humans dig mines in the ground or inside mountains	sinkholes can form, swallowing large areas of land; trees are logged to create areas for dumping debris from the mine; water can be polluted by chemical runoff from mines	Extract metals and minerals to build things; make jewelry; make medicines and materials, etc.
beavers create dams which block the flow of water	water does not reach plants or animals downstream who depend on it for survival	dams create pond environments in which new plants and animals can survive
due to lack of resources, animals migrate to new areas	there is more competition for space and food	None
Farmers/companies replanting fields with the same crop repeatedly	Long term harm – depleting soil of minerals	Short term benefit – provide food and/or resources

Natural Occurrences	Harmful Effect	Helpful Effect
floods	destroys ecosystems on the land which cause animals to struggle to meet basic needs (food, shelter, space, etc.)	floods carry and deposit nutrients that enrich soil so that new plants can grow
fires	destroy plants and trees which are sources of food and shelter	benefits plants by adding nutrients to the soil; removes dead and decaying plants; eliminates dense foliage, allowing seeds to grow and thrive; restores plant nutrients to the soil
droughts	plants and trees may die due to lack of water; organisms that rely on the plants and trees for food may die as a result	in wetlands/marshes, droughts allow these areas to begin to dry out, causing new plant growth
landslides	destroys habitats	makes uninhabitable environments more easily accessible; make new areas for plants and animals to grow
volcanic eruptions	destroy entire ecosystems including all plants and animals; make the air difficult to breathe nearby	volcanic ash contains nutrients that enrich the soil which will help new plants grow; volcanic rocks are often used as building materials
earthquakes	earthquakes can trigger landslides, which can destroy plant and animal habitats	can make natural resources easier to access

NOTE TO TEACHER: Some of the natural changes listed above are covered in **3E.4B.3**.

Extended Learning Experiences:
The following knowledge and learning experiences are not essential to the success of this learning goal but can be used by teachers to extend the depth and rigor of student engagements.

- Students may obtain information related to other factors that can impact habitats and the organisms that live there, such as climate change, acid rain, etc…
- Students may obtain information related to the specific abiotic and biotic factors for a given habitat.
- Students may obtain information related to the impact of invasive species.
- Students may obtain information related to how changes impact specific limiting factors.

Assessment Guidelines:
Students should engage in multiple science and engineering practices when interacting with the content outlined in this performance indicator. For further information please see SEP Support Guide at:
https://ed.sc.gov/scdoe/assets/File/instruction/standards/Science/Support%20Documents/Complete_2014SEPsGuide_SupportDoc2_0.pdf

Learning Connections	**Previous Learning Connections (K-2):** **1.L.5B.3:** Analyze and interpret data from observations to describe how changes in the environment cause plants to respond in different ways (such as turning leaves toward the Sun, leaves changing color, leaves wilting, or trees shedding leaves). **2.L.5B.3:** Analyze and interpret data from observations to describe how animals respond to changes in their environment (such as changes in food availability, water, or air). **2.L.5B.4:** Construct scientific arguments to explain how animals can change their environments (such as the shape of the land or the flow of water). **Future Learning Connections (4-8):** **5.L.4B.4:** Construct scientific arguments to explain how limiting factors (including food, water, space, and shelter) or a newly introduced organism can affect an ecosystem. **6.L.4B.3:** Construct explanations of how animal responses (including hibernation, migration, grouping, and courtship) to environmental stimuli allow them to survive and reproduce. **6.L.4B.5:** Analyze and interpret data to compare how endothermic and ectothermic animals respond to changes in environmental temperature. **6.L.5B.4:** Plan and conduct controlled scientific investigations to determine how changes in environmental factors (such as air, water, light, minerals, or space) affect the growth and development of a flowering plant. **6.L.5B.5:** Analyze and interpret data to describe how plants respond to external stimuli (including temperature, light, touch, water, and gravity). **7.EC.5A.3:** Analyze and interpret data to predict changes in the number of organisms within a population when certain changes occur to the physical environment (such as changes due to natural hazards or limiting factors). **7.EC.5B.3:** Analyze and interpret data to predict how changes in the number of organisms of one species affects the balance of an ecosystem. **7.EC.5B.4:** Define problems caused by the introduction of a new species in an environment and design devices or solutions to minimize the impact(s) to the balance of an ecosystem.

Life Science: Environments and Habitats

Standard 3.L.5: The student will demonstrate an understanding of how the characteristics and changes in environments and habitats affect the diversity of organisms.	
3.L.5B. Conceptual Understanding: When the environment or habitat changes, some plants and animals survive and reproduce, some move to new locations, and some die. Fossils can be used to infer characteristics of environments from long ago.	
Performance Indicator	**3.L.5B.2:** Develop and use models to explain how changes in a habitat cause plants and animals to respond in different ways (such as hibernating, migrating, responding to light, death, or extinction).
Science and Engineering Practice	**3.S.1A.2:** Develop, use, and refine models to (1) understand or represent phenomena, processes, and relationships, (2) test devices or solutions, or (3) communicate ideas to others.
Crosscutting Concepts	The following Crosscutting Concepts may be applied to the content of this indicator. For more information see page 6. Cause and Effect Systems and System Models Stability and Change

Essential Learning Experiences:
It is essential that students use information from various sources, including observations, informational texts, videos, pictures, expert speakers, field studies, etc. to develop models that can be used to construct explanations for how plants and animals respond to changes in habitats in different ways, including the following:

- Animals may respond to changes in habitats by migrating to new areas if their basic needs cannot be met in their existing habitat.
- Other animals (such as bears) may hibernate if they are unable to find sufficient food sources or if the temperature becomes too cold.
- More light is available for the forest floor when some trees are cut, allowing other plants to grow taller.
- Seeds may not germinate if there is insufficient rainfall or if the temperature is too cold.
- Both plants and animals may be unable to respond to changes in their habitat and may individually die or become extinct. Extinction is the death of an entire group of organisms. Extinction occurs if over many generations, animals or plants cannot adapt to changes in the environment.

Extended Learning Experiences:
The following knowledge and learning experiences are not essential to the success of this learning goal but can be used by teachers to extend the depth and rigor of student engagements.

- Students may develop models to illustrate other ways organisms respond to changes in their habitats beyond those listed above.
- Students may develop models to illustrate how organisms respond to different natural events, such as those described in the essential learning experiences for **3.L.5B.1**.
- Students may obtain information about specific organisms that have gone extinct.

Assessment Guidelines:
Students should engage in multiple science and engineering practices when interacting with the content outlined in this performance indicator. For further information please see SEP Support Guide at:
https://ed.sc.gov/scdoe/assets/File/instruction/standards/Science/Support%20Documents/Complete_2014SEPsGuide_SupportDoc2_0.pdf

Learning Connections	**Previous Learning Connections (K-2):** **1.L.5B.3:** Analyze and interpret data from observations to describe how changes in the environment cause plants to respond in different ways (such as turning leaves toward the Sun, leaves changing color, leaves wilting, or trees shedding leaves). **2.L.5B.3:** Analyze and interpret data from observations to describe how animals respond to changes in their environment (such as changes in food availability, water, or air). **2.L.5B.4:** Construct scientific arguments to explain how animals can change their environments (such as the shape of the land or the flow of water). **Future Learning Connections (4-8):** **5.L.4B.4:** Construct scientific arguments to explain how limiting factors (including food, water, space, and shelter) or a newly introduced organism can affect an ecosystem. **6.L.4B.3:** Construct explanations of how animal responses (including hibernation, migration, grouping, and courtship) to environmental stimuli allow them to survive and reproduce. **6.L.4B.5:** Analyze and interpret data to compare how endothermic and ectothermic animals respond to changes in environmental temperature. **6.L.5B.4:** Plan and conduct controlled scientific investigations to determine how changes in environmental factors (such as air, water, light, minerals, or space) affect the growth and development of a flowering plant. **6.L.5B.5:** Analyze and interpret data to describe how plants respond to external stimuli (including temperature, light, touch, water, and gravity). **7.EC.5A.3:** Analyze and interpret data to predict changes in the number of organisms within a population when certain changes occur to the physical environment (such as changes due to natural hazards or limiting factors). **7.EC.5B.3:** Analyze and interpret data to predict how changes in the number of organisms of one species affects the balance of an ecosystem. **7.EC.5B.4:** Define problems caused by the introduction of a new species in an environment and design devices or solutions to minimize the impact(s) to the balance of an ecosystem.

	8.E.6A.3: Construct explanations from evidence for how catastrophic events (including volcanic activities, earthquakes, climatic changes, and the impact of an asteroid/comet) may have affected the conditions on Earth and the diversity of its life forms. **8.E.6B.2:** Obtain and communicate information to support claims that natural and human-made factors can contribute to the extinction of species.

Life Science: Environments and Habitats

Standard 3.L.5: The student will demonstrate an understanding of how the characteristics and changes in environments and habitats affect the diversity of organisms.	
3.L.5B. Conceptual Understanding: When the environment or habitat changes, some plants and animals survive and reproduce, some move to new locations, and some die. Fossils can be used to infer characteristics of environments from long ago.	
Performance Indicator	**3.L.5B.3:** Construct scientific arguments using evidence from fossils of plants and animals that lived long ago to infer the characteristics of early environments.
Science and Engineering Practice	**3.S.1A.7:** Construct scientific arguments to support claims, explanations, or designs using evidence from observations, data, or informational texts.
Crosscutting Concepts	The following Crosscutting Concepts may be applied to the content of this indicator. For more information see page 6. Patterns Cause and Effect Stability and Change

Essential Learning Experiences:
It is essential that students use evidence from fossils to construct scientific arguments for how different fossils support claims for how past environments from earlier time periods of Earth's history might have been different. For example:

- A fossil is the remains of a living organism that lived long ago and has been preserved in rock or has hardened minerals. Fossils can give information about what the environment was like in the location where the fossil was found.
  - Fossils of a water organism found in an area that is now mountains means that area was possibly once under water.
  - Fossils of crab burrows found on grasslands suggest that area was possibly once near an ocean.
  - Fossils of trees or tree parts found in a desert mean that area was possibly once a forest.
  - Fossils of plants found in very cold areas of Earth means that area at one time possibly had a warmer climate.
- Every time a new fossil is found, more information about life on Earth and the environment of Earth is discovered. For example,
  - Fossilized shark teeth suggest that sharks in the past lived in an environment similar to current environments, because their teeth are similar.
  - Skulls and lower jaws of crocodilians found in the sandy clay of the coastal plain suggest that these ancestors of modern day alligators and crocodiles lived in the shallow, warm waters of an estuary/salt marsh.

- The wide horns of the ancient buffalo that once roamed the land indicate that there were more grasslands in South Carolina.
- The long, sharp teeth on the skull of the saber-toothed cat fossil, found in rocky sand with other animal fossil, hints that the saber-toothed cat lived in a heavily populated forest.

Extended Learning Experiences:
The following knowledge and learning experiences are not essential to the success of this learning goal but can be used by teachers to extend the depth and rigor of student engagements.

- Students may obtain information about the methods of fossilization and what those methods indicate about past environments.
- Students may obtain information about why organisms change over time as a result of adaptations to changing environments.

Assessment Guidelines:
Students should engage in multiple science and engineering practices when interacting with the content outlined in this performance indicator. For further information please see SEP Support Guide at:
https://ed.sc.gov/scdoe/assets/File/instruction/standards/Science/Support%20Documents/Complete_2014SEPsGuide_SupportDoc2_0.pdf

Learning Connections	**Future Learning Connections (4-8):** **8.E.6A.2:** Analyze and interpret data from index fossil records and the ordering of rock layers to infer the relative age of rocks and fossils. **8.E.6A.3:** Construct explanations from evidence for how catastrophic events (including volcanic activities, earthquakes, climatic changes, and the impact of an asteroid/comet) may have affected the conditions on Earth and the diversity of its life forms. **8.E.6A.4:** Construct and analyze scientific arguments to support claims that different types of fossils provide evidence of (1) the diversity of life that has been present on Earth, (2) relationships between past and existing life forms, and (3) environmental changes that have occurred during Earth's history.

References

National Research Council. A Framework for k-12 Science Education: Practices, Crosscutting Concepts, and Core Ideas. Washington, DC: The National Academies Press, 2012. doi: 10.17226/13165.

South Carolina Department of Education. (2015). South Carolina Academic Standards and Performance Indicators for Science 2014. Retrieved from http://ed.sc.gov/scdoe/assets/file/agency/ccr/StandardsLearning/documents/South_Carolina_Academic_Standards_and_Performance_Indicators_for_Science_2014.pdf